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**Ministry of Business, Innovation and Employment Report:
700 MHz Auction: Reserve Price**

Date Sent:	8 August 2013	Tracker No:	0132 13-14
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Action Sought

	Action Sought	Deadline for Action
Minister for Communications and Information Technology (Hon Amy Adams)	Forward to Ministers English and Joyce Read before trilateral Ministers meeting on 21 August 2013	19 August 2013
Minister of Finance (Hon Bill English)	Read before trilateral Ministers meeting	21 August 2013
Minister for Economic Development (Hon Steven Joyce)	Read before trilateral Ministers meeting	21 August 2013

Agencies Consulted (include contact where relevant)

Treasury s9(2)(a)

Contact for Telephone Discussion (if required)

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Len Starling	Manager, Radio Spectrum Policy & Planning	04 462 4221 (wk)	s9(2)(a) ✓

Minister's Office Actions (if required)

Office of Minister for CIT: Forward to Ministers English and Joyce
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Enclosures (3): Network Strategies Update Report. IDC Peer Review. PWC Peer review

Minister's Comments

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700 MHz Auction: Reserve Price

Executive summary

This report provides advice and a recommendation on the reserve price for the 700 MHz spectrum auction. It is one of three reports you will receive relating to the 700 MHz auction. You are scheduled to meet with other delegated Ministers to consider these matters on 21 August 2013.

The Ministry has received reports from Network Strategies that help to inform the reserve price decision. The Network Strategies results, along with peer reviews from IDC and PWC, are summarised here and the actual reports appended.

Approach

Three broad approaches have been taken. First, *benchmarks* provide a guide to prices achieved in other auctions. International benchmarks may provide useful guides but must be used with care as in practice the value to a New Zealand network operator is subject to a range of local factors. Previous New Zealand sales also provide relevant benchmarks.

Second, *commercial modelling* attempts to determine the business case for purchase from the perspective of a New Zealand mobile network operator (i.e. what the spectrum might be worth to company). In this case the commercial model is highly sensitive to some key assumptions. Network Strategies and the peer reviewers agree that this is the weakest form of evidence.

Third, *ability to pay* (i.e. ability of a company to raise the necessary funds) provides a reality check on the amount of revenue that the government might achieve. In this case 2degrees faces significant constraints relative to Vodafone and Telecom.

Objectives

The government wishes to ensure that all existing operators have the opportunity to purchase 700 MHz spectrum and has announced acquisition limits to help achieve this. These limits imply a preference for each existing network operator to obtain 2x15 MHz, but 2x10 MHz or lesser acquisitions are also allowed for in the auction rules. The government also has a preference that all the available spectrum rights are sold in order to achieve the large national economic benefits expected to accrue from the use of high speed mobile broadband. Subject to those objectives the government wishes to obtain a fair price for the rights being offered, including recouping the costs it has occurred to clear the spectrum.

Context

There have been significant changes in the spectrum market in the last 18 months. Technology advances are enabling operators to deploy 4G services using other bands. In particular, the very recent emergence of 1800 MHz as a 4G band¹ has reduced the value of 700 MHz spectrum since most of the auctions used as benchmarks. While still desirable, 700 MHz is no longer essential to provide 4G services.

Network Strategies' results

Network Strategies recommends that the reserve price be set within the range of \$3.9 to \$4.6 million per paired MHz (total \$176 million to \$207 million if all spectrum is sold). This range is the lower bound of the valuation estimates, but using the 2007 renewal price for

¹ All existing operators have plans to deploy, or are already using, 4G services at 1800 MHz. In future they will also be able to deploy 4G at 850/900 and at 2100 MHz if they wish.

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850/900 MHz spectrum as a minimum. The table below summarises Network Strategies' valuations.

Method	Price per paired MHz 18 years (NZ\$ millions)		
	Estimated Price (mid-point)	Lower Bound	Upper Bound
Simple benchmark	7.27	1.24	8.27
Digital dividend benchmark	7.49	4.38	10.39
Benchmark model	6.68	3.61	9.74
Commercial valuation model	5.42	4.62	9.68
850/900 renewal price	-	3.90	

Options and Analysis

The Ministry has considered four options for setting the reserve price, shown in the table below.

Option	Reserve price (NZ\$ million per paired MHz)	Estimated fiscal return (NZ\$ million)
1. Cost of clearing the spectrum	3.49	157
2. Fair return consistent with small operator participation being likely (recommended)	4.2	189
3. Fair return consistent with small operator participation being unlikely	6	180-240
4. Revenue maximisation	9	270

Given our understanding of the government's objectives we recommend Option 2. This figure is within the lower bound of the benchmark range. However, this recommendation is not without risk. Specifically, 2degrees may not have the ability to pay this price for 2x15 MHz as a lump sum. Ministers will need to consider this risk, and the government's comfort with 2degrees obtaining less than 2x15 MHz.

An arrangement allowing for payments to be made over a longer timeframe would help 2degrees match incoming and outgoing cash flows, increasing its ability to pay (and therefore also the price that can be obtained from the other bidders). The price could possibly even be increased slightly from that shown in Option 2 above if a time payment option was available. You will be receiving a separate paper including discussion of payment options.

Consultation

Treasury has been consulted on this report and is content with it.

The Ministry has not publically consulted on this issue but has received many unsolicited submissions recommending a low price.

² Simple benchmark = all data, unmodified. Digital dividend benchmark = 4G bands only. Benchmark model = prices adjusted for GDP per capita, population density, urbanisation, mobile penetration.

³ Assuming that all of the spectrum is sold the fiscal return (in \$ million) can be obtained by multiplying the numbers in this table by 45.

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Recommendations

We recommend that you:

- 1 Refer this report to Ministers English and Joyce for final decision by joint Ministers
Yes/No

- 2 Agree to a nominal reserve price of \$4.2 million per MHz paired (equivalent to \$189 million for the total 2x45 MHz)
Yes/Other: \$___million per MHz paired

- 3 Agree that this nominal price be subject to adjustment for any time payment arrangement that may be agreed
Yes/No

Len Starling
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Resources, Energy and Communications
Branch

Hon Amy Adams
Minister for Communications and
Information Technology

Date: ___/___/___

Hon Steven Joyce
Minister for Economic Development

Date: ___/___/___

Hon Bill English
Minister of Finance

Date: ___/___/___

Minister's feedback on quality of report:					1 Not satisfactory; 2 Fall short of expectations in some respects; 3 Met expectations 4 Met and sometimes exceeded expectations; 5 Greatly exceeded expectations
1	2	3	4	5	

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700 MHz Auction Paper 3: Reserve Price

Purpose

- 1 This report provides advice and a recommendation on the reserve price for the 700 MHz spectrum auction to be held by the Ministry of Business, Innovation and Employment (the Ministry) later this year.

Context for the 700 MHz auction

- 2 The Ministry is planning an auction of 2x45 MHz of spectrum in the 700 MHz band. This spectrum has been freed up by the switchover to digital television and is expected to be used internationally for the deployment of next generation mobile broadband services. Spectrum freed up by the switchover to digital television is sometimes referred to as 'digital dividend' spectrum. Annex 1 provides further detail on the context for the 700 MHz auction.

Valuing 700 MHz spectrum

- 3 There are a number of important points that should be kept in mind when considering the valuations of spectrum and setting the reserve price. These factors are explored below:
 - Methods of valuing spectrum
 - Effects of payment timing on reserve price
 - Centrality of the reserve price to the auction outcome
 - Existing baseline figure for 700 MHz spectrum
 - Estimate of overall economic benefits
 - Limitations of valuation methodologies
 - Weighting of objectives in setting the reserve price
 - Views of interested parties.

Valuation methods

- 4 Valuation methods that assist with setting reserve prices for spectrum auctions include:
 - Benchmarking historical prices from New Zealand auctions for comparable spectrum.
 - Benchmarking prices from auctions for comparable spectrum in other jurisdictions
 - Business modelling the net present value of 700 MHz spectrum to the licence holder.
- 5 The Ministry obtained valuations using these methods from Network Strategies, with peer reviews prepared by IDC and PWC. The results are set out in the attached Network

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Strategies, IDC and PWC reports. The Ministry has applied these valuations as an input into the options and the recommendation.

Effects of payment timing on reserve price

- 6 Prices quoted in this report assume payment in full shortly after the auction. However, Ministers are considering a staggered payment scheme for the auction. Such a scheme would have two implications for the reserve price. First, it would be necessary to adjust the price for the time value of money (that is, apply the appropriate interest rate correction based on the specific cashflows agreed as part of any time payment scheme). Second, Ministers may wish to consider the impact of staggering payment on bidders' ability to pay. To the extent that the decision on price is based on ability to pay, a time payment scheme may allow a higher reserve price.

Reserve price likely to be central to auction outcome

- 7 The reserve price is likely to be central to the auction for two reasons. First, it will determine which parties choose to participate in the auction. For example, a party is unlikely to participate in the auction if the reserve price is set above the maximum value of spectrum to it or its maximum ability to pay.
- 8 The reserve price is also likely to be key to the revenue obtained by the Crown. For example if there were three bidders and each bid up to its maximum allocation of 2x15 MHz, the price set at the end of the Clock Allocation Phase would be equal to the reserve price. A Supplementary Allocation Phase would not be required.

Existing baseline figure for 700 MHz spectrum

- 9 Treasury baselines currently include an estimate of \$119 million for revenue from the 700 MHz auction. This number, provided by MED several years ago, was a deliberately conservative figure determined before the APT Band Plan was adopted. The original estimate was based on an expectation of 2x30 MHz of 700 MHz spectrum being made available to auction. The adoption of the APT Band Plan means that 2x45 rather than 2x30 MHz is available.
- 10 All of the reserve prices considered in this brief are likely to result in greater revenue to the Crown than the current baseline estimate. The most likely bidders are aware of the Budget baseline figure but are also aware that the Ministry has been conducting international benchmarking to obtain a better estimate of the likely value.
- 11 We expect that serious bidders will do their own benchmarking and reach similar conclusions about international prices.

Estimate of overall economic benefits

- 12 There is a clear policy choice set out in the options in this report between facilitating long term competition and dynamic efficiency, which will maximise overall economic benefits, and maximising revenue from the auction.
- 13 The revenue to the Crown from the auction of 700 MHz spectrum is likely to be greatly outweighed by the overall economic benefits from an allocation that facilitates competition and dynamic efficiency. For example, in a 2011 report for the Ministry, Venture

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Consulting concluded that NZ\$1.2-2.4 billion of net economic benefit from digital dividend spectrum would be a reasonable estimate based on analysis undertaken overseas.⁴

Limitations of valuation methodologies

- 14 International auction prices are a small data set with a very wide range. That range is generated by local conditions, most notably the number of existing and aspiring operators, but also including the wealth of the country, the profitability of its network operators, the timing of the auction relative to economic cycles, and conditions placed on use of the spectrum. The small sample size and wide dispersion mean that the confidence limits on estimates of the median price are also very wide. Some technical adjustments may reduce the range but considerable uncertainty remains due to limitations of the initial data set.
- 15 Further, the existence of local factors means that even if the global median price could be established with high accuracy it would still not be a precise guide to the local price. In the same way that the New Zealand average house price is not an accurate guide to house prices in Invercargill or Auckland, the global average spectrum price is not an accurate guide to the correct New Zealand price. The global median estimate may suggest a 'ballpark' figure, but it is still necessary to take local factors into account.
- 16 Commercial modelling gives a second form of estimate but suffers from its own issues. In particular, long term costs and revenues are very difficult to estimate and it is difficult to have confidence that modelling assumptions will be consistent with those used by commercial operators. In this case the uncertainties are such that, under a range of plausible assumptions, the value could be anywhere from negative to \$1 billion dollars.⁵ Sensitivity testing of Network Strategies commercial model by PWC shows that a 10% change in either price or volume impacts on total spectrum value by more than \$40 million. As cellular data volumes are currently growing by around 100% per annum, long term volume estimates are very uncertain and it would be very surprising if long term volume estimates were accurate to 10%.

Weighting of objectives in setting the reserve price

- 17 The government has a number of objectives it wishes to achieve through the auction. The choice of a reserve price ultimately depends on the relative importance placed on different objectives. Our recommendation assumes a high weighting for broader economic benefits and the competitive structure of the industry. It also assumes that unsold spectrum is undesirable. It puts a lower relative weighting on fiscal returns.
- 18 Theoretically the government could price the spectrum at up to its value to the operators. However, that value is uncertain. Pricing at the midpoint of the valuation estimates implies that the government is willing to take a significant risk (~50%) that its price is too high and some spectrum will remain unsold. This would likely reduce both the broader economic benefits and the total revenue received from the auction. Taking a more conservative approach, such as the lower bound of the estimates, reduces this risk.

⁴ Venture Consulting, A Review of the Applicability to NZ of International Digital Dividend Cost and Benefits Studies, 29 June 2010.

⁵ For example, one set of Network Strategies scenarios modelled by IDC with some revised assumptions produced a value of over NZ\$25 million per paired MHz.

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Views of interested parties

- 19 Although it was excluded from the Ministry's consultation in May and June 2013 on auction design and implementation requirements, a number of submitters chose to comment on the reserve price.
- 20 All commenting submitters preferred a lower reserve price, with most suggesting a reserve price that would ensure, in effect, that the existing network operators can bid for spectrum. For example:
- 2degrees submitted that the reserve price should be set at the cost of supply to the Crown

s.9(2)(ba)(i)

21

s.9(2)(b)(ii)

Small and large operators

- 22 This Brief and the Network Strategies' reports distinguish between small and large operators, because the value of spectrum to an operator depends to a large extent on its market share. Network Strategies define a small operator as an existing operator with a 20% market share, and a large operator as an existing operator with a 40% market share.
- 23 2degrees, with a market share of under 20% can be regarded as a small operator. Telecom and Vodafone can be regarded as large operators.

Network Strategies' reports

- 24 Network Strategies has prepared two reports for the Ministry estimating the likely commercial value of the 700 MHz spectrum to be auctioned later this year. These reports are:
- *Commercial valuation of the 700MHz band in New Zealand, 30 November 2012 (NS Report)*. This report sets out the results of the international benchmarking conducted by Network Strategies from auctions of 700, 800 and 900 MHz spectrum, the results of modelling these benchmarks to attempt to correct for variations between jurisdictions, and the results of a model built to determine the commercial valuation of spectrum.
 - *Reserve pricing for digital dividend spectrum – supplementary benchmarking, commercial valuation and reserve price analysis for 700 MHz, 12 July 2013 (NS Update)*. This report updates the benchmarks in the first report with auction results that have occurred since the earlier report's publication. It also includes a review of

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changes in international reserve prices over time and case studies of auctions in Australia, Ireland and the United Kingdom.

- 25 A summary of these reports is set out at Annex 2 and copies of the NS Update is attached as Annex 3.

Summary of Network Strategies' conclusions

- 26 Network Strategies used benchmarking and commercial modelling to derive four valuations for 700 MHz spectrum, and also included the historical renewal price for 850/900 spectrum in New Zealand as a relevant valuation. In New Zealand in 2007, spectrum management rights in the 800/900 MHz bands were renewed by agreement for the equivalent of \$3.92 million per paired MHz for an 18 year term.

- 27 Network Strategies overall conclusion is to set the reserve price within the lower bound of valuations using the historical renewal price for 850/900 MHz as a minimum; i.e. within \$3.9 to \$4.6 million per paired MHz⁶. This equates to total revenue of \$176 million to \$207 million if the entire available spectrum (2x45 MHz) is sold. The details of each valuation method are set out in Annex 2.

- 28 The table below sets out the estimated price and the lower bound and the upper bound for each of the valuations.

Method	Price per MHz paired for 18 years (NZ\$ millions)			
	Estimated Price (average winning bid)	Lower Bound	Upper Bound	
1. 850/900 renewal price	NA	3.92	NA	
2a. Simple benchmark (800/900/900 auctions)	7.27	1.24	8.27	
2b. Simple benchmark (digital dividend auctions only)	7.49	4.38	10.39	
2c. Benchmark model	6.68	3.61	9.7	
Commercial valuation model	Small operator	3.91	0.97	5.24
	Large operator	6.83	6.60	12.78
	Combined ⁷	5.42	4.62	9.68

Peer reviews

- 29 The Ministry obtained two peer reviews of the Network Strategies' reports, from IDC and PWC, that:

- Identified risks
- Reviewed the commercial model
- Considered the ability of existing mobile operators to pay for 700 MHz spectrum.

⁶ Note, the upper and lower bounds for the simple and digital dividend benchmarks correspond to the upper and lower quartiles of the average winning bid. The estimated price for the simple and digital dividend benchmarks is the average winning price across the relevant data sets.

⁷ The combined result assumes 700 MHz spectrum is allocated as two lots of 2x15 MHz for large operators and one lot of 2x10 MHz to the small operator, with 2x5 MHz unsold.

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30 The peer review reports are attached as Annex 4 (IDC) and Annex 5 (PWC).

Key points of the IDC peer review

31 IDC's key points are:

- The commercial modelling should not be used to set the reserve price because the model produces a wide range of estimates of the value of spectrum (e.g. valuations from negative to \$1 billion with a set of plausible assumptions).
- The benchmarking data set should be used to set the reserve price.
- As Network Strategies recommend, the reserve price should be set within the lower bound of benchmarking estimates with the 850/900 MHz renewal price as a minimum; i.e. within the range of NZ\$3.9 to \$4.6 million per paired MHz.
- Based on 2degrees' public statements, IDC considers that 2degrees' ability to pay for 700 MHz spectrum is approximately \$30 million if required to pay a lump sum. However, this is likely to increase significantly if payment terms are staggered.

Key points of the PWC peer review

32 PWC's key points are:

- The commercial model relies on a number of critical assumptions that are, by and large, dependent on Network Strategies' views and are not verifiable to external data. Consequently, it should be used as a cross-check for the benchmarking data set rather than a method of setting the reserve price

PWC's suggested corrections are a consequence of the model being applied by Network Strategies from an engineering rather than financial perspective⁸

Other factors that may affect value

33 Other factors that could affect the value of spectrum to (1) bidders, and (2) the government, are set out below.

Value of spectrum to bidders

Relative non-scarcity of spectrum

34 Spectrum is less scarce in New Zealand than in many comparator jurisdictions. For example, 2x45 MHz of spectrum is being made available to the market in the 700 MHz band, while only 2x30 MHz will be available in some other jurisdictions. New Zealand also has fewer mobile network operators and a lower population density than many comparator jurisdictions.

35 This is likely to mean a less competitive market for 700 MHz spectrum in New Zealand than in most other jurisdictions, potentially reducing the price bidders are willing to pay.

⁸ PWC and Network Strategies were unable to reach agreement on the best approach to some of the issues related to the commercial modelling. They did however agree that resolution of those issues would not significantly improve confidence in the results of that modelling.

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Unexpected use of 1800 band for 4G

- 36 In February 2013, Vodafone launched a geographically limited 4G service using 1800 MHz spectrum.⁹ Telecom and 2degrees have also indicated that they intend to operate 4G services using 1800 spectrum later this year and within a year, respectively. The rapid deployment of 1800 MHz 4G services was unexpected, in New Zealand and elsewhere¹⁰. This means that price benchmarks derived from earlier sales may not fully reflect the alternative deployment option that is now available. (Network Strategies has taken into account the use of 1800 MHz spectrum for 4G in its commercial modelling.)
- 37 In addition, the global mobile standards organisation 3GPP has developed standards for 4G using the 850/900 and 2100 MHz bands. The New Zealand operators therefore currently have access to at least 2x50 MHz of "4G spectrum".

Coverage and implementation obligations

- 38 Purchasers of 700 MHz spectrum will be required to meet coverage and implementation obligations. At the time of writing the exact form of these obligations has not been finalised. Ministers will need to consider the likely costs of the obligations and the extent that these should be recognised in the reserve price.
- 39 As a guideline we note that expenditure required to build a new rural cell site suitable for co-location is around \$450,000¹¹. Upgrading an existing tower to run 700 MHz LTE is likely to cost around \$100,000¹².
- 40 To meet an additional coverage obligation a large operator with an existing nationwide network of cell sites would probably have to construct new cell sites it would otherwise not have built, i.e. it is likely to require actual additional expenditure. In contrast a small operator that is continuing to roll out its network of cell sites and co-locations is likely to be able to meet an additional coverage obligation without additional unplanned expenditure because it would be within its existing rollout plan.
- 41 However, as noted by Telecom, even if the obligations are consistent with a company's current deployment plans they are not costless. Such obligations increase business risk because they lock-in capital expenditure that would otherwise be able to be modified to match changing circumstances. This risk will therefore be reflected in the price companies are willing to pay. Government agreement to consider such circumstances and modify the obligations accordingly may mitigate this risk, to some extent.

Commercial position of likely bidders

- 42 It appears that Telecom and Vodafone have an ability to pay well in excess of their likely commercial valuations of the spectrum. That is, if the business case is positive they will be able to raise the capital.
- 43 In contrast, 2degrees does face significant capital constraints and will likely have to go back to its shareholders to fund the spectrum purchase (if required to pay immediately). We are unable to determine if shareholder support would be forthcoming.

Value of spectrum to government

⁹ <http://community.vodafone.co.nz/t5/Press-releases/4G-launches-in-NZ-first-on-Vodafone/m-p/82378>.

¹⁰ For example, 1800 MHz LTE is barely mentioned in the Digital Dividend submissions received from the three network operators in October 2011.

¹¹ Vodafone is using a cost of \$450,000 per cell site in its own business modelling.

¹² Assuming suitable backhaul is available.

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Fiscal return

- 44 A key value to the government is the fiscal return from the auction of 700 MHz spectrum. An objective of the auction is to obtain a fair return to the Crown.

Competition and economic benefits from use

- 45 In a 2011 report for the Ministry, Venture Consulting concluded that NZ\$1.2-2.4 billion of net economic benefits from the use digital dividend spectrum would be a reasonable estimate based on analysis undertaken overseas.¹³

Opportunity costs of fallow spectrum

- 46 Some of these competition and economic benefits will be lost if some spectrum is unsold after the auction. The impact on competition and economic benefits will depend on the amount of spectrum unsold and the period during which it remains unallocated.

Cost of clearing the spectrum

- 47 The total amount expended by the Crown in clearing the 700 MHz band has been assessed for the Ministry at \$157 million.¹⁴ This cost of supply of \$157 million does not include the \$30 million set aside for the information, technology and communications development fund to support Maori digital interests, which could arguably also be included as a cost of supply. Ministers might want to consider whether the cost of this fund should be included as part of the cost of supply.

- 48 The cost of supply could be regarded as the minimum required return to the Crown from the 700 MHz auction, because taxpayers should not subsidise the provision telecommunications services that a private company has chosen to provide.

Options

Introduction to Options

- 49 The four options set out in this report for setting the reserve price are:

Cost of supply

2. Fair return to Crown consistent with increased likelihood of small operator participation
3. Fair return to the Crown consistent with reduced likelihood of small operator participation
4. Maximising revenue to the Crown.

- 50 These options require decisions on the desired policy outcome from the auction and the exact dollar reserve price that would best give effect to that policy outcome. A number of points are worth keeping in mind when reviewing the options:

¹³ Venture Consulting, A Review of the Applicability to NZ of International Digital Dividend Cost and Benefits Studies, 29 June 2010.

¹⁴ These costs include setting up two new TVNZ digital channels, funding to Freeview Limited to support the digital transition of free-to-air broadcasters, and a tagged contingency of \$53.29 million on various digital switchover initiatives.

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- i. The benchmark data set is used as the primary method for selecting a reserve price. The commercial modelling is used as a cross-check and an indication of which point in the benchmark range is likely to be appropriate. In each option, the process for selecting a reserve price is:
 - a. Selecting the appropriate benchmark range (e.g. the lower bound of benchmark estimates)
 - b. Determining of the most appropriate point within that range (informed by the commercial modelling)
 - c. Determining the impact of the other factors on the point selected
 - d. Determining the impact of each operator's ability to pay on the point selected.
- ii. The small operator may still not bid despite encouragement from a lower reserve price. This may be, for example, because of capex constraints or priorities, or a differing view of the value of 700 MHz spectrum.
- iii. There is a trade-off set out in the options between overall economic benefits from an allocation that maximises long-term competition and dynamic efficiency, and revenue to the Crown from the auction. Overall economic benefits from an efficient allocation and full deployment are expected to greatly outweigh revenue to the Crown.

Option 1 – Cost of Supply

Description

- 51 The reserve price could be set to ensure that the Crown recovers the cost of \$157 million expended in clearing the 700 MHz band. The reserve price necessary to recover the cost of supply of \$157 million would be \$3.49 million per paired MHz. This assumes that all of the spectrum would be sold at auction. A price of \$4.16 million per paired MHz is required to recover \$187 million.

Impact of other factors that may affect value

- 52 Nil.

Impact of ability to pay

- 53 At a reserve price of \$3.49 million per paired MHz, the effective reserve price would be \$35 million for 2x10 MHz and \$52 million for 2x15 MHz. The small operator should be able to meet this reserve price for 2x10 MHz of spectrum, but may not be able to bid for more spectrum without shareholder support or a time payment scheme

Assessment of likely auction outcome

- 54 Likely outcomes of the Clock Allocation and Supplementary Allocation Phases would be either:
- Three successful bidders each bidding at the reserve price for their maximum allocation of 2x15 MHz in the Clock Allocation Phase. The Supplementary Allocation Phase would not be held. (Total revenue \$157 million.) or

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- In the Clock Allocation Phase, two large operators bidding for 2x15 MHz and the small operator bidding for 2x10 MHz, all at reserve price, with one large operator bidding for the remaining 2x5 MHz in the Supplementary Allocation Phase. (Total revenue \$157 million.)

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Analysis of advantages and disadvantages

55 The advantages of this option are:

- The reserve price is based on an exact figure (Crown expenditure)
- It is likely to result in an efficient allocation of spectrum among the three existing operators, resulting in greater overall economic benefits
- Expected revenue would be greater than the current baseline estimate.

56 The disadvantages of this option are:

- It may not produce a fair return to the Crown as all of the operators are likely to pay less (significantly less for large operators) than the value of the spectrum to them.

Conclusion

57 Although simpler to apply, this option is not preferred because it is not likely to produce a fair return to the Crown.

Option 2 – Fair return to Crown consistent with increased likelihood of small operator participation (recommended option)

Description

58 The reserve price could be set at a conservative figure closer to the value of spectrum to the small operator. The primary purpose of this option would be to increase the likelihood of the small operator participating in the auction. The secondary purpose would be to obtain the fairest return to the Crown consistent with the purpose of encouraging the small operator's participation.

59 The reserve price that best gives effect to this option would be set within the lower bound range of Network Strategies' benchmarks. Consistent with Network Strategies' recommendation, the historical price for the renewal of 850/900 MHz spectrum would be the minimum of that range. The range would therefore be from \$3.9 to \$4.4 million per paired MHz.

60 The median value of the commercial model for a small operator is \$3.91 million per paired MHz. This suggests that the middle of the range is appropriate given that Network Strategies considers that the commercial model produces a more conservative figure than benchmarking does.

Impact of other factors that may affect value

61 The value of spectrum to the small operator may be reduced slightly by the relative non-scarcity of spectrum and the small operator's proposed deployment of 4G equipment in the 1800 MHz band.

Impact of ability to pay

62 At a reserve price of \$4.2 million per paired MHz, the effective reserve price would be \$42 million for 2x10 MHz and \$63 million for 2x15 MHz.

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- 63 With a time payment arrangement, the small operator should be able to meet the reserve price for at least 2x10 MHz of 700 MHz spectrum. Without a time payment scheme or shareholder support, the small operator may not be able to bid for more than 2x5 MHz of spectrum.

Reserve price

- 64 The reserve price under this option would be \$4.2 million per paired MHz. This is towards the middle of the lower bound range to reflect the lower commercial model valuation and the impact of other factors.

Assessment of likely auction outcome

- 65 The small operator would be more likely to participate under this option.
- 66 Likely outcomes of the Clock Allocation and Supplementary Allocation Phases would be either:
- Three successful bidders each bidding at the reserve price for their maximum allocation of 2x15 MHz in the Clock Allocation Phase. The Supplementary Allocation Phase would not be held. (Total revenue \$189 million.) or
 - In the Clock Allocation Phase, two large operators bidding for 2x15 MHz and the small operator bidding for 2x10 MHz, all at reserve price, with one large operators bidding for the remaining 2x5 MHz in the Supplementary Allocation Phase. (Total revenue \$189 million.)
- 67 A less likely outcome of the Clock Allocation and Supplementary Allocation Phases would be:
- The small operator choosing not to participate, and the large operators bidding for 2x15 MHz each in the Clock Allocation Phase, and 2x5 MHz each in the Supplementary Allocation Phase. (Total revenue \$169 million and 2x5MHz unsold.)

Analysis of advantages and disadvantages

- 68 The advantages of this option are:
- It is likely to result in an efficient allocation of spectrum among the three existing operators, resulting in greater overall economic benefits
 - It will produce a fair return to the Crown consistent with the purpose of increasing the likelihood of the small operator participating in the auction
 - Likely revenue would exceed the cost of supply and be greater than the current baseline estimate.
- 69 The disadvantages of this option are:
- It does not maximise revenue to the Crown
 - A less likely but possible result is both the large operators paying significantly less than the value of spectrum to them and the small operator not participating.

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Conclusion

- 70 This is the recommended option because it aims to balance an efficient allocation of spectrum, among the three existing operators, with a fair return to the Crown.

Option 3 – Fair return to Crown consistent with reduced likelihood of small operator participation

Description

- 71 The reserve price could be set at the price of the spectrum estimated by Network Strategies, which would be an amount closer to estimated value of spectrum to a large operator. The primary purpose of this option would be to obtain a fair return to the Crown. The secondary purpose would be to ensure that as much of the spectrum as possible was allocated.
- 72 The reserve price that best gives effect to this option would be set using Network Strategies' benchmark range of estimated prices. That is using the range from \$6.58 to \$7.49 million per paired MHz.
- 73 The median value of the commercial model for large operators is \$6.83 million per paired MHz. This suggests the middle of the range of may be appropriate given Network Strategies considers that the commercial model produces a more conservative figure than benchmarking.

Impact of other factors that may affect value

- 74 The other factors that may reduce the value of the spectrum to large operators need to be considered when setting this reserve price.¹⁵
- 75 The other factor with the greatest impact will be the additional coverage obligation. This is estimated to cost \$11.25 million over five years to each large operator purchasing 2x15 MHz and \$22.5 million over five years to each large operator purchasing 2x20 MHz.¹⁶ Assuming there are only two bidders, it is desirable that the maximum possible allocation of 2x40 MHz should be taken up to meet the deployment objective. Therefore, a reduction based on the cost of \$22.5 million per operator (or \$1,125,000 per paired MHz)¹⁷ should be applied to the reserve price to reflect the reduced value of the spectrum to large operators.
- 76 The relative non-scarcity of spectrum and the deployment of 4G equipment in the 1800 MHz band may also reduce the value of the spectrum to large operators. This suggests that a slightly more conservative reserve price would be appropriate, especially if the fullest possible allocation of 2x20 MHz is to be achieved.

¹⁵ The other factors affecting the small operator would not be relevant in this option where the reserve price is set with reference to the value of spectrum to the large operators.

¹⁶ This assumes additional coverage obligations of five cellsites per year for five years for purchasers of 2x15 MHz and ten cellsites per year for five years for purchasers of 2x20 MHz. It also assumes that this additional coverage is not part of the MNOs' commercial deployment plans. We understand this to be the case for Vodafone. Telecom's cost would be less as it has the option of co-location on RBI towers. If Ministers prefer different assumptions, or if different coverage obligations are chosen, these amounts would need to be reconsidered.

¹⁷ That is, the estimated cost to \$22.5 million multiplied by the expected bidders (2) divided by the number of 2x5 MHz spectrum lots expected to be sold (8) divided by 5 to give a value per paired MHz.

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Impact of ability to pay

- 77 As discussed above, the large operators should be able to meet a reserve price set at this level and the small operator is unlikely to participate.

Reserve price

- 78 The reserve price under the option would be \$6 million per paired MHz. This reflects a reduction in the reserve price of \$1.2 million to take into account the impact of other factors.

Assessment of likely auction outcome

- 79 The small operator is unlikely to participate under this option because the reserve price would be set above the maximum value of spectrum to the small operator estimated by Network Strategies of \$5.24 million per paired MHz.

- 80 Likely outcomes of the Clock Allocation and Supplementary Allocation Phases would be:

- The small operator choosing not to participate, and the large operators bidding for 2x15 MHz each in the Clock Allocation Phase, and 2x5 MHz each in the Supplementary Allocation Phase. (Total revenue \$240 million and 2x5 MHz unsold.)
- The small operator choosing not to participate, and the large operators bidding for 2x15 MHz each in the Clock Allocation Phase, with one operator bidding for 2x5 MHz in the Supplementary Allocation Phase. (Total revenue \$210 million and 2x10 MHz unsold.)

The small operator choosing not to participate, and the large operators bidding for 2x15 MHz each in the Clock Allocation Phase. There Supplementary Allocation Phase would not be held. (Total revenue \$180 million and 2x15 MHz unsold.)

Analysis of advantages and disadvantages

- 81 The advantages of this option are:

- It should produce a fair return to the Crown that is greater than the previous option, because the auction participants that value the spectrum the most are likely to pay an amount reasonably close to the value to them
- Expected revenue would be greater than both the cost of supply and the current baseline estimate.

- 82 The disadvantages of this option are:

- It is likely to result in a less efficient allocation and deployment of 700 MHz spectrum (i.e. only to the two large operators), resulting in fewer overall economic benefits
- Some spectrum is likely to be unsold, reducing economic benefits
- It may not maximise revenue to the Crown, as large operators may pay less than the maximum value of the spectrum to them.

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Conclusion

- 83 While this option is likely to produce greater revenue to the Crown than the previous two options, it is not preferred because it is likely to exclude the small operator and leave spectrum unsold, resulting in a less efficient allocation of spectrum and fewer overall economic benefits.

Option 4 – Maximise revenue to the Crown

Description

- 84 The reserve price could be set at the maximum value of spectrum estimated by Network Strategies. This would be closer to the maximum value of spectrum to a large operator, which is likely to be based on higher traffic volume assumptions. The purpose of this option would be to maximise revenue to the Crown from the auction by taking advantage of the uncertainty inherent in forward-looking valuations.
- 85 The reserve price that best gives effect to this option would be set using the upper bound range of Network Strategies' benchmarks. That is, using the range from \$8.27 to \$10.39 million per paired MHz.
- 86 The highest value of the commercial model for large operators is \$0.68 per paired MHz. This suggests that a reserve price at the higher end of the upper bound range may be appropriate given the Network Strategies considers that the commercial model produces a more conservative figure than benchmarking.

Impact of other factors on the reserve price

- 87 Other factors that might reduce the value of the spectrum to large operators need to be considered when setting this reserve price. The other factor with the greatest impact will be the additional coverage obligation, which is calculated as per Option 3.
- 88 An allocation of more than 2x15 MHz is unlikely under this option, so a reduction based on the cost of \$11.25 million per operator (or \$750,000 per paired MHz)¹⁸ should be applied to the reserve price to reflect the reduced value of the spectrum to large operators.
- 89 The relative non-scarcity of spectrum and the deployment of 4G equipment in the 1800 MHz band may also reduce the value of the spectrum to large operators. This means that a slightly more conservative reserve price would be appropriate.

Impact of ability to pay

- 90 As discussed above, the large operators should be able to meet a reserve price set at this level and the small operator is highly unlikely to bid.

Reserve price

- 91 The reserve price under the option would be \$9 million per paired MHz. This reflects a reduction in the reserve price of \$1 million to take into account the impact of other factors.

¹⁸ That is, the estimated cost to \$11.25 million multiplied by the expected bidders (2) divided by the number of 2x5 MHz spectrum lots expected to be sold (8) divided by 5 to give a value per paired MHz.

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Assessment of likely auction outcome

92 The small operator would almost certainly not participate under this option because the reserve price would be set significantly above the estimated maximum value to it of the spectrum of \$5.24 million per paired MHz.

93 Likely outcomes of the Clock Allocation and Supplementary Allocation Phases would be:

- The small operator choosing not to participate, and the large operators bidding for 2x15 MHz each. (Total revenue \$270 million and 2x15 MHz unsold.)

Analysis of advantages and disadvantages

94 The advantages of this option are:

- Assuming large operators participate fully, this option is likely to maximise revenue to the Crown, as the auction participants that value the spectrum the most are likely to pay the maximum value to them
- Likely revenue would be significantly greater than the cost of supply and the current baseline estimate

95 The disadvantages of this option are:

- If the Ministry's commercial modelling and benchmarking have overestimated the value of spectrum to one or both large operators, the reserve price may significantly reduce participation in the auction. This could significantly reduce overall economic benefits and may damage markets for 4G services.

It is likely to result in a less efficient allocation and deployment of 700 MHz spectrum (i.e. a lesser allocation to the two large operators only), resulting in fewer overall economic benefits.

Conclusion

96 While this option may produce greater revenue to the Crown than the other options, it is not preferred because it is almost certain to exclude the small operator and probably leave significant amounts of spectrum unsold. This would result in a less efficient allocation of spectrum and fewer overall economic benefits. There is also a risk of significantly less participation by large operators which would exacerbate these outcomes and may damage markets for 4G services.

Summary table of options

Option	Reserve price Simple paired MHz	Estimated revenue, \$ millions
1 Cost of supply	3.49	157
2 Fair return consistent with small operator participation likely	4.2	189
3 Fair return consistent with small operator participation unlikely	6.0	180-240
4 Revenue maximisation	9.0	270

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Recommendation

- 97 The recommended option is Option 2, which aims to balance an efficient allocation of spectrum among the three existing operators with a fair return to the Crown.
- 98 Option 1 is not preferred because the Crown is unlikely to obtain a fair return. Options 3 and 4 are not preferred because the overall economic benefits from an efficient allocation of spectrum among the three existing operators outweigh the likely increased revenue to the Crown from a higher reserve price.

Communications strategy

- 99 The reserve price needs to be announced six to eight weeks prior to the auction, together with the date of the auction, the coverage obligations for purchasers of spectrum, and the detailed requirements of the auction.
- 100 The information will be announced simultaneously in press releases, on the www.rsm.govt.nz website, and emailed to interested parties.

Risks

- 101 The recommended option does not maximise revenue to the Crown from the auction of 700 MHz spectrum. However, this risk is mitigated by several factors: the reserve price will still ensure a reasonably fair return to the Crown, the expected revenue from the recommended option is significantly greater than the current published baseline figure of \$119 million, and the overall economic benefits from an efficient allocation of spectrum are expected to greatly outweigh revenue to the Crown.
- 102 Even with a reserve price (and other aspects of the auction) set to encourage the small operator to participate in the 700 MHz auction, the small operator may still choose not to participate, for example because of capex constraints or alternative priorities, or if the reserve price still exceeds the actual value to the small operator.
- 103 As no consultation with interested parties is anticipated before setting the reserve price, it is not certain how potential bidders will react to it. This risk would be mitigated by the recommended option which aims to encourage the fullest participation consistent with a reasonably fair return to the Crown.

Legal Risks

- 104 No legal risks related to setting the reserve price have been identified.

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Annex 1: Context for 700 MHz spectrum auction

Background

The Government has made the following decisions on the allocation of the 700 MHz spectrum band:

- The band will be configured in two 45 MHz paired blocks separated by the 10 MHz centre band gap (the APT Band Plan).
- The spectrum will be allocated in 2x5 MHz blocks as long-term management rights for use from 1 January 2014. Two types of management rights will be available to successful bidders:
 - i. Early Management Rights will be available from 1 January 2014 and expire on 1 March 2020.
 - ii. Conditional Management Rights will be available from 12 March 2020 and expire on 28 November 2031, if the implementation requirements cited below have been met.
- An initial acquisition limit of 2x15 MHz per bidder will be applied, but may be relaxed to 2x20 MHz during the auction if bids above the reserve price are not received for all spectrum blocks.
- Conditional Management rights will be subject to implementation requirements ensuring that services are deployed across New Zealand in a timely manner.
- Early and Conditional Management Rights will be allocated for commercial use by a simplified combinatorial clock auction which includes three phases:
 - i. Clock Allocation Phase where parties place package bids for generic blocks of 2x5 MHz of spectrum, up to the acquisition limit of 2x15 MHz.
 - ii. Supplementary Allocation Phase where successful bidders in the Clock Allocation Phase compete for any generic blocks of spectrum not sold in that phase (up to a revised acquisition limit of 2x20 MHz).
 - iii. Combinatorial Assignment Phase where successful bidders bid to determine the specific locations in the band, of the blocks of spectrum that they have purchased.
- The auction date and reserve prices will be announced at least two calendar months prior to the auction.

Objectives of the Auction

The objectives of the auction are:

- Allocative efficiency – Spectrum auctions, by commoditising spectrum rights, help identify the highest value use and users of specific parts of the radio spectrum.
- Technical efficiency – It is important to ensure that the auction outcome results in a technically efficient allocation.
- Transparency – Auctions should invite open and honest bidding by parties.

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- Fair return – To minimise private windfall gains, it is important to ensure that an appropriate price is paid by the private companies in exchange for use of highly contested spectrum.
- Deployment – The government wishes to see all available spectrum allocated to market for rapid deployment, if there is a willing buyer.

We have considered these objectives in the development of the options and the recommendation. The most significant objectives for setting the reserve price are fair return, efficiency, and deployment.

Structure of the mobile market

New Zealand's three mobile network operators together have 4.92 million mobile connections. Vodafone New Zealand (**Vodafone**) operates nationwide 2G GSM and 3G UMTS networks.¹⁹ Telecom New Zealand (**Telecom**) operates a nationwide 3G UMTS network, and 2degrees operates 2G GSM and 3G UMTS networks in most towns and cities, teaming on Vodafone's network outside its network coverage.

On a connections basis, Vodafone has 42% market share, Telecom has 37% and 2degrees has 20%.²⁰ With 70,000 connections and \$38 million revenue, Mobile Virtual Network Operators (**MVNOs**) have an insignificant 1% share of the New Zealand mobile market.²¹

While all three existing operators have indicated an interest in acquiring 700 MHz spectrum, the most likely fourth bidder and largest MVNO, Telstra, recently exited the New Zealand market with the sale of TelstraClear to Vodafone. Also, while 700 MHz spectrum could be of value to Chorus, the Ministry does not expect Chorus to participate in the auction.

Therefore, unless a very low reserve price is set, it is likely that the existing operators will be the only bidders for 700 MHz spectrum.

¹⁹ Vodafone has launched 4G services on a geographically limited basis using 1800 MHz spectrum.

²⁰ 2degrees' connection numbers tend to overstate its market share because it has a higher proportion of lower value pre-paid customers.

²¹ Commerce Commission, Annual Market Monitoring Report 2012, April 2013. The MVNO market share will decline further with the integration of TelstraClear's MVNO into Vodafone.

Annex 2: Summary of the Network Strategies' reports

Details of valuation methods

The NS Report and NS Update set out estimated valuations derived from:

1. Benchmarking historical prices in New Zealand for similar spectrum
2. International benchmarking to assess the value placed on spectrum in auctions in other jurisdictions using:
 - a) Market prices for similar spectrum
 - b) Market prices for digital dividend spectrum
 - c) Statistical modelling of the benchmarks to adjust for differences across benchmarked countries
3. Business modelling to assess the commercial value of the spectrum to New Zealand operators.

Method 1 – Benchmarking historical prices in New Zealand for 850/900 MHz spectrum (NS Report, 18)

Spectrum in the 800 and 900 MHz bands is considered similar to 700 MHz spectrum as it has similar propagation characteristics. The benchmarks selected by Network Strategies are almost exclusively of spectrum auctioned in these bands.

In New Zealand in 2007, spectrum management rights in the 800/900 MHz bands were renewed by agreement for the equivalent of \$3.92 million per paired MHz for an 18 year term.²² Network Strategies considers the historical price for 850/900 spectrum a lower bound for the 700 MHz auction without any premium that is generally associated with digital dividend spectrum.

Method 2 – International benchmarking (NS Report, 19-36; NS Update, chapter 2)

Benchmarking involves selecting market prices for similar spectrum in other jurisdictions, standardising those prices for differences in population, and converting into New Zealand dollars. The purpose of this process is to compare prices across different jurisdictions.

The international benchmarking conducted by Network Strategies is summarised below. Key points to keep in mind when considering all three benchmarking estimates (methods 2a-2c) are:

- i. Spectrum prices were standardised to an annualised price per paired MHz per 1000 of population, to produce comparable data.
- ii. The benchmarks were collected from auctions for 700/800/900 MHz spectrum held over the period from 2001 to May 2013 (see NS Update Annex A for the list of auctions included).
- iii. The benchmarks underestimate the total cost of spectrum to the operator. Annual spectrum usage fees are commonly charged in addition to the auction price. The fees

²² The agreed price was informed by benchmarking and modelling that estimated the value to be between \$2.1 and \$7.8 million per MHz paired for a 20 year term.

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vary from minor to substantial (see NS Report pages 21 to 27 for examples). The fees are not included in the benchmarks which concentrate only on the auction price bid. New Zealand has very low annual fees.

- iv. Purchasing power parity was used for currency conversions. Historical prices were adjusted to reflect the effect of inflation.

Methods 2a & 2b – All auctions and digital dividend only benchmarks (NS Report, 29-35; NS Update, 3-7)

Network Strategies used benchmark data to determine maximum, minimum, average and median winning bids across:

- all the auctions in the dataset, and
- a subset of digital dividend auctions.²³

The results of the international benchmarking are shown in the table below. The results from different jurisdictions were made comparable by reducing the price to an annualised price by per thousand of population. That annualised price was then multiplied by the 18 years of the New Zealand management rights and the New Zealand population in thousands.

The estimated price is the average winning bid, while the upper and lower bounds correspond to the upper and lower quartiles of the average winning bid.

	Estimated price (average winning bid)	Lower bound	Upper bound
2a. Across all auctions in the data set			
Price per 18 year term (millions)	7.27	1.24	8.27
2b. Across digital dividend auctions only			
Price per 18 year term (millions)	7.49	4.38	10.39

Method 2c – Benchmark model (NS Report, 35-36; NS Update 7-8)

The benchmark model seeks to adjust the benchmarks from all auctions to account for differences across sample countries.

There is a large variation within the spectrum prices in the data set. The benchmark model can be used to explain about 40% of the variations found.

The results from the benchmark model are shown in the table below. The upper and lower bounds represent one standard error above and below the model estimate.

²³ The digital dividend subset consists of thirteen auctions in the 800 MHz band and one in the 700 MHz band from May 2010 to May 2013 (see NS Update, exhibit 2.2 for the list of auctions).

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	Per paired MHz		
	Estimated price	Lower bound	Upper bound
Price for 18-year term (millions)	6.68	3.61	9.74

Method 3 – Commercial valuation model (NS Report, 37-53; NS Update, 9-11)

The purpose of the commercial model is to estimate the value of 700 MHz spectrum to New Zealand operators. The commercial model considers a range of scenarios²⁴ for a small and a large operator with variable parameters to determine an expected range of net present values (NPV).

Fourteen likely scenarios (7 for a small, and 7 for a large operator) were determined by analysing inputs and assumptions for demand, engineering assumptions and unit costs. Each scenario was modelled to give a NPV for that scenario. The median, and the lower and upper bound, estimates were extracted for comparison with other valuation techniques.

The median, and lower and upper bound, estimates from the scenarios are shown in the table below.

	Price per paired MHz for 18-year (NZ\$ millions)		
	Median	Lower Bound	Upper Bound
Small operator	3.91	0.97	5.24
Large operator	6.83	6.60	12.78
Combined ²⁵	5.42	4.62	9.68

Network Strategies does not expect the results to mirror exactly the operators' own commercial valuations because of the number of assumptions required. However, it considers that the commercial model results are a reasonable approximation of a commercial net present value analysis.

Although, as the results are generally lower than the benchmark results, Network Strategies considers that the commercial model may not capture all of the value associated with the spectrum.

Reserve pricing review (NS Update, 13-15)

Network Strategies considered the trends over time in reserve prices and winning bids from auctions in the benchmarked jurisdictions.

Case studies (NS Update, 17-29)

Network Strategies examined case studies of digital dividend auctions in three countries: Australia, Ireland and UK.

Australia

²⁴ The scenarios considered used the following broad rules:

- A small operator is likely to have less alternative spectrum available to carry its traffic, therefore a greater proportion of the operator's total traffic is likely to be carried on the 700 MHz spectrum
- A small operator is likely to have a higher WACC
- A small operator is less likely to be able to complete a fast network roll-out.

²⁵ The combined result assumes 700 MHz spectrum is allocated as two lots of 2x15 MHz for large operators and one lot of 2x10 MHz to the small operator, with 2x5 MHz unsold.

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In April and May 2013 the Australian Communication and Media Authority (ACMA) simultaneously auctioned 2x45 MHz of 700 MHz spectrum and 2x70 MHz of spectrum in the 2.5 GHz band. The reserve price for the 700 MHz spectrum was set by a Ministerial direction issued in December 2012 at an amount of AUD1.36/MHz/pop.²⁶ The Ministerial direction indicated the importance of getting a reasonable return on a valuable public asset.

Lack of demand in Clock Round 1 of the auction led to three unsold lots of 2x15 MHz in the 700 MHz band, with Telstra obtaining 2x20 MHz and Optus Mobile 2x10 MHz of 700 MHz spectrum. Network Strategies consider that the outcome suggests that the reserve price may have been set too high.

Network Strategies also note that if all the 700 MHz spectrum had been sold for the same total revenue as the auction returned, the price would have been one-third less than the reserve price; i.e. NZ\$9.2 million per MHz paired for the 18 year term.

Ireland

Between November and December 2012, ComReg auctioned spectrum rights in the 800 MHz, 900 MHz and 1800 MHz bands by a combinatorial clock auction. ComReg stated that its aims in setting reserve prices for the auction were:

- To deter frivolous bidders without genuine business cases
- To ensure administrative cost recovery
- To protect against anti-competitive behaviour including collusion of bidders
- To avoid setting the price so high that efficient demand may be choked off
- To ensure efficient use of spectrum.

The final reserve prices were derived from international benchmarking and reflected a conservative lower bound estimate of the market value of liberalised spectrum. The reserve price for 2x5 MHz of sub-1GHz spectrum (with 13 lots of 2x5 MHz available) was set at EUR20 million (NZ\$35.42 million).²⁷ Due to competition during the auction all winners paid prices above the specified reserve prices set by ComReg, with total revenue of over twice the level of the reserve prices.

United Kingdom

In early 2013, Ofcom auctioned spectrum in the 800 MHz and 2.6 GHz bands. The reserve prices were set by estimating a market value but with a discount.²⁸

Ofcom received advice from its consultants on a range of estimates per MHz per capita derived from a combination of international benchmarking, business modelling and expert advice. The consultants recommended that the reserve price for 800 MHz spectrum be set at the mid-point of the small bidder benchmark range to take into account the risk of choking off efficient demand and uncertainty associated with valuations.

²⁶ A conversion of the Australian reserve price using the New Zealand population implies a price per paired MHz of NZ\$13.4 million for the 18 year term.

²⁷ There were also annual usage fees per 2x5 MHz of sub-1GHz spectrum of EUR1.08 million (NZ\$1.91 million).

²⁸ In previous auctions, Ofcom had set reserve prices at a low but not trivial price.

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Ofcom ultimately selected reserve prices for 800 MHz spectrum that were in the top half of the benchmark range (i.e. higher than the consultant's recommendation) in order to balance the risks of spectrum inefficiency (e.g. from strategic bidding) against the risk of deterring potential bidders and leaving spectrum unsold.

There was a degree of competition in the auction with prices obtained more than double the minimum reserve price of GBP1.3 billion.

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**Ministry of Business, Innovation and Employment Report:
700 MHz Auction: Implementation Requirements**

Date Sent:	15 August 2013	Tracker No:	0152 13-14
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Action Sought

	Action Sought	Deadline for Action
Minister for Communications and Information Technology (Hon Amy Adams)	Forward to Ministers English and Joyce Read before trilateral Ministers meeting on 21 August 2013	16 August 2013
Minister of Finance (Hon Bill English)	Read before trilateral Ministers meeting	21 August 2013
Minister for Economic Development (Hon Steven Joyce)	Read before trilateral Ministers meeting	21 August 2013

Contact for Telephone Discussion (if required)

Name	Position	Telephone	1st Contact
Len Starling	Manager, Radio Spectrum Policy & Planning	04 462 4221 (wk)	99(2)(a) ✓
Robin Campbell	Policy Advisor, Radio Spectrum Policy & Planning	04 901 1555 (wk)	

Minister's Office Actions (if required)

Office of Minister for CIT: Forward to Ministers English and Joyce

Minister's Comments

700 MHz Auction: Implementation Requirements

Executive summary

In response to submissions from mobile network operators ('MNOs') and other stakeholders, we have investigated options for an implementation requirement linked to rural coverage. We have identified a preferred option that is based on specification of the number of rural cell towers to be fitted with 4G 700 MHz equipment. When combined with the MNOs' current 4G roll-out plans in cities using 1800 MHz, this implementation requirement would result in over 90% population coverage within five years. Adoption of our proposed rural implementation requirement would therefore allow the government to announce a credible policy objective of 90% 4G coverage within five years (by the end of 2018).

This is one of three reports you will receive covering the 700 MHz auction. The others cover the reserve price and auction format. You are scheduled to meet with the other delegated Ministers to consider these matters on 21 August 2013. As the other reports include detailed explanations of the auction's context, this report does not duplicate that information.

Objectives

There are three objectives for the implementation and coverage requirements:

1. Ensure that the spectrum is used to provide services to consumers.
2. Improve mobile broadband services in rural areas.
3. Extend cellular coverage to currently un-served areas.

Context

Feedback in the recent consultation on the 700 MHz auction was strongly in favour of improved rural coverage. The mobile network operators also stated that the Ministry of Business, Innovation & Employment's ('MBIE') original proposed implementation requirements (50% national population coverage within five years, including 30% within any given region – see Annex 2) incentivise 700 MHz deployment in highly populated urban areas. This distorts their planned deployment of 4G services using 1800 MHz in urban areas and 700 MHz in rural areas.

In light of this feedback, and the policy interest in rural coverage, we have looked again at options for implementation requirements that would better meet the various policy objectives of the government and the commercial objectives of the MNOs. In addition to reviewing options previously considered we considered several new options. This report focuses on MBIE's recommended option but details of other options are provided in Annex 1.

Recommended Option

We recommend that the government announce a policy objective of achieving 4G service availability to 90% of the total population within five years. This will be achieved by a combination of commercial incentives to roll out 4G in urban areas using existing 1800 MHz spectrum and a specific 700 MHz licence requirement for rural deployment. The 90% 4G coverage would be stated as a policy objective but would not be a specific licence requirement. The specific rural deployment licence requirement for 700 MHz would be for MNOs to upgrade

¹ All three MNOs hold management rights to 2x25 MHz (each) of 1800 MHz spectrum (2x10 MHz of 2degrees' 1800 MHz spectrum is owned by 2degrees shareholder Trilogy Ltd). Vodafone has already deployed urban 4G services using 1800 MHz. Telecom has announced it will do so by the end of 2013. 2degrees has recently obtained funding to do so, but has not announced a date.

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75% of their existing rural 850/900 MHz² cellsites to 4G using 700 MHz, within five years, up to a maximum of 300 sites nationwide. The 75% cellsite upgrade would be a practical way of ensuring the 90% population coverage objective will be met. MNOs are expected to use 1800 MHz to provide urban 4G services. Indeed there is already competition to be first and fastest in urban areas with 4G. Our network modelling suggests that a combination of urban deployment with 1800 MHz plus a requirement to upgrade 75% of rural towers will achieve 90% population coverage with a comfortable buffer.

This proposed option would ensure the spectrum gets used, provide improved rural coverage, and allow MNOs flexibility to deploy their preferred network architectures.

Setting a maximum number (or cap) of cellsites to be upgraded is suggested to equalise the obligation for Vodafone and Telecom. The intention is that the cap is roughly equal to 75% of either Vodafone's or Telecom's current rural cellsites (whichever is less). 300 is our best estimate for a cap based on registered licenses. The obligation is also considerably easier for 2degrees as it has a limited number of existing rural sites. This license condition should not impact on 2degrees' ability to bid.

Annex 3 presents maps that show the likely coverage achieved by a 75% upgrade requirement in Hawke's Bay, Southland, and Canterbury.

Compatibility with original implementation and coverage requirement proposals

Existing MNOs would be required to meet the new rural cellsite upgrade requirement. However, the originally proposed population-based implementation requirement (outlined in Annex 2) would still be needed in case a new market entrant with no existing cellsites to upgrade is successful in the auction. Requiring a new entrant to provide 90% population coverage within five years would be extremely onerous.

The originally proposed additional coverage obligation (outlined in Annex 2) would still stand for all successful bidders. A single cellsite could be eligible to meet both the newly proposed 700 MHz requirement and the originally proposed additional coverage requirement, if it met both requirements' criteria.

Consultation

MNOs have been informally consulted on the new recommended option. Although differing in the details, initial industry feedback about this option was positive overall.

Risks and mitigations

Any implementation requirement could affect the returns that can be expected from the auction. This will need to be considered when setting the reserve price. However, it appears that our recommended option is not too dissimilar from the MNOs current implementation plans so we expect it will not have a major effect on value of the spectrum to the MNOs.

Recommendations

We recommend that you:

- 1 Refer this report to Ministers English and Joyce for final decision by joint Ministers.

Yes/No

² 2degrees and Vodafone use spectrum in the 900 MHz band for 2G and 3G services, while Telecom uses comparable spectrum in the 850 MHz band for 3G. Telecom no longer operates a 2G network.

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- 2 **Note** that MBIE received feedback that encouraged rural coverage requirements and argued that the originally proposed population-based implementation requirements could overly distort technically and economically sensible 4G network deployment.
- 3 **Agree** to a new requirement for existing MNOs, to upgrade 75% of their existing 2G/3G 850/900 MHz rural cellites within five years to 4G using 700 MHz, up to a maximum of 300 cellites (Option A).

Yes/No

- 4 **Note** that MBIE modelling shows that, when combined with existing plans to deploy urban 4G services using 1800 MHz, this will achieve 90% population coverage.
- 5 **Agree** that the original population-based requirement will be retained for a new market entrant only, in case a new entrant is successful in the auction.

Yes/No

Len Starling
 Manager, Radio Spectrum Policy & Planning
 Resources, Energy and Communications
 Branch

Hon Amy Adams
**Minister for Communications and
 Information Technology**

Date: ____/____/____

Hon Steven Joyce
Minister for Economic Development

Date: ____/____/____

Hon Bill English
Minister of Finance

Date: ____/____/____

Minister's feedback on quality of report:					1 Not satisfactory; 2 Fell short of expectations in some respects; 3 Met expectations 4 Met and sometimes exceeded expectations; 5 Greatly exceeded expectations
1	2	3	4	5	

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700 MHz Auction: Implementation Requirements

Purpose

- 1 This report considers options for alternative implementation requirements and recommends a requirement for 4G-LTE services using 700 MHz to be implemented on 75% of mobile network operators' existing 850/900 MHz rural cellsites (up to a cap of 300 sites). Adoption of our proposed rural implementation requirement would allow the government to announce a credible policy objective of 90% 4G coverage within five years.

Context

- 2 The Ministry of Business, Innovation & Employment (MBIE) is planning an auction of spectrum in the 700 MHz band. This spectrum has been freed up by the switchover to digital television and is expected to be used internationally for the deployment of next generation 4G mobile broadband services. Spectrum freed up by the switchover to digital television is sometimes referred to as "digital dividend" spectrum.
- 3 The government has in the past imposed implementation requirements on spectrum allocated via auction. These are sometimes called "use-it-or-lose-it" clauses, as they are designed to ensure that owners of spectrum management rights put their spectrum to use to deploy wireless networks. Implementation requirements are enforced through deeds between management rights holders and the Crown acting through the Chief Executive of MBIE.
- 4 From a technical perspective, 700 MHz provides good rural 4G coverage, while higher frequency spectrum (e.g. 1800 MHz) is better for urban 4G services.³ The originally proposed implementation requirement incentivised urban use of 700 MHz because it required 50% population coverage, which would most easily be met by covering the main cities.
- 5 Responses to the recent consultation on the 700 MHz auction highlighted this issue. The MNOs were concerned that the proposed population-based implementation requirement would overly distort their planned network deployments. Rural advocacy and industry groups argued that the 700 MHz auction should be used to promote rural connectivity. We have therefore looked again at options for implementation requirements.

Recommended option

- 6 We have reviewed international examples of implementation requirements, reconsidered options that we had previously considered, and formulated new options. These are presented in full in Annex 1. In brief, other options considered include:
 - A requirement to upgrade particular cellsites to 700 MHz, which would see the government getting very involved in the detailed design of cellular network architectures;
 - A generic 4G implementation requirement, which would not ensure that 700 MHz spectrum gets used;

³ In the longer term, 700 MHz will also be valuable for urban areas – to provide extra capacity and to boost in-building coverage.

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- Options to require coverage of particular towns, rural areas, or state highways, which could raise questions of transparency over why particular towns or areas or chosen;
 - A single coverage requirement lot in the auction, which would require MBIÉ to redesign the auction process and could encourage gaming behaviour by bidders;
 - A zoned "outside-in" deployment requirement, which could perversely delay urban 4G network deployment;
 - A rollout ratio (for example, one rural tower for every three urban towers built/upgraded), which may not work due to the expected initially limited deployment of urban 700 MHz networks.
- 7 We recommend an option whereby MNOs are required to upgrade a percentage of their existing rural 2G/3G cellsites (850/900 MHz) to 4G using 700 MHz. This would allow MNOs flexibility to deploy networks in line with their preferred network architectures. 1800 MHz in the cities and 700 MHz in smaller towns and rural areas.
- 8 We recommend 75% as a suitable proportion of cellsites to be upgraded. As explained below, this will achieve 90% population coverage with some comfort margin,⁴ help to prevent clustered network deployment around urban centres, achieve substantial geographic coverage, and allow for extremely remote sites not to be upgraded for cost reasons.
- 9 This option would be equitable for existing MNOs as it would be proportional to MNOs' existing network infrastructure.
- 10 This option would achieve the policy objective to ensure that 700 MHz spectrum gets used to deploy 4G networks in a timely and widespread manner, as well as force the deployment of 4G networks using 700 MHz to cover rural areas, to help facilitate rural economic growth and social connectivity. It would achieve much greater geographic and population coverage than many of the other options.
- 11 We recommend that only rural 850/900 MHz cellsites should be counted for this requirement, as these are the sites that currently provide rural 2G/3G coverage. 2.1 GHz cellsites are generally only used in cities to provide extra 3G capacity, and 1800 MHz cellsites are generally used to provide urban capacity for 2G and 4G services.
- 12 From a technical perspective, we are indifferent to whether MNOs choose to build rural 4G networks using new or retrofitted cellsites. We recommend that MNOs be allowed to build new towers rather than upgrade old towers to meet the proposed requirement, given that it may be technically and/or economically difficult to upgrade some existing towers. In practice, this means that the requirement is to provide a rural 4G network with a number of cellsites equal to 75% of the operator's current rural 2G/3G cellsites, within five years. New cellsites built to meet this requirement could count towards the originally proposed additional coverage requirement, as long as they served previously un-covered areas (outlined in Annex 2).
- 13 Co-location would be an acceptable way to meet the requirement.⁶

⁴ Population is defined here in reference to residential premises.

⁶ Co-location is where two or more operators install their own base station equipment on a single tower or cellsite.

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- 14 Future Rural Broadband Initiative (RBI) towers built after the date on which Vodafone begins deploying a 4G 700 MHz cellular network must use 700 MHz for high speed fixed wireless broadband, so these would not be counted towards Vodafone's requirement. However, upgrading existing 3G RBI towers would be counted towards the requirement. We understand that Vodafone is upgrading 380 existing towers under the RBI, approximately two thirds of which have been completed, and building an additional 154 new towers of which 50 have been completed. While the base station technology is essentially the same, the RBI provides fixed wireless broadband and 4G-LTE networks provide cellular mobile broadband.

Industry feedback

- 15 We have shared our initial thinking about our preferred option with the three MNOs, including specifically testing the 75% upgrade figure. All have provided generally positive feedback, although 2degrees would still prefer a generic 4G requirement, and Vodafone would still prefer a TSO Zone-based requirement or an option whereby different coverage requirements are applied to different blocks of spectrum. These options have significant disadvantages from our point of view, as explained in Annex 1.
- 16 Telecom was concerned that without a cap on the total number of rural cell sites to be upgraded, the policy sends a message that existing investment in rural infrastructure beyond what a company's competitors have invested could be "punished". MBIE has proposed such a cap, mitigating Telecom's concern (see below).
- 17 2degrees argued that it should not be subject to the same level of requirement as the other MNOs because it is at an earlier stage in its network build. Telecom argued that Vodafone and Telecom should be required to upgrade the same number of sites, but accepted that 2degrees may be subject to a lighter requirement. Vodafone suggested all MNOs should be subject to the same upgrade requirement.
- 18 Both 2degrees and Telecom stressed that the new proposal is more extensive than the initial population-based proposal, and this should be reflected in the reserve price. Telecom has advised that the cost to upgrade an existing cell site to 700 MHz 4G is [REDACTED]

Detailed design considerations

- 19 Our recommended option (Option A) raises some challenges:
- Some rural cell sites are likely to be very expensive for MNOs to upgrade, particularly those that currently lack the backhaul capacity to make 4G worthwhile. This challenge is mitigated as MNOs will be able to choose which rural cell sites they upgrade to meet the requirement. If the government's intention is to provide improved rural mobile broadband in all uneconomic remote areas, this would be better addressed through the RBI.
 - There could be a perception that this option goes beyond the original stated objective of an implementation requirement (to ensure the spectrum is used) to also encompass rural coverage policy objectives. However, MNOs have argued strongly that an implementation requirement that incentivises urban population coverage is not in line with their preferred network architecture because it is technically and more economically efficient to use 700 MHz in rural areas, and MNOs and other stakeholders have argued that the auction should be used to promote rural connectivity.

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- There may be an impact on the MNOs' valuation of the spectrum, which would need to be taken into account when setting the reserve price. However, given that MNOs have provided general support for this proposal we do not think the impact on the valuation is very significant.

Setting an appropriate percentage of towers to be upgraded

- 20 As noted above, some remote rural cell sites lack the backhaul capacity to make upgrading them to 4G worthwhile. If these sites were upgraded, users would be unlikely to experience improved mobile broadband speeds. We understand that 2degrees is likely to have a greater proportion of inferior (microwave) backhaul than its competitors.
- 21 We have provided coverage maps (Annex 3) showing that a 75% upgrade requirement would in practice provide significant rural coverage. (Please note that these maps are high level approximations. More precise coverage maps would require tools and information not currently available to us).
- 22 If a 75% cell site upgrade is deemed to meet the 90% population coverage objective there will be a comfort margin, as our calculations suggest that MNOs could be able to provide nominal 90% population coverage by upgrading fewer cell sites. Requiring 75% of rural cell sites to be upgraded will ensure that the 4G coverage provided is not merely "on paper" but provides useful real-world coverage levels for consumers to experience improved mobile broadband speeds in a range of locations.
- 23 Further, we have calculated that by upgrading 75% of existing rural cell sites to 700 MHz and deploying 1800 MHz 4G networks in cities, MNOs may exceed 90% population coverage.
- 24 We had initially considered an additional requirement to upgrade a percentage or fixed number of cell sites within every region, to ensure widespread network deployment. However, setting regional targets is not necessary as the 75% nationwide upgrade requirement necessitates a wide spread of upgraded cell sites.

Equity between network operators

Equity of upgrade requirement

- 25 As noted above, Telecom supports our recommended option as long as Telecom and Vodafone are required to upgrade the same number of rural sites. Vodafone would prefer that all MNOs are subject to the same requirement.
- 26 We think that the Telecom argument has merit. To address this we propose a cap on the number of rural sites to be upgraded. We do not know the precise numbers of rural towers currently in operation as not all registered sites are operational. However, Telecom advises that it has about 450 rural sites. Based on its registered licences Vodafone is likely to have slightly less. We therefore suggest 300 as the cap.
- 27 While the number 300 is round and approximate we think that it is sufficiently accurate to ensure that the policy objectives are achieved with a margin for comfort. Our modelling suggests that 90% 4G coverage can be achieved with main city coverage (at 1800 MHz) plus about 150 rural towers using 700 MHz. However this estimate is based on coverage modelling at the regional level and does not allow for minor local obstructions or other issues that may cause coverage holes. The number 300 appears to provide a good compromise between providing a safety margin on the policy objective and not pushing the MNOs into highly uneconomic expenditure.

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- 28 The cap is designed to place the same requirement on Vodafone and Telecom and a lesser (but proportionate) requirement on 2degrees. 2degrees has 209 licenced rural sites so is likely to be required to upgrade approximately 150 sites.

Equity of population coverage objective

- 29 The option proposes 90% population coverage as a policy objective, rather than a requirement for the MNOs. MNOs would be deemed to achieve this objective, in part through the requirement to upgrade 75% of their existing rural cellsites.

- 30 A smaller MNO may not achieve 90% population coverage by upgrading 75% of its existing rural sites to 700 MHz and deploying urban 1800 MHz networks, within five years. There are two options to address this:

- Allow the population coverage objective to be met with roaming agreements. 2degrees customers currently roam on Vodafone's network in rural areas where 2degrees does not have its own network. We understand that 2degrees' own 2G/3G network now covers §9(2)(b)(i) of the national population, and is still being extended. This option is likely to result in requests (from 2degrees and possibly other stakeholders) for price-regulated roaming, which would add another layer of complexity to the implementation requirement and would likely require substantial work by the Commerce Commission to set the appropriate regulated price. The major MNOs are likely to oppose price-regulated roaming.
- Require MNOs to upgrade 75% of rural cellsites as a proxy for providing 90% nationwide population coverage. In practice, a smaller MNO is highly likely to deploy an urban 1800 MHz network and upgrading 75% of rural cellsites in addition to this is likely to bring the MNOs' coverage very close to 90%. This is MBIE's preferred option.

Avoiding "clustered" deployment at urban fringes

- 31 If the required proportion of rural sites is relatively low there may be concerns that the MNOs might "cluster" deployment of 700 MHz services around urban fringes to meet the requirement without providing coverage in truly rural areas. At the extreme, clustering at urban fringes would not be an issue if the requirement was for 100% of rural towers. Although 100% is not a practical obligation,⁶ there is an obligation level which would enable us to be indifferent about which rural towers were chosen. We suggest that at 75% clustering is unlikely to be a problem.

- 32 After viewing current cellsite placements and coverage maps we consider this risk of clustering to be low. A 75% upgrade requirement would require widespread deployment beyond urban fringes. Most urban fringe towers appear to be serving smaller townships, industrial areas, or highly developed rural areas. It is not clear why we would want to prioritise against coverage of these areas.

- 33 In addition, once the planned 1800 MHz 4G services are deployed in urban areas there will be little reason for MNOs to duplicate urban fringe coverage with 700 MHz in the short-medium term.

⁶ This is because some remote rural cellsites lack the backhaul capacity to make 4G worthwhile.

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Monitoring and Enforcement

- 34 Monitoring of a 75%/300 sites obligation is straight-forward, particularly in comparison with the difficulties inherent in monitoring alternative measures such as population coverage.
- 35 Implementation requirements can be difficult to enforce. However, as the management rights to 700 MHz spectrum are to be issued in two tranches⁷ (from 2014-2020 and 2020-2031), the government could choose not to allocate the conditional rights in 2020 if the requirements have not been met in the required five years. MNOs will be required to meet the requirements in five years, by 1 January 2019.

Total upgrade, coverage, and implementation requirements

- 36 The table below shows the requirements and obligations that would apply to existing MNOs that are successful bidders in the 700 MHz auction

Quantity of spectrum purchased	Requirement to upgrade existing rural 850/900 MHz cell sites to 700 MHz	Additional coverage requirement (using any spectrum)
2x5 MHz	Upgrade 75% of existing rural cell sites (to a maximum of 300 cell sites)	N/A
2x10 MHz	Upgrade 75% of existing rural cell sites (to a maximum of 300 cell sites)	N/A
2x15 MHz	Upgrade 75% of existing rural cell sites (to a maximum of 300 cell sites)	Five new coverage cell sites per year, for first five years.
2x20 MHz (if available)	Upgrade 75% of existing rural cell sites (to a maximum of 300 cell sites)	10 new coverage cell sites per year, for first five years.

- 37 As noted, some existing rural cell sites will not be able to be upgraded and will need to be replaced to meet the 75% upgrade requirement. If a MNO chooses to build a new 4G cell site in an area that it previously did not provide coverage to, this cell site could count towards both the upgrade and additional coverage requirements. Likewise, a new cell site built to meet the additional coverage requirement could also count towards the population coverage and upgrade requirements, as long as it was 4G.

Communications strategy

- 38 We recommend that the Minister for Communications and Information Technology announces the government's policy objective (90% population coverage) and its means of achieving this (upgrading 75% of rural cell sites).

⁷ This is because of the inability under the Radiocommunications Act (1989) to cancel the current (ex-broadcasting) 700 MHz management rights which run to 2020.

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- 39 We recommend that the implementation and coverage requirements be announced at least eight weeks prior to the auction, together with the date of the auction and the detailed format of the auction. This information could be announced simultaneously in press releases, on the Radio Spectrum Management website (www.rsm.govt.nz), and emailed to interested parties. MBIE holds a list of parties who have nominated themselves to receive auction updates by email.

Risks

- 40 Any implementation requirement could affect the returns that can be expected from the auction. This will need to be considered when setting the reserve price. This risk has previously been raised with Ministers. However, it appears that our recommended option is not too dissimilar from the MNOs current implementation plans so we expect it will not have a major effect on value of the spectrum to the MNOs.
- 41 Promoting rural connectivity through spectrum allocation potentially overlaps with the policy objectives of the RBI.
- 42 There are a number of technical details that MBIE still needs to work through. However, we do not believe that these technical details will have any effect on the broad policy objectives or significantly affect the total number of towers classified as rural. For example, the method of defining the exact boundaries between 'urban' and 'rural' is yet to be finalised. Telecom has proposed using the Statistics New Zealand boundaries rather than local government wards. We intend to investigate this before finalising the implementation details as the Statistics New Zealand boundaries are available in a form that appears to have some technical advantages for MBIE and the MNOs.

Legal Risks

- 43 No legal risks related to the recommended implementation requirements have been identified.

Annex 1: Options for implementation requirements

International examples

- 1 Internationally, a wide range of implementation requirements are applied to cellular mobile spectrum.
- 2 Single coverage requirement lot: the UK regulator (Ofcom) attached a 98% population coverage requirement to a single lot in their recent 800 MHz⁸ auction. Telefonica UK won this lot and must develop a network that will supply 98% of the population who reside in premises that have less than a specified signal propagation loss level with a minimum cellular downlink speed of 2 Mbps indoors.
- 3 Zoned outside-in rollout requirement: the German regulator required phased 4G network deployment in its least populated areas before deployment in more populated areas was allowed. German states are broken up into four zones, with the smallest consisting of "villages" with less than 5,000 people and the largest covering areas with 50,000 or more people. Once the required level of coverage (90%) in a zone has been reached by one operator, all operators may move on to the next zone. It has taken an average of two years for German MNOs to meet their initial requirement to provide coverage to 90% of the phase one population.
- 4 Specific targeted network deployment: the Swedish regulator (PTS) holds a list of households and businesses with inadequate broadband coverage (below 1 Mbps). One lot in the recent 800 MHz auction had a coverage obligation attached to it to provide mobile broadband to 75% of premises on this list by the end of 2013 (the auction finished in March 2011). The list is updated annually, and MNOs will be required to provide coverage to new sites on the list by 31 December each year.
- 5 General targeted network deployment: the Danish regulator required mobile broadband coverage with speeds of at least 10 Mbps to be provided in particular regions that did not already have good mobile broadband coverage. This requirement will result in over 99% population coverage.
- 6 Population coverage: In France, holders of 800 MHz spectrum must provide coverage to 98% of the population within 12 years and 99.6% in 15 years. In Ireland, the regulator (ComReg) has proposed a 70% population coverage requirement to be met within three years.
- 7 No implementation requirement: the ACMA in Australia did not attach any coverage or implementation requirements to their recently allocated 700 MHz spectrum.⁹

New options

- A. **Requirement to upgrade a percentage of existing rural cellsites to 700 MHz [MBIE recommended option]**
- 8 This option achieves widespread rural 4G coverage by requiring a percentage of MNOs' existing rural cellsites to be upgraded to 4G using 700 MHz

⁸ In Europe, the "digital dividend" spectrum freed up by the television digital switchover, to be used for 4G, is the 800 MHz band, equivalent to New Zealand's 700 MHz band.

⁹ Cabinet has already agreed that there will be an implementation requirement in New Zealand.

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- 9 This option allows the government to set a policy objective for MNOs to provide 90% 4G population coverage, to be achieved by requiring 75% of existing rural cellsites to 4G using 700 MHz, in addition to MNOs existing planned deployments of urban 4G using 1800 MHz.
- 10 Details of this option are presented in the main body of this report (above).

B. Requirement to upgrade particular cellsites to 700 MHz

- 11 This option would allow particular areas to be targeted for improved mobile broadband. However, it would require MBIE or the Minister of Communications and Information Technology ("the Minister") to choose the sites to be upgraded, which could result in adverse comments from both MNOs and members of the public who live or work in areas served by cellsites that are not chosen. Care would have to be taken to make the selection process transparent.
- 12 There are also considerable administrative burdens: there are over 3500 cellsites in New Zealand using 850/900 MHz to choose from, including approximately 1800 in rural areas. It could be difficult to choose which to upgrade.
- 13 This option would have the government very involved in the detailed design of each MNO's network architectures.

C. Requirement to upgrade non-1800 MHz cellsites

- 14 MNOs could be required to upgrade a proportion of cellsites that do not already provide 4G services using 1800 MHz. However, this would encompass all Telecom and 2degrees cellsites, significantly advantaging Vodafone as the only MNO who has to date deployed a 4G network using 1800 MHz and effectively punishing Telecom and 2degrees for not yet deploying 4G using 1800 MHz.
- 15 However, it would not necessarily encourage rural coverage, as all MNOs could choose to upgrade urban 700 MHz sites.
- 16 Our recommended option (Option A, below) has similar benefits but fewer disadvantages.

D. Generic 4G implementation requirement

- 17 2degrees suggested allowing the population coverage requirements to be met with any 4G-capable spectrum (700, 1800, or 2600 MHz). While this would allow MNOs the flexibility to determine their preferred network architectures, it would not achieve the policy objective of ensuring that the 700 MHz spectrum is put into use. The initially-proposed population coverage requirement (50% nationally and 30% within each region) would be unlikely to lead to 4G deployment outside cities and major towns.
- 18 Our recommended option (Option A, below) incorporates this option with a requirement to upgrade rural cellsites to use 700 MHz, thereby meeting the objectives to provide widespread 4G services including in rural areas, and to ensure that 700 MHz spectrum gets used.

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Options previously considered

- 19 For completeness, we also note the options that have previously been considered.

E. Requirement to cover particular towns or areas

- 20 As with option B (above), this option would allow targeted 4G deployment in particular areas that might benefit most from improved mobile broadband. However, it would involve the Minister or MBIE choosing towns or areas to be covered. This could be administratively cumbersome and result in criticism from residents in towns or areas that were not chosen. Care would have to be taken to make the selection process transparent.
- 21 As a variant of this option, requirements to cover different towns or areas could be attached to different lots in the auction, potentially leading to more evenly distributed costs but patchy network deployment. This would require MBIE to redesign the auction process to accommodate the different requirements attached to different lots (currently all lots are generic). It could also raise similar gaming issues as option F, a single coverage obligation lot.

F. Single coverage requirement lot

- 22 A single lot in New Zealand's 700 MHz auction could have an implementation/coverage requirement attached to it. This could be a population-based requirement, or some other requirement. An advantage of this option is that the cost of meeting the implementation requirement can be reflected in a lower reserve price for this spectrum block, however this complicates the auction.
- 23 This option does not meet the key policy objective to ensure that all 700 MHz spectrum gets used by all successful bidders, as the requirement would apply to only one successful bidder. Bidders would face significant uncertainty going into the auction about whether they would end up with an implementation requirement or not.
- 24 This option could encourage the larger MNOs to game the auction by bidding up the prices of the other lots so that a smaller MNO was forced to purchase the coverage obligation lot, without the means to achieve the coverage requirement.
- 25 Alternatively, different spectrum blocks could have different regional coverage obligations attached to them. These could be specific rural regions, state highways, or tourist areas. This could help spread the cost over all MNOs and would help to ensure that all spectrum is used (but not necessarily in a widespread manner). It would likely lead to patchy network deployment and would require MBIE to redesign the auction process to accommodate non-generic lots.

G. Zone 4 coverage option

- 26 Vodafone has suggested an option based on providing 4G coverage to 80% of premises in the Telecommunications Service Obligations (TSO) Zone 4. TSO Zones are based on fixed line telephone exchanges, not cellular catchment areas.
- 27 Vodafone is already obligated to provide fixed wireless broadband to 80% of Zone 4 premises under the RBI and is being provided with a substantial capital subsidy to do so. Therefore this option would significantly disadvantage 2degrees and Telecom by forcing them to duplicate the RBI's coverage but without the subsidy provided to Vodafone.

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Excluding RBI towers from this option could lead to extensive network infrastructure duplication.

- 28 An advantage of this option is that it would bring increased competition to the rural wireless broadband market but, as noted, this would be distorted by existing RBI subsidies.

H. Staged implementation requirements

- 29 MNOs could be required, for example, to provide 50% population coverage within five years, 75% within eight years, and 90% within 10 years. This would allow MNOs to initially focus their deployment on areas with high demand.

- 30 While this option does promote rural coverage, it does not avoid the issue that 700 MHz spectrum is better suited to rural areas because the option would strongly encourage urban deployment first to meet the 50% population requirement. It may be unreasonable to expect a 700 MHz 4G network to be deployed in cities if urban consumer demand for 4G is able to be met in a more economic and technically efficient manner using just the 1800 MHz band.

I. Rollout ratio

- 31 Government could mandate a ratio for cellsite deployment to ensure that rollout in rural areas is commensurate with urban areas. MNOs could be required, for example, to deploy one rural 700 MHz cellsite for every three urban 700 MHz cellsites. This would allow MNOs some flexibility to build networks in accordance with their preferred network architectures. It could be difficult to arrive at the appropriate ratio.

- 32 However, the use of 1800 MHz for 4G in urban areas could significantly reduce the effectiveness of this proposal. It seems unlikely that many urban 700 MHz cellsites will be built in the near future, at least until MNOs' urban 1800 MHz 4G networks are close to capacity. It is therefore likely that MNOs would only be required to build a very low number of rural 4G cellsites.

- 33 Because 2degrees has less sub 1-GHz spectrum than the other MNOs it may need to use 700 MHz in urban areas before the other MNOs do, to meet increasing consumer demand for mobile data. If this were the case, this option would impact more on 2degrees than on the other MNOs.

J. German-style outside-in option

- 34 This could be difficult to translate into the New Zealand context, and be costly for MNOs, considering the difference in population density between Germany and New Zealand (609 people per square mile vs 39 people per square mile respectively). This means that providing services in low population areas in Germany is far more commercially viable than in New Zealand. Germany's "least populated" category covers towns with up to 5,000 residents, while some RBI sites cover less than 200 people.

- 35 In addition, there would be administrative costs involved in splitting the country by population into regions (unless the existing TSO zones were used, which present their own difficulties – see option G).

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- 36 This option could encourage MNOs to delay urban 4G deployment, or preclude some unforeseen use of 700 MHz in urban areas where its technical characteristics could be particularly useful to provide extra capacity or building penetration. This would constrain the services available to the bulk of New Zealand's population who live in cities, and consequently limit the economy-wide benefits of faster mobile broadband (estimated to be up to \$2.4b over 20 years).

K. State highway coverage requirement

- 37 Covering key state highways could provide benefits to the tourism sector and to residents and businesses in the rural areas around state highways. However, it would be extremely costly for MNOs. Our modelling suggests that even with an additional five cellsites (costing up to \$500,000 each – the approximate price of an RBL tower), there would still be coverage gaps on state highway one from Christchurch to Blenheim.
- 38 Providing coverage at a rate of one co-locatable cellsite every ten kilometres on state highways 1, 2, 3, and 6 (key tourist routes) could cost MNOs \$70m each.

Evaluation criteria

- 39 We evaluated the options are against the following criteria:
- meets the policy objective to ensure that 700 MHz spectrum is used to deploy 4G mobile broadband networks in a timely and widespread manner;
 - Improves mobile broadband availability in rural areas;
 - allows MNOs flexibility to deploy 4G networks using 700 MHz, 1800 MHz, and potentially 2800 MHz spectrum as per their own technical and economic considerations; i.e. does not overly distort the MNOs' intended network architectures and deployment plans;
 - is equitable for all three existing MNOs and is unlikely to negatively impact on market competition;
 - is administratively straightforward for the Crown, both to monitor and enforce and in the way it can be incorporated into the existing auction design; and
 - meets Treasury principles for best practice regulation: proportionality, certainty, flexibility, durability, transparency/accountability, capable regulators, supports growth.

Annex 2: Originally proposed population coverage and additional coverage requirements

1 The table below (from the 2013 *Consultation on Auction Design and Implementation Requirements, and Execution* document) sets out MBIE's original proposals for implementation and coverage requirements for 700 MHz spectrum.

Quantity of spectrum purchased	Implementation requirement (using 700 MHz)	Additional coverage obligation (using any spectrum)
2x5 MHz	50% national population coverage within five years.	NA
2x10 MHz	50% national population coverage, including at least 30% population coverage within any given region within five years.	NA
2x15 MHz	50% national population coverage, including at least 30% population coverage within any given region, within five years.	5 new coverage cell sites per year, for first five years.
2x20 MHz (if available)	75% national population coverage, including at least 50% population coverage within any given region, within five years.	10 new coverage cell sites per year, for first five years.

2 The objective of an implementation requirement is to ensure that spectrum is used in a timely manner to provide services, while the objective of a coverage requirement is to improve cellular mobile coverage generally. These two objectives have in the past usually been treated separately.

3 As stated in the briefing above, the originally proposed 50% national and 30% regional population coverage requirements are still useful, as it would be applied to a new entrant that did not have any existing cellsites to upgrade.

4 The additional coverage requirement remains useful to meet the objective of improving general mobile coverage, and would be applied to all successful bidders as per the table above.

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Annex 3: Coverage Maps

Figure 1a. Hawke's Bay – all Vodafone cellsites

Figure 1b. Hawke's Bay – MBIE prediction of 4G 700 MHz coverage with 75% of existing Vodafone cellsites upgraded

Figure 2a. Southland – all Vodafone cellsites

Figure 2b. Southland – MBIE prediction of 4G 700 MHz coverage with 75% of existing Vodafone cellsites upgraded

Figure 3a. Canterbury – all Vodafone rural cellsites

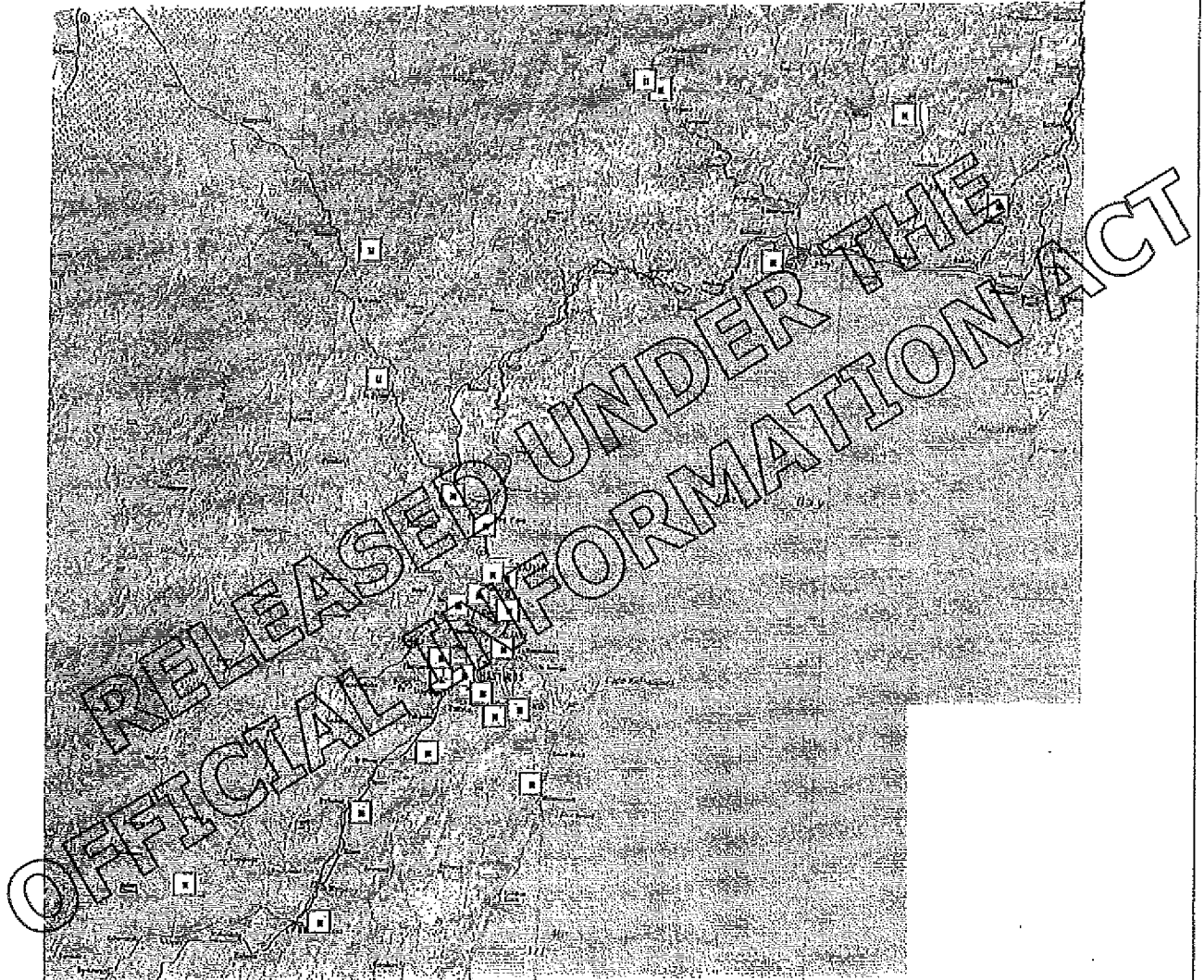
Figure 3b. Canterbury – MBIE prediction of 4G 700 MHz coverage with 75% of existing Vodafone cellsites upgraded

Notes:

1. The rural sites shown in these maps are based on licences registered in our licence database (SMART) for use at 900 MHz. It is possible that some of these sites may not currently be operational.
2. The 900 MHz sites have been used because these are the sites likely to be upgraded to 4G using 700 MHz. Coverage using 700 MHz will be slightly better than using 900 MHz. Our modelling is based on 700 MHz coverage.
3. The coverage maps have been generated for illustrative purposes using some generic assumptions that in practice may not apply to every site. Therefore, there will be some differences between the theoretical coverage shown in these maps and an actual network deployment with real-world coverage.
4. We have defined 'rural' based on local government ward boundaries. We have included in the definition of rural wards within city councils that are largely rural (for example, Banks Peninsula, Franklin, Rodney).

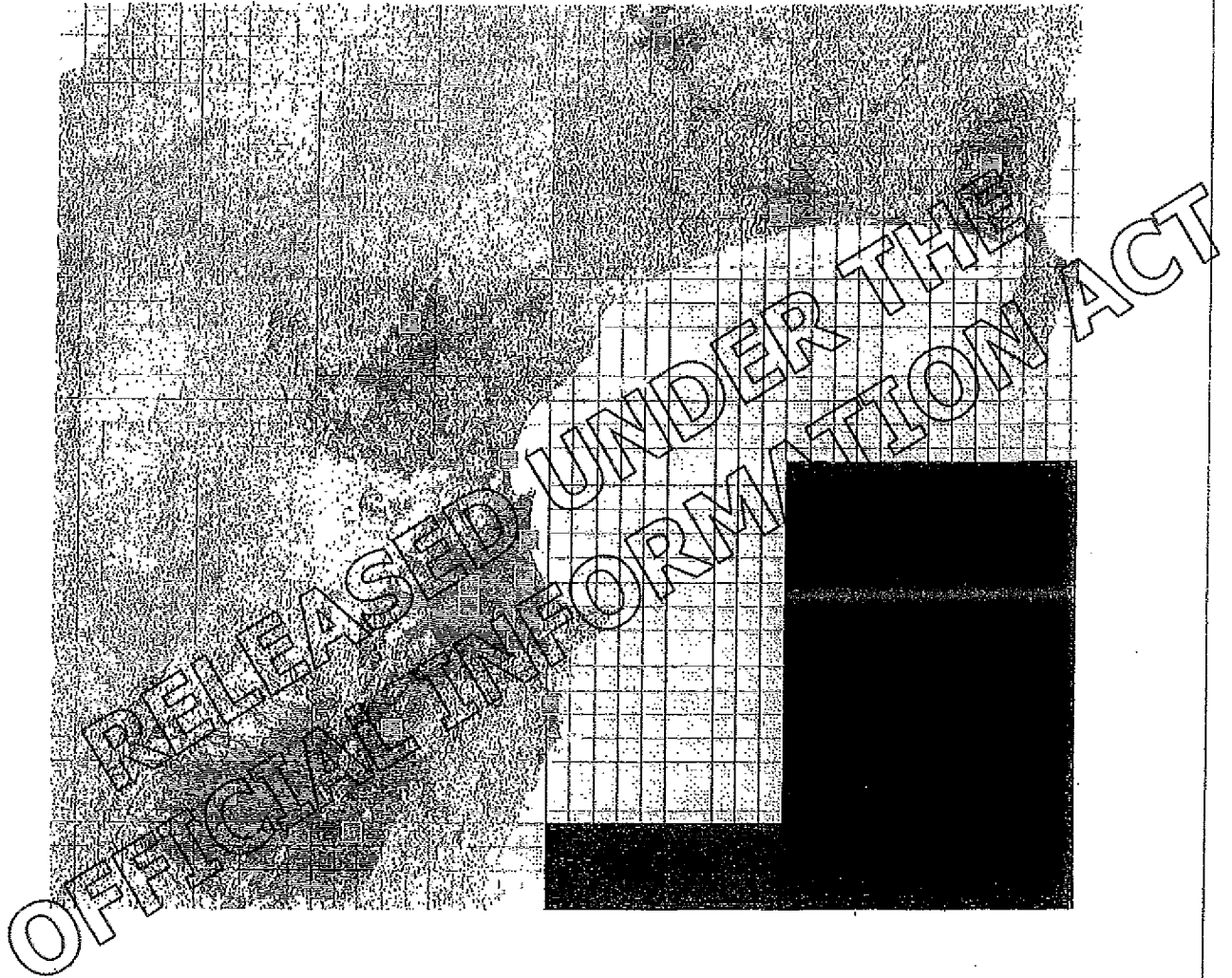
Figure 1a – Hawke’s Bay: all Vodafone 900 MHz cellsites

Rural sites shown as red squares, urban sites as green squares.



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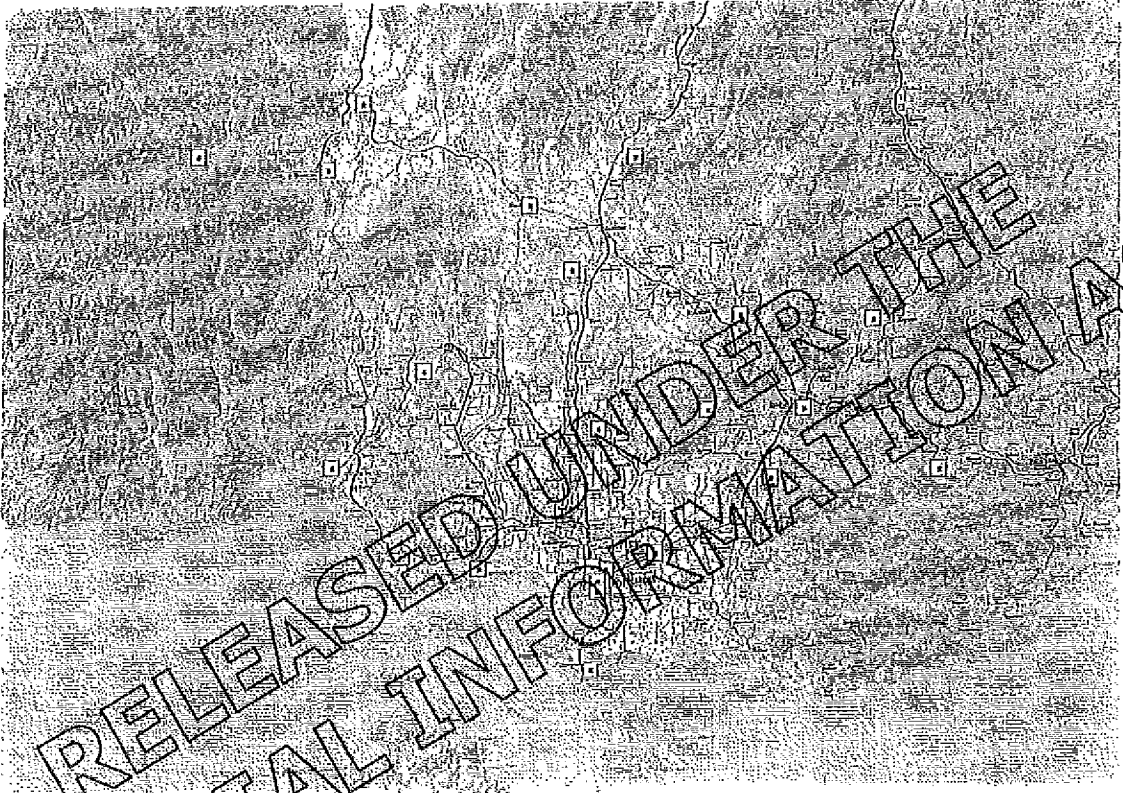
Figure 1b – Hawke's Bay: MBIE prediction of 4G 700 MHz coverage with 75% of existing Vodafone rural cellsites upgraded



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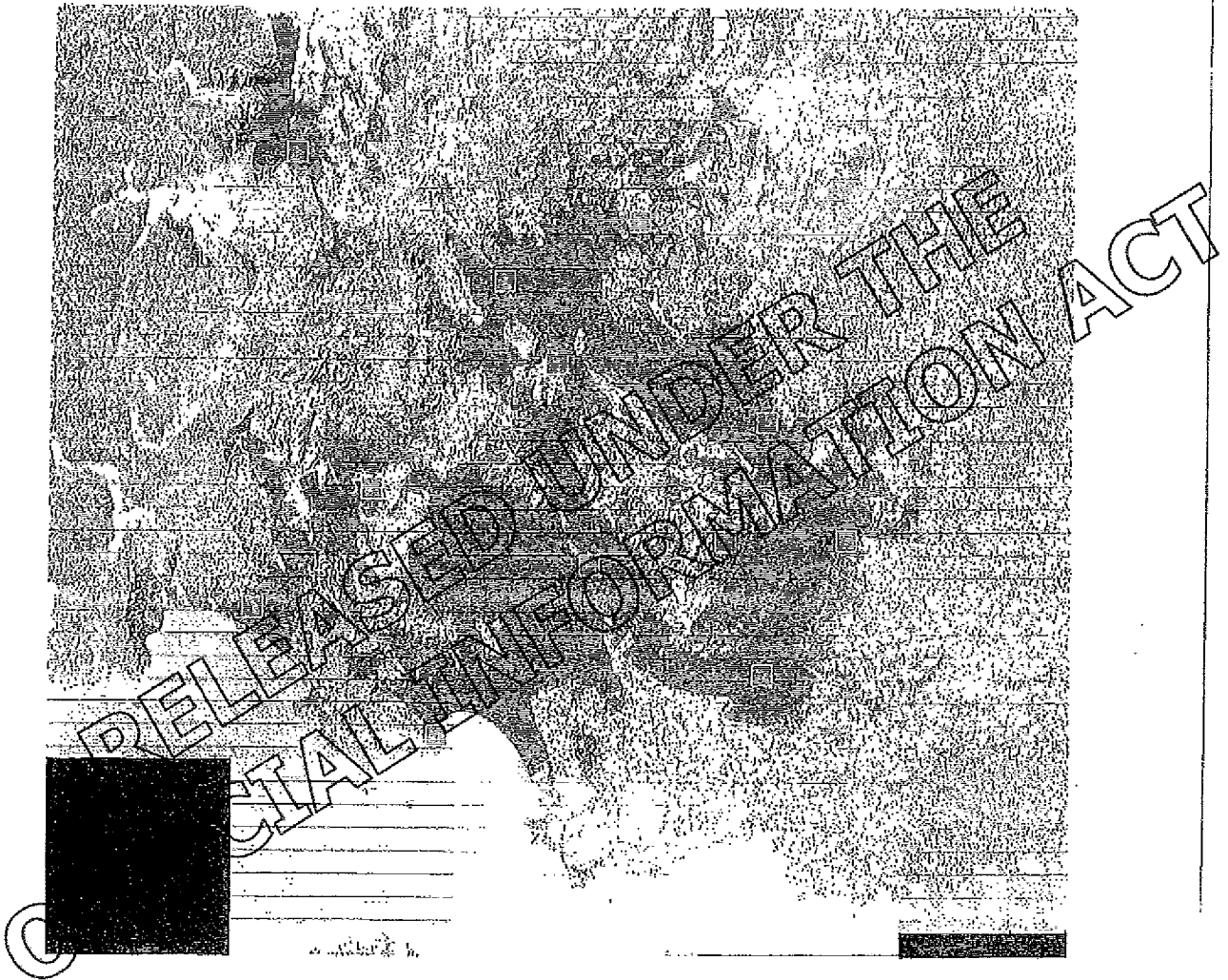
Figure 2a – Southland: all Vodafone cellsites

Rural sites shown as red squares, urban sites as green squares.



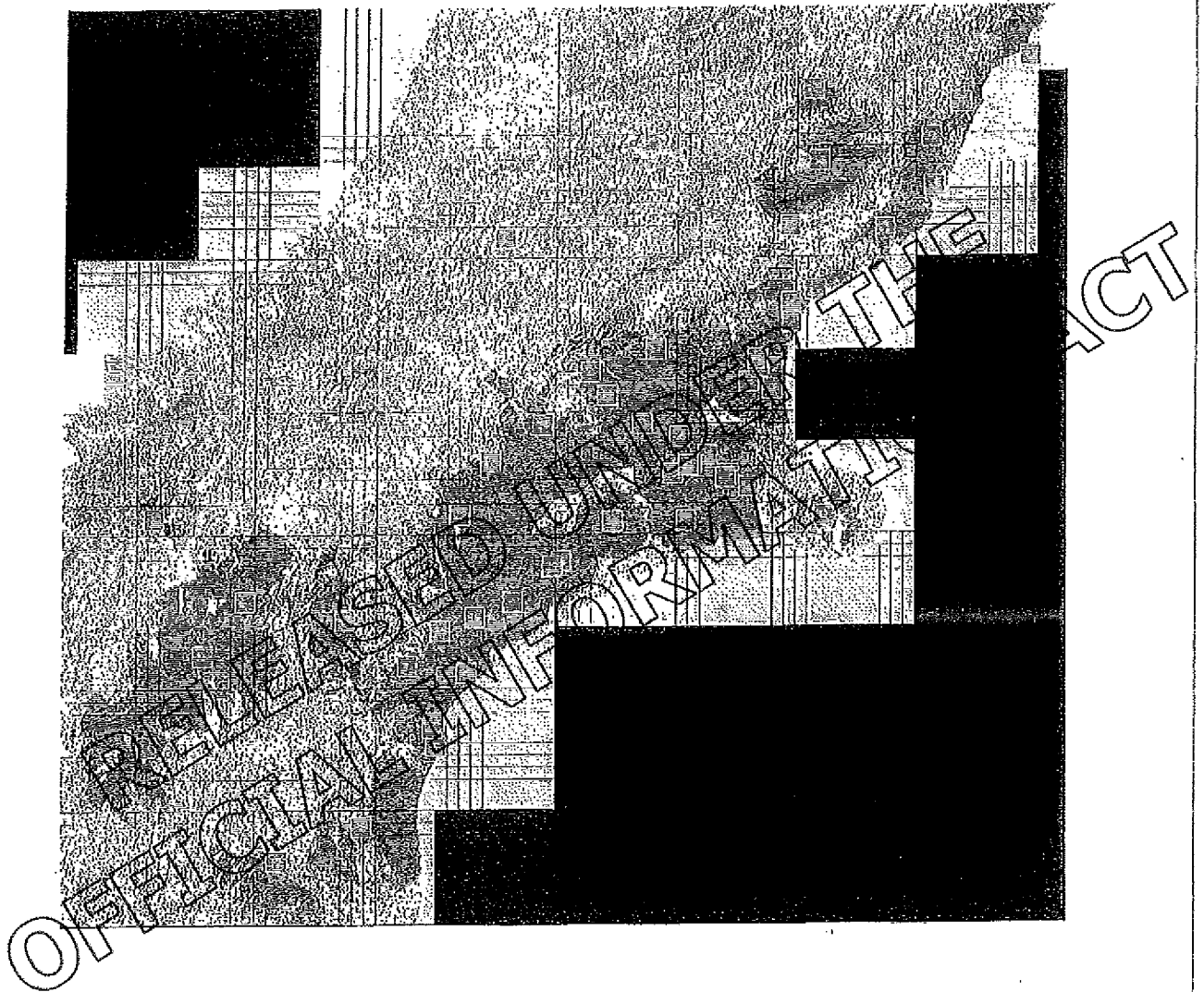
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Figure 2b – Southland: MBIE prediction of 4G 700 MHz coverage with 75% of existing Vodafone rural cellsites upgraded



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Figure 3a – Canterbury: all Vodafone rural cellsites showing coverage



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Figure 3b – Canterbury: MBIE prediction of 4G 700 MHz coverage with 75% of existing Vodafone rural cellsites upgraded

