NSW DEPARTMENT OF BUSINESS AND CONSUMER AFFAIRS

UNIVERSITY, WESTERN SYDNEY
TECHNOLOGY PRECINCT
STRATEGIC PLAN

Final Draft

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EXECUTIVE SUMMARY

1 AIM AND OBJECTIVES OF STUDY

The aim of the study is to prepare a strategic plan for the new university in western Sydney and its environs (called the technology precinct), so that its potential for technology and regional economic development can be maximised.

Specific objectives to achieve this aim are to:

- Ensure that existing available land around the university is used to its potential as an interface between the university and industry.
- Maximise the possibility of the technology precinct being linked to the proposed Multifunction Polis.
- Prepare a development strategy for the technology precinct.
- Provide a framework to implement the development strategy, including organisation, finance, marketing and planning measures.

2 ROLE OF TECHNOLOGY PRECINCTS IN ECONOMIC DEVELOPMENT

Overseas experience shows that technology precincts (research, science, technology parks, technopoli) are playing a more important role in regional, state and international economic development.

Firstly, increased international competition has made developed countries focus on the development of new processes and new technologies to improve long term competition. One consequence of this is that many businesses are turning to universities and associated technology developments for assistance in basic research and development.

Secondly, high technology and related industries are becoming a much larger component of the industrial structure of developed nations. As a result, developed economies are becoming more dependent on research and technological innovation for economic growth, reinforcing the need for industrial ties with academia.

Thirdly, job growth in traditional manufacturing industries is declining, while job growth in the service and high technology sectors has been expanding.

3 INTERNATIONAL AND AUSTRALIAN EXPERIENCE

Experience overseas and in Australia shows that successful technology precincts have certain basic ingredients.

A university appears to be essential, particularly for research and science parks. The university needs to have high quality international research programs with strong faculties in science and technology. There also needs to be convenient public access to university facilities such as libraries, computers, recreation and cultural facilities.

Another important location criterion for technology precincts is that the soft infrastructure is as important as the hard infrastructure. In particular, the environmental quality of the precinct and its surrounding areas is critical. Environmental quality is measured by high quality residential areas, good schools, cultural and social facilities, sophisticated shopping facilities, and good urban and landscape design.

Other important ingredients are:

- Accessibility to international airport.
- Special infrastructure eg. powerful computers.
- Region characterised by an existing high technology industrial base.
- Local business and community support.

4 THE TECHNOLOGY PRECINCT AT WERRINGTON AND THE WESTERN SYDNEY REGION

As the university is being developed at the same time as the technology precinct, there are unique opportunities for integrated planning and development. It is most important in this process that the following goals be set for the university:

- It should strive to be a world renowned institution of the highest international standard.
- It should have strong faculties in science and technology from the very beginning.

The technology precinct stands out in the Cumberland Plain as an undulating and attractive environment. This environmental quality is enhanced by the Orchard Hills area with its scenic qualities and the backdrop of the Blue Mountains.

Another important potential of the location is the planned second Sydney international airport at Badgerys Creek, conveniently located in relation to the technology precinct. There is a possibility that the proposed Very Fast Train will eventually be linked to this airport, providing convenient access between the university and the city centres of Sydney, Melbourne and their international airports.

Other opportunities include:

- Westmead Hospital with its strong research and development base.
- The existing concentration of tertiary facilities in the Werrington locality.
- The CSIRO Division of Animal Production at Prospect.
- NSW Department of Agriculture's Biological and Chemical Research Institute at Rydalmere.
- Major Defence Force facilities, in particular the Guided Weapons and Electronics Support Facility at St Marys and the Royal Australian Navy Missile Maintenance Establishment at Orchard Hills.
- Emerging biotechnology industries in the region.
- Concentration of electronics establishments in the Liverpool - Bankstown and Penrith areas.

5 THE STRATEGIC PLAN

5.1 GOALS AND OBJECTIVES

The goals of the strategic plan are to:

- Develop a technology precinct of international significance which will act as a catalyst for economic development in the western Sydney region.
- Make the new university and its environs the centre of the precinct.
- Encourage the growth of research and advanced technology development within the technology precinct through local initiatives rather than relying on attracting development from elsewhere.
- Ensure development is compatible with the surrounding environment, including Orchard Hills and adjacent residential areas.

Objectives to support these goals include:

- Establish technology - orientated centres of learning in western Sydney with links to the technology precinct.
- Provide the necessary infrastructure to encourage technology transfer and development.
- Create a living and working environment associated with the precinct that is conducive to the attraction of intellectual capital, social well-being and business development.
- Develop a technology image for the western Sydney region.

- Establish an organisation structure which will support research and technology development by the university.

- Provide opportunities and encourage investment in research and technology facilities within the technology precinct.

- Develop facilities and systems, which will assist in the transfer of information and technology and its translation into development opportunities.

5.2 LAND USE STRATEGY

The basic principle of the concept plan is a strong activity centre or spine of common facilities in the geographic centre of the technology precinct. This will be the interface between the different components of the technology precinct, namely the northern campus, technology park, business park, existing education institutions and residential areas. It will be the meeting place for people from academia, industry and the community, and the place where technology transfer will be maximised.

Several meeting place functions will be located in this centre, including conference centres; research centres where interdisciplinary teams comprising individuals from academia and private industry will work together on research and development projects; cultural and recreation facilities; and informal meeting places, such as restaurants and squares.

Another basic principle of the general concept is the rich mix of activities which will be located in the technology precinct, including education, research, manufacturing, shopping, housing, cultural and recreation facilities. The focus will be on developing a multiplicity of activities which will enrich the environment and stimulate creative thought and economic development.

This rich mix of activities follows trends in Japan and Sweden where the emphasis is on developing technology villages with a strong focus on cultural and recreation activities to develop a good quality environment. This concept also fits the initial thinking on the Multifunction Polis.

A land use strategy is presented in Figure 1. Major components include:

- The northern campus of the university.

- The activity centre which will include campus accommodation, hotel/conference centre, commercial centre, recreation and leisure facilities, a regional cultural centre and the research park. Key elements of the research park will be the business information and technology development centre, incubator centres and research centres.

- The technology park orientated to full scale development, testing and manufacture of new technology based products.

- The business park focussing on information based technologies.

- Existing education centres (CAE, TAFE).

- A new international school for secondary and primary pupils.

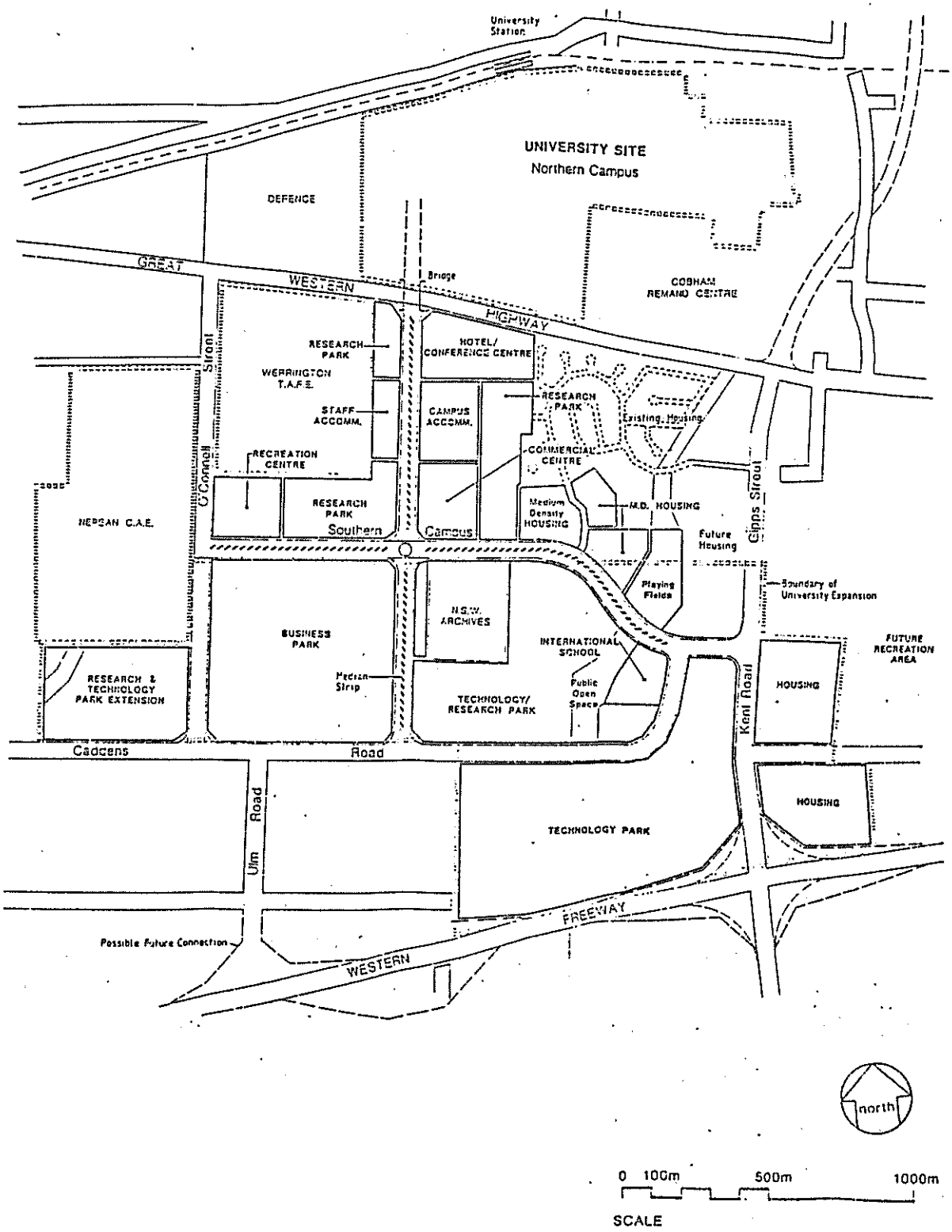

Figure 1 Strategic Plan

- Residential areas.
- Outdoor recreation activity associated with the South Creek utility corridor eg. golf course.

5.3 IMPLEMENTATION

The first step in implementation will be to establish an implementation organisation to implement the strategy. It is proposed that this be a non-profit Research and Development Corporation under the direction of the university. The Corporation would administer development within the research, technology and business parks. A chairman and board would be appointed and include representation from the State Government and private sector.

The development program is illustrated in Figure 2. It involves a twenty year program broken up into four stages. Stage 1 would set the implementation and planning framework. This would include the establishment of the Research and Development Corporation, the preparation of a regional environmental plan, development control plans and requests for proposals for specific projects in the technology precinct. Stage 2 would involve the first stage of the development program including student/staff accommodation, the first stage of the commercial centre and medium density housing development. Stage 3 would involve development of the activity centre and in particular the research park components, hotel/conference centre and recreation/cultural centre. The final stage would involve the development of the technology and business parks.

The development of the technology precinct would be a joint venture between the university, State Government and the private sector. The university and government would provide land and expertise, and the private sector would be responsible for the development of infrastructure and buildings.

The university and State Government would maintain ownership of the land in return for rent. The business information and technology development centre and incubator buildings on the research park would be financed on a lease-back arrangement with a private sector developer. The technology and business parks would be financed by the private sector with the university and State Government maintaining ownership of the land.

Promotion of the technology precinct will require a carefully developed marketing strategy aimed at attracting publicity and investments. A critical component of this marketing strategy will be a program of consultations/public relations with the western Sydney and local community. Another important aspect of the marketing strategy will be the establishment of a technology orientated university in the precinct.

As the technology precinct is of regional significance, it is proposed that a regional environmental plan be prepared to control development in the precinct. In accordance with planning policy in New South Wales, development control should be achieved by objectives. The aim will be to minimise the number of zones and maximise flexibility.

	YEARS																				RESPONSIBILITY
COMPONENTS OF DEVELOPMENT	1989	90	91	92	93	94	95	96	97	98	99	2000	1	2	3	4	5	6	7	8	9	
STAGE1																						
Open university																						Dept of Education
Adoption of strategic plan																						State Government
Establish R&D Corporation																						University
Preparation of REP																						Dept of Planning
Preparation of DCPs																						Private sector
Preparation of requests for proposals																						R & D Corporation
Engineering services																						
- Feasibility studies																						Private sector
- Design and construction																						Private sector
STAGE 2																						
Provision of student/staff housing																						University
Commercial centre																						
- First stage																						Private sector
- Second stage																						Private sector
Medium density housing																						Dept of Planning
STAGE 3																						
Business information and development centre																						R & D Corporation
Hotel/conference centre																						Private sector
Recreation centre																						Private sector
International school																						Private sector
STAGE 4																						
Business park																						Private sector
Technology park																						Private sector

Figure 2 Program

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1 INTRODUCTION

1.1 GENERAL

This study was commissioned by the NSW Department of Business and Consumer Affairs through the Industries Assistance Fund. The views expressed in this discussion paper are those of the consultants and not necessarily those of the department.

1.2 BACKGROUND

Following the Federal Government's White Paper on Education, academic activity is now required to have greater relevance to commerce and industry. This in turn requires the promotion of mechanisms by which corporate university links can be forged and maintained. This direction has also been evolving overseas in many developed countries. Allied with this has been the changing role of the university. Increasingly, the university has become an important engine of regional economic development.

The study area is the new university in western Sydney and its environs. It is the area bounded by the Main Western Railway to the north, Bringelly Road to the west, the Western Freeway to the south and South Creek to the east. This area is referred to as the technology precinct.

1.3 AIMS AND OBJECTIVES OF THE STUDY

The aim of the study is to prepare a strategic plan for the technology precinct, so that its potential for technology and regional economic development is maximised.

Specific objectives to achieve this aim are to:

- Ensure that existing available land around the university is used to its potential as an interface between the university and industry.
- Maximise the possibility of the technology precinct being linked to the proposed Multifunction Polis (MFP) project which the Japanese Government presented to the Australian Government in 1987.
- Prepare a development strategy for the technology precinct.
- Provide a framework to implement the development strategy, including organisation, finance and planning measures.

1.4 STRUCTURE OF THE REPORT

The report is presented in three parts. Part A discusses the principles of university related technology development. Part B assesses opportunities for and constraints to university related technology development. These two parts are used as a basis for the strategic plan in Part C.

Part A

Concept Development

In this part of the report, information is provided to assist in developing the concept for university related research and technology development in the technology precinct.

It includes assessments of:

- International models - Section 2.
- Technopolis and Multifunction Polis concepts - Section 3.
- Australian models - Section 4.

2 INTERNATIONAL MODELS

2.1 GENESIS OF UNIVERSITY RELATED RESEARCH PARKS

The earliest examples of research parks go back to the end of World War II when the land along Route 128 near Boston was used to develop defence related enterprises that had close connections with MIT and Harvard. During the same period, Stanford University in California and the universities of North Carolina, Duke and North Carolina State decided to develop land within their immediate environs for university related industrial purposes. These early parks were designed primarily to develop university linked or related activities on the institution's perifery such as hospitals and government funded research facilities.

The intentions of the universities were mixed. Some wanted to protect their surrounding land from urbanisation influences that could detract from the ambience of the institutional environment. Others, like Stanford, recognised the need to provide facilities for emerging industrial activity that desired space near the campus. Some universities, like George Washington University in Washington DC, used their valuable real estate holdings to control development near their campus and generate income from developing and leasing property.

Today the research park is increasingly playing a more important role for the following reasons (Levitt 1986):

- Increased international competition has made developed countries focus on the development of new processes and new technologies to improve long term competition. One consequence of this competition is that many businesses are turning to universities for assistance in basic research and the development of technology.

- High technology and related industries are becoming a much larger component of the industrial structure of developed nations. As a result, developed economies are becoming more depended on research and technological innovation for economic growth, reinforcing the need for industrial ties with academia.

- Job growth in traditional manufacturing industries is declining, while job growth in the service and high-tech sectors has been expanding.

Many countries, states and regions have therefore initiated programs to more effectively use their university systems as an engine of regional economic development.

Some examples are discussed below.

2.2 EXAMPLES IN THE UNITED STATES, UNITED KINGDOM AND SWEDEN

There is no precise definition of research/science/technology parks. A recent survey conducted by the Batelle Laboratories suggests two general descriptions for large integrated developments of 200 hectare or more land.

- A tract of land fully developed and designed for buildings and other infrastructure such as special communications to accommodate research and development activities with space for only prototype fabrication.

- Land developed especially for research and development organisations that have a definite scientific orientation and foster interrelationships with universities or key governmental research facilities.

Research/science/technology parks fall into three broad classifications:

- **Research/science parks** - the primary focus of the research/science park is to provide a direct link between basic science activities, usually conducted at universities or government labs, and commercial research and development firms. The synergy that develops between basic sciences and commercial applied sciences stimulates the development of new products and services. These parks are primarily operated by universities or joint ventures between universities and other development interests. Research/science parks operate under very stringent covenants that restrict the type of firms and sometimes the nature of the firm's activities on the site such as prohibitions against full scale manufacturing and retailing on the premises. Selection of firms is also governed by strict rules that generally require some link between the firm's research activities and the university.

  Example:

  The University of California at Berkeley-Research Campus Park - This facility currently under development 16 kilometres from the Berkeley campus will combine active university research on a site with commercial research adjacent to these facilities. University researchers and commercial firms will share facilities on the site such as recreation centres, library, computer, short and longer term housing, and special scientific laboratories. Very strict criteria have been established with respect to commercial participation on the site, including some direct link with university research activities.

- **Technology parks** - are designed to serve as high quality industrial space in a campus like setting. These ventures are generally private sector operations with some university involvement. The types of activities on the park include both research and technology supported light manufacturing as well as some commercial activities. This is the most common and easily replicated development form.

Examples:

Cambridge, England Technology Park - This is an excellent illustration of a park designed to accommodate technology orientated enterprises. The amenity standards are high which restricts entry to established firms. This park is composed primarily of larger tech firms such as IBM. The reason for locating on the site is its proximity to the university and the relatively easy access to the large pool of university graduates as well the availability of some academics for consulting or board memberships.

Stanford Research Park - While called a research park, the Stanford development fits the tech park definition. The University acts as a land leaser to private firms to establish and build facilities on the site. Amenity standards and other covenants determine the physical character and the activities carried out on the site.

- **Incubator centres** - are an attempt to stimulate increased technology development by lowering the business enterprise threshold for emerging firms. Universities sometimes become involved in developing and operating such projects. They are generally smaller facilities or they may be a component of a larger tech or science/research park.

Examples:

Georgia Institute of Technology - The institute operates a 370 square metre building developed to facilitate new business start ups coming from within the university or the community. The incubator is designed for high tech firm start ups. As a result, central facilities are orientated toward core scientific resources with some administrative support.

Linkoping University Incubator Centre

This centre in Linkoping, Sweden is an interesting example of the re-use of an old army warehouse area as a small research/factoryette facility. The university manages this centre and facilitates faculty member involvement and the creation of a special faculty title that enables university staff to maintain their institutional connections when they join new firms or act as consultants for extensive periods of time.

MIT-Technology Square

This development is an incubator by virtue of its location and size. This facility operates like any commercial real estate operation with low graduated rents to induce new start up firms to use the facility.

2.3 LESSONS FROM INTERNATIONAL EXPERIENCE

The most important lesson from international experience is that successful research/science/technology parks are part of a wider state/regional strategy and cannot succeed by themselves. Successful projects include the following ingredients:

- University with high quality international research programs.
- High quality residential areas in the immediate area or associated with the park.
- Good elementary and secondary schools with special programs for gifted and/or creative students.
- Special infrastructure such as international research facilities, powerful computers, telescopes, laboratories etc.

- Highly controlled research/science/technology park and high amenity surrounding environment.
- Incubating facilities for new entry entrepreneurs/firms (perhaps on the park).
- International airport or similar link to international transportation.
- Area characterised by an existing technology industry base.
- Positive business climate and close association between universities and local industries via some organised approach such as industrial associates or affiliates.
- A systematic means of accessing university facilities such as libraries, computers, recreation and cultural facilities.

2.4 ORGANISATIONAL AND FINANCING APPROACHES

The majority of successful technology parks have special organisational structures that merge the needs of universities, developers and local business. It is generally well recognised in the literature that a full time executive body must be established to operate the project. Organisational structures include:

- Regional or local authority - these are quasi-government authorities established by state or local governments to govern the park and usually assist in the development of the surrounding area. Examples include the Florida Innovation Park which is governed by a Board composed of the presidents of two universities, the chamber of commerce and tenants of the park.

- Non profit corporation - in many instances universities establish separate non profit corporations to organise and manage tech parks. The vice chancellor or other chief executive appoints the members of the Board. The University of California uses this type of approach in order to take advantage of the tax exempt status of the University and the need to separate this type of venture from the educational programs of the University.

- University as developer - some universities develop their sites and appoint a university official as the manager of the project. Stanford University is an example of this pattern in that it leases its land to prospective tenants. On the other hand, the University of Arkansas and Georgia Tech University act as the direct developer by financing and constructing buildings.

- Joint developers - universities seldom have the expertise to act as developers even when they own the land. Therefore, universities frequently obtain the assistance of a developer to assume the risk of constructing and renting buildings. This is the predominant pattern for most tech parks. There are many good examples of this type such as the Evanston University Research Park in Illinois.

International experience in financing options for high tech projects indicate that they do not differ significantly from other financial projects. Most projects are financed from the usual investor sources. The university or government provides land and the developer contributes the longer term capital for the buildings. In most instance the land is leased rather than sold to the developer. The developer uses the long term lease to secure financing for the project. In other cases, the university uses the developer as a builder only. In these cases, the developer does not assume the risk for the project and receives a fee for acting as building developer of the project.

Long term financing may be available to the university through special bond financing arrangements. In the United States, industrial bonds and tax exempt finance are available. In Australia, government borrowing or special state bonds might be commissioned to satisfy this requirement.

Finally, the sale of some land on the park for retail commercial purposes that support the park such as hotel and shopping centre might be used to finance the infrastructure for the site.

3 TECHNOPOLIS AND MULTIFUNCTION POLIS

In this chapter, the concepts of technopolis and Multifunction Polis are discussed.

Technopolis is the Japanese Governments technology and regional economic development strategy for the 21st Century. It is discussed in Section 3.1.

Multifunction Polis is an extension of this concept which may be implemented in Australia. This is discussed in Section 3.2.

3.1 TECHNOPOLIS

The Ministry of International Trade and Industry (MITI) launched the technopolis concept in 1980. The following are the basic design requirements of these technopolises (JETRO):

- There will be three interlinked components: an industrial unit made up of factories, distribution centres and other business facilities; an academic group comprising universities and public research and development institutions; and a habitation zone to accommodate managers, teachers, engineers, scientists and their families.
- The technopolis should be build adjacent to a "mother city" populated by 200000 or more to benefit from city conveniences.
- The technopolis should be located close to an airport or a major railway station, so that inhabitants will be able to make round trips to the big cities of Tokyo, Osako or Nagoya within one day.

Other criteria that were established in the selection of sites for technopoli include:

- No heavy industries as an existing economic base.
- Favourable physical, economic and social conditions.
- A current agglomeration of technology enterprises.
- Available land and housing.
- Accessible university and/or reinforcing research institutions of international standing.

The aims of the technopolis program are to:

- Upgrade the nation's industrial structure to develop creative and sophisticated advanced technologies.
- Develop areas away from the leading industrial and cultural centres of Tokyo, Osaka and Nagoya.

3.2 THE MULTIFUNCTION POLIS

The Multifunction Polis offers special opportunities for development in the environs of the university in western Sydney. In this section, the concept is explained and its opportunities for the technology precinct highlighted.

3.2.1 Background

The concept was first presented by the Japanese Government at the 1987 Australia-Japan joint ministerial talks. The Japanese Ministry for International Trade and Industry (MITI) and the Australian Department of Industry Technology and Commerce (DITAC) agreed to examine the concept further by undertaking a joint feasibility study. This feasibility study commenced in April 1988.

3.2.2 The general concept

The concept will be developed by consultants which have been commissioned to undertake the feasibility study. The preliminary concept emphasises:

- Creating a truly international city, involving people from Australia, Japan and other areas, particularly the United States, Europe and other Asian and Pacific countries, and involving international cultural exchange.

- Providing the appropriate soft and hard infrastructure including new technologically advanced communications, transport, education and research facilities as the basis of developing competitive advantage in a series of "information society" industries.

- Establishing a series of "leading edge" industries in which Australia has demonstrated some element of international competitive advantage which would drive the development of the Multifunction Polis, including:

  - An education and research sector which is not only engaged in the production of basic vocational education and research, but is also an income earner in it own right.

  - Other "information" related industries such as business services, production of entertainment material and hardware/software development.

  - Leisure and tourism activities of a traditional variety and potentially with a focus on new learning and experiencing.

  - Other mixed industries, such as the conference industry.

3.2.3 Elements of the concept

Education

There appears to be some recognition that an essential element of the infrastructure of the Multifunction Polis is a university of international standing. This could be publicly or privately funded. There has also been discussion of this university being a multinational university with participation from leading universities in Australia and overseas. Naturally, as the university in western Sydney is being planned at the same time as the Multifunction Polis, there are unique opportunities to integrate development with any of the above scenarios.

Potential research capabilities

Potential research capabilities that are being discussed for the Multifunction Polis include:

- Telecommunications/information industries including computer software and hardware, and databases.

- Medical research in particular preventative, curative and sports medicine to capitalise on Australia's strength in basic medical research. Areas identified include gerontology i.e. medical studies relating to aging, neurology, diagnostic services, medical biotechnology, space medicine.

- Marine science and technology, including marine sea-bed exploration, harvesting of marine resources, vessel engineering (leisure craft).

- Building and construction technologies.

- Space and aerospace (space port).

- Robotics.

- Food processing with a focus on cosmopolitan tastes of international consumers.

- New materials in particular fine ceramics, fibre optics.

- Biosciences including agricultural biotechnology and chemistry, tissue culture and floriculture of Australian native plants.

Lifestyle

The lifestyle component of the Multifunction Polis would provide a major attraction to the highly skilled, highly paid researchers and innovators necessary for the viability of the Multifunction Polis. The aim is to make the Multifunction Polis an attractive domestic and international recreation destination. The communications infrastructure should also make it attractive as a location for international conferences.

3.2.4 The feasibility study

Four phases are proposed:

- Establish joint administration structures to oversee study, select consultants to oversee and assist in the study and develop basic concepts for the Multifunction Polis.

- Define concepts, assess potential of Multifunction Polis to attract investors.

- Review potential sites and related concepts and selection of a site and concept.

- Confirm investment interest against a more detailed proposal.

At this stage joint administration structures to oversee the study have been established, consultants have been selected to oversee and assist in the study. The second phase is about to commence.

3.2.5 Consultative arrangements

The Australian and Japanese Governments will establish a Joint Steering Committee to guide the feasibility study as well as a Joint Secretariat to service the committee.

Each country is developing its own mechanism for private sector consultations. In Australia, the main participating organisation is the Australian (Multifunction Polis) Committee. Membership is expected to include 70-80 companies, public authorities, representatives of the relevant Commonwealth and state government departments, as well as experts drawn from academia, and key interest groups.

4 AUSTRALIAN MODELS

In Australia, the drive towards improving the nations performance in the technology development field is in its infancy. Universities, government instrumentalities and research laboratories are being actively encouraged to combine with industry to commercialise the unrealised capacity of Australian based technological expertise.

Various approaches have been developed to achieve this objective ranging from greenfield technology parks, incubator cells to rezoning areas to focus on specific technologies.

With one exception, the Australian models are driven by state government initiatives. Most private initiatives using the banner of technology development, are no more than real estate ventures. The following briefly describes the models developing in five states.

4.1 VICTORIA

Central to the Victorian Government's drive to promote technology development is the Technology Strategy. This Strategy recognises the state's strengths in the scientific, medical and technological research and development areas. Funds are provided for a number of specific initiatives including:

- Australian Research and Development Consortium comprising eight research institutions including Walter and Eliza Hall Institute of Medical Research and Howard Florey Institute. This consortium aims to speed up the transfer of technology development from the laboratory to the market place.
- Separation Technology Facility established as a joint venture with Monash University's Industrial Biotechnology Group.
- DARATECH to commercialise the research undertaken by the Department of Agriculture and Rural Affairs (DARA).
- Advanced Ceramic Design Centre established as a joint venture between CSIRO Division of Materials Science and Monash University's Department of Materials Science.
- Centre for Manufacturing Management established at Melbourne University Graduate School of Management.
- Advanced Manufacturing Technology Centre established in conjunction with CSIRO Division of Manufacturing Technology.

Various government led support mechanisms are being provided. These include:

- Technology Support Programs.
- Victorian Innovation Centre.
- Victorian Business Centre.
- Business Planning Scheme.
- Export Market Development.

- Government Supply Support Agency.
- Growth Firm Industry Revitalisation and Assistance Program.
- Investment Facilitation Group.
- Victorian Industry Support Organisation Register.
- Victorian Economic Development Corporation.
- Victorian Investment Corporation Limited.
- Victorian Small Business Development Corporation.

Having established the support mechanisms, the Government is moving towards the establishment of six technology precincts which will include a network of technology incubators. These include the Parkville Knowledge Precinct, the Southport Precinct (around the Victorian Technology Centre), the Monash Precinct (around Monash University), the Latrobe Precinct (Latrobe University), the Werribee Biotech Precinct and the Bendigo Precinct. Each of these precincts has some form of technology infrastructure such as technology centre, research park, science park and technology park. The Victorian Government is now in the final stage of implementing the strategy to develop these six precincts.

4.2 QUEENSLAND

The Queensland Government has established the following support agencies and facilities:

- Queensland Industrial Development Corporation.
- Queensland Innovation Centre Limited.
- Department of Industry Development controlled Technology Parks at Labrador and Eight Mile Plains.
- Small Business Development Corporation.
- Department of Industry Development, Industry Advisory Service Division.

The Queensland Government has recently developed the Mount Gravatt Research Park which will accommodate the Queensland Centre for Manufacturing Technology. The technology parks at Labrador and Eight Mile Plains will provide industrial space for newly developed technology based industries.

By linking the research park with the technology parks within the context of a research quadrangle involving the University of Queensland, Griffith University, Bond University, Queensland Institute of Technology and possible other colleges of advanced education, research with commercial potential could be established.

The establishment of the Bond University with its associated research and technology park is a model which follows the State strategy - although it operates independently of it. Bond University is the first Australian commercial university. It is a model that will be closely observed in Australia as most Australian universities are now moving towards greater commercialisation and linkages with industry.

Some of the essential elements of the Bond University's approach to technology development are:

- Close working relationships will be maintained between the university and research park, with staff exchanges occurring at various levels.

- The research park will be commercially orientated and research development will therefore be conducted in a commercial environment.

- The research park enterprises will reflect the core activities of the schools within the university. This will be a growing field as the university expands its scope of studies. At present the research park is directing its activities in the fields of:

  - Drug design development.
  - Forensic science.
  - Plant biotechnology.
  - Biomedical technology.
  - Information technology.

- The research park acts as a facilitator linking commercial enterprises with academics to affect technology transfer in both directions. It is envisaged that this process will lead to the establishment of centres for technology transfer.

- There are currently 12 x 250 m^2 development modules (incubators) in operation within the research park.

4.3 SOUTH AUSTRALIA

South Australia was the first state to establish a greenfield technology park on a 85 ha site close to the South Australian Institute of Technology. The Technology Park Adelaide Corporation was established by an Act of parliament in 1982 and the park opened in April 1984.

The Technology Park has given South Australia a focus for technology development and the corporation's plan set out the objectives to promote:

- Industrial development.
- Innovation development.
- Technology transfer.
- Research and development.
- Tertiary institution/industry interaction.

There are now some 40 companies resident within the Technology Park. Incubation facilities are also provided on a multi-tenant rent and fees for service basis.

More recently the South Australian Government announced the establishment of the centre for manufacturing in conjunction with the General Electric Corporation.

General Electric, as part of its offset obligation, will commit $45 million to the centre over seven years and will station staff at the centre to provide training in computer-aided design, engineering and manufacturing hardware and software. The centre will be linked electronically to the General Electric resources in the United States as well as locally to the Adelaide University, Regency College of TAFE and the South Australian Institute of Technology.

The South Australian Government has also established an infrastructure support system comprising the following support agencies:

- South Australian Development Fund.
- SA Council on Technological Change.
- SA Manufacturing Advisory Council.
- Biotechnology Promotion Committee
- Aerospace Promotion Committee.
- SA International.
- Enterprise Investments (South Australia) Ltd.
- Small Business Corporation.

4.4 WESTERN AUSTRALIA

Western Australia has based its approach to technology development on the establishment of a technology park. The WA Technology Park was opened in 1985 on a 32 ha site in close proximity to the WA Institute of Technology (now Curtin University).

Other technology infrastructure support mechanisms established by the WA Government include:

- WA Technology Directorate.
- WA Science and Technology Council.
- WA Technology Development Authority.
- WA Technology Development Fund.
- WA Development Corporation.
- WA Exit Corporation (export).
- WA Small Business Investment Company.

The Western Australian Government has recently announced the formation of the Technology and Industry Development Authority (TIDA) which brings together the various elements of government associated with technology development.

The Western Australian Technology Park is still in its building phase and caters for three types of companies:

- The small firm in the early stages of product development.
- Medium sized Australian companies.
- Large overseas companies capable of producing new skills and technology in the state.

The Technology Park will focus on the following technologies:

- Biotechnology.
- Medical and pharmaceutical technology.
- Microelectronic technology.
- Information technology.

In addition, the Western Australia Government has recently announced the establishment of two new technology parks:

- Defence Technology Park.
- Advanced Materials Technology Park.

Emphasis to date has been on development and attention is now being directed towards marketing.

4.5 NEW SOUTH WALES

The NSW Government has taken the following initiatives on technology development:

- The establishment of the NSW Science and Technology Council in 1979 to advice the government on science and technology policy.

- The establishment of the Advanced Technology Centre as a division of the Department of Business and Consumer Affairs. The aims of this centre are to:
  - Provide support, advice and guidance to local high technology companies and to traditional industries seeking to apply new technologies.
  - Establish a financial and management data base.
  - Provide information about key technologies offering particular opportunities for the development of the state.

- The development, in association with Lend Lease, of an high technology and business park, Australia Centre, at Homebush Bay.

- The establishment of the Research and Consultancy Bureau to facilitate the commercialisation of research undertaken by the NSW Government.

- The establishment of the Hunter and Illawarra technology development centres associated with the universities of Newcastle and Wollongong respectively to facilitate technology transfer and development. These centres provide management consulting advice as well as incubator space for start-up companies.

4.6 LESSONS FROM THE AUSTRALIAN EXPERIENCE

Lessons to be learnt from the Australian models include:

- The university should be developed in conjunction with the research park. This is clearly the direction in development not only in Australia, but also overseas. Integration should be built in from the outset to ensure the proper working relationship between the university and research park staff.

- A technology theme should be developed which reflects the core technologies of the research park relevant to the faculties of the university. The objective should be to establish the region as a centre of excellence which has world-wide recognition.

- The research park should be established on the largest available parcel of land. It is important that at least one major company operating in the technology field relevant to the park's theme be attracted into the research park.

- Land use should be controlled to maintain the integrity of the technology theme of the park.

- It is likely that early financing and management of the research park will be government led. However the structure should be flexible to allow direct corporate involvement at the earliest possible stage.

Part B

Strengths/Weaknesses Assessment

5 REGIONAL OPPORTUNITIES AND CONSTRAINTS

Strengths and weaknesses related to university related technology development are assessed at two levels in this study:

- The region.
- The study area.

The region does not have any boundaries, but is generally confined to western Sydney which extends to Parramatta City Centre in the east, the Blue Mountains in the west, Camden - Campbelltown in the south and Windsor in the north.

The preconditions (requirements) for university related technology development were identified in the assessment of international and Australian models in Chapters 2 - 4. In this chapter, the performance of western Sydney in satisfying these requirements is assessed.

5.1 HUMAN RESOURCES

Human resources in western Sydney are generally less skilled than in other parts of Sydney. For example (Census of Population and Housing, 1986):

- Although western Sydney has 36 percent of metropolitan Sydney's population, it has only 24 percent of the total professional/management occupations in the metropolitan area.

- A comparison of the western Sydney with metropolitan Sydney for the highest level of qualification obtained in the population reveals the following:

  - Degree or higher : 2.3 percent western Sydney, 4.8 percent Sydney.
  - Diploma : 1.9 percent western Sydney, 2.7 percent Sydney.
  - Trade or other certificate : 17.2 percent western Sydney, 18.5 percent Sydney.

The implications of the lower skills base in western Sydney are that there are fewer entrepreneurs and scientists because entrepreneurs and particularly scientists are generally highly skilled. The university will play a role in redressing this balance by providing convenient tertiary education to inhabitants of the region.

On the other hand, the population and population growth is a major opportunity in the region. Western Sydney is projected to grow from a population of 1 071 550 in 1986 to 1 175 000 in 1991 to 1 613 500 in 2011 (medium projection, Department of Planning, 1988). The region will be the major population growth area in Sydney and one of the largest urban areas in the country.

In addition, it will form an integral part of Sydney, the largest urban concentration in Australia.

5.2 ADVANCED EDUCATION AND RESEARCH ESTABLISHMENTS

Higher education facilities in metropolitan Sydney are generally concentrated in the city area. Included in this concentration are the Universities of Sydney and Technology. The other two universities in Sydney are outside this concentration, namely the University of NSW in the eastern suburbs and Macquarie University in the northern suburbs.

Western Sydney's advanced education institutions are the Hawkesbury Agricultural College at Richmond, Nepean College of Advanced Education at Kingswood and Westmead, and the Westmead Hospital. Each facility is also involved in research.

Westmead Hospital is a significant education and research facility in western Sydney and is a key institution within the study area's sphere of influence. It is a teaching hospital affiliated with the University of Sydney. Because it is a centre of excellence, and due to its status as a teaching hospital, Westmead has attracted high calibre doctors with a research orientation. As a result, a wide range of applied research is undertaken at the hospital.

Important developments and facilities at the hospital include:

- Study of hormonal diseases in China.
- Development of an advanced technology pacemaker in conjunction with a private firm, Telectronics.
- Animal research facilities for experimental surgery.
- The largest pathology laboratories in Australia.
- Dental research.

Hawkesbury Agricultural College is a multi-purpose institution specialising in applied science and technology which provides courses at both undergraduate and postgraduate levels. These include agriculture, food sciences and technology, social communication, home economics, horticulture, valuation, environmental and community health, and nursing.

Apart from its teaching role, the College is also committed to industry research and development. This is administered through its company, Hawkaid. Hawkaid is also involved in testing new products (such as sprays and drugs) for outside clients and runs short industry related courses on a commercial basis. There are also two other major companies on campus conducting applied research namely:

- APACE which conducts research into alternative energy and is developing alternative tractor fuels.
- SYRINC which develops membranes for food processing.

Other research on campus includes:

- The development of pectin from citrus peel.
- The study of water plants to reduce the phosphorus content of sewage.
- Wind power generation and solar power for glasshouses.
- Cholera research.
- Agricultural research.

The Nepean College of Advanced Education offers higher education courses in business, education, health studies, humanities and applied social sciences, science and technology, and visual and performing arts. New areas of study are being considered in the applied social sciences, science and technology, applied communications and language studies.

Adjacent to the Nepean College of Advanced Education is the South Werrington College of Technical and Further Education. This is planned as the largest TAFE college in western Sydney. It will provide useful support to the technology precinct in the form of basic skills required in technology development.

An education establishment which is in the planning phase, is the proposed E Simon Graduate School of Business Administration of the University of Rochester at Harrrington Park, Camden. The school is planning to offer a two-year, full-time MBA course as well as extensive MBA and PHD programs

The region's largest research establishment is the CSIRO's Division of Animal Production at Prospect. Its major research areas include:

- Improving the efficiency of livestock production.
- Improving the reproduction efficiency of livestock.
- Improving the nutritional value of forages for livestock.
- Improving the efficiency of wool production.

The NSW Department of Agriculture's Biological and Chemical Research Institute is located at Rydalmere. The Institute specialises in plant pathology, chemistry and entomology. Research is undertaken into crop diseases and pests; pesticides and disease control; crop nutrition, physiology and biochemistry; soils and soil fertility; and water quality.

The Institute also houses a major part of the Australian National Plant Diseases Herbarium, which has over 70,000 specimens; a large insect collection; and the NSW Plant Quarantine Station.

5.3 REGIONAL HIGH TECHNOLOGY INDUSTRIAL BASE

Within Australia, Sydney and Melbourne are the major centres for research and technology development.

Within Sydney, research and development companies have tended to locate in the eastern parts of the metropolitan region with few establishments in western Sydney.

Computer establishments have tended to concentrate in a corridor linking the city centre, North Sydney and St Leonards. The main location requirement appears to be the need to be close to large private and public corporate headquarters and their computer installations in the Sydney city centre and North Sydney.

With the decentralisation of several government departments to Parramatta, there is a possibility that some computer establishments will relocate to the region.

The university in western Sydney and other advanced education institutions in its vicinity will be major users of computer equipment and could therefore attract computer establishments.

Electronics manufacturers are spread through the inner and middle suburbs of Sydney with outer suburbs having a reasonable number of factories. Within the general pattern, there are two significant clusters. One is the Meadowbank-Gladesville-North Ryde area in the northern suburbs and the other is in the Bankstown-Liverpool area in the middle south-western suburbs. Standard Telephones and Hawker de Havilland are located in the Bankstown-Liverpool area.

There are a number of significant Defence Force establishments in western Sydney. A major facility close to the technology precinct is the Defence Force's Guided Weapons and Electronics Support facility (GWESF), Forrester Road, St Marys.

This facility has been part of the Office of Defence Production. With the trend to privatisation and the need for such agencies to become commercial, the Office of Defence Production is soon to become Australian Defence Industries, which will be more independent and commercial. This could provide unique opportunities for the university in western Sydney and related research and development activities.

The operations of this facility include:

- Antenna testing - GWESF operates the only antenna test range in Australia that has the capacity and diversity to test almost all antennae in the Defence Force inventory. GWESF also operates the only antenna modelling range in the southern hemisphere.

- Environmental testing - GWESF has mechanical shock test facilities which are unique in the southern hemisphere and has NATA registration in the field of vibration and shock testing. Other testing includes temperature and humidity extremes, corrosion, fungus and mould, drop, bump and immersion testing. GWESF owns and maintains a complete range of calibrated instrumentation for testing and has a workshop with the capability to fabricate all necessary fixtures.

- Software engineering.

- Standards laboratory - GWESF maintains a large number of reference and transfer standards that are directly traceable to the National Measurement Laboratory.

- Calibration laboratory with resources to calibrate and repair electronic test and measuring equipment.

- Manufacturing and repair - a comprehensive mechanical workshop with the resources to fabricate a variety of metal components.

- Automatic testing and repair of printed circuit boards.

Other significant Defence Force establishments of relevance to the technology precinct include:

- The Royal Australian Navy Missile Maintenance Establishment at Orchard Hills, south of the Penrith Golf Course.
- HMAS Nirimba at Quakers Hill which is a main Navy training area for trades and skills.
- Royal Australian Air Force Base at Richmond.

The electronics establishments and facilities in the corridor Liverpool-Badgerys Creek-Penrith could play a major role in the development of electronics systems for the Second Sydney Airport.

Biotechnology establishments are scattered widely throughout the Sydney region. Some of these industries are centrally located, often contracting research to one of the universities which are accessible to inner city locations. There are also a number of establishments in outer areas, including some beyond the main urban area. These are often laboratories which service production, requiring large amounts of land, such as nurseries and poultry production. Examples are Websters at Penrith, Inghams at Windsor, Leppington at Camden and Coopers Animal Health at Bringelly.

Another opportunity in the region is its strong traditional manufacturing base. There is an opportunity to revitalise this base by providing facilities which will lead to the introduction of new manufacturing processes.

5.4 INTERNATIONAL AIR LINKS

Badgerys Creek, about 12 km south of the study area, has been selected by the Federal Government as the site for Sydney's second airport. The Civil Aviation Authority (CAA) has commenced buying land on the airport site on a voluntary piecemeal basis and, to date, about 25 percent of the 1,800 ha required have been purchased.

The site is intended to function as a small-scale general aviation airport for light aircraft (up to F28 size) by 1993 and to continue in this capacity at least until the year 2000. At that time, a further decision will be made to either further develop Kingsford-Smith Airport or upgrade Badgerys Creek to international standard. This decision will be based on demand levels and political considerations. Should such upgrading occur, it is likely that Kingsford-Smith would be the main gateway to Sydney, while Badgerys Creek would play a supporting role.

It is expected that, initially, the airport will handle aircraft from Bankstown Aerodrome, which is at or near capacity, and Hoxton Park Aerodrome, which may soon close due to development pressures. It may also be used by civil aircraft currently using Schofields Aerodrome, at HMAS "Nirimba", which the Department of Defence is considering selling (CAA, personal communications).

5.5 THE ENVIRONMENT

Our research indicates that entrepreneurs and personnel involved in research and development choose to live in high quality residential environments with good amenities, cultural, commercial and education facilities.

Generally, western Sydney has a poor reputation for living environments which is associated with the flat Cumberland Plain and its predominantly uniform low cost housing areas.

Within the western Sydney context, the study area and its environs have the following unique qualities which distinguish them from this poor image:

- The Blue Mountains are considered a good environment, particularly by scientists and academics.

- At the interface between the Blue Mountains and the Cumberland Plain, the land is generally undulating with spectacular views of the mountains. These undulating high quality environments stretch from Penrith in the north to Camden in the south.

- The Orchards Hills area has potential for rural residential development close to the university and related activities. This area has unique scenic qualities which could attract world class academics and chief executive officers. Similar rural residential areas exist in the Mulgoa Valley.

- The existing high quality residential areas in the Penrith subregion namely Leonay, River Road Emu Plains and Emu Heights. In addition, the "Hills" area in Baulkham Hills Shire Council has already been accepted as a good quality residential environment by management and professionals.

- There is potential to plan for high quality residential environments in western Sydney because large areas such as the North West Sector and South Penrith are still to be developed. Local councils and private developers are considering providing space (large lots) to facilitate the development of better quality residential environments.

- The Nepean River and Blue Mountains are major regional recreation resources close to the study area.

- The planned Penrith Lakes recreation area will be a major regional water based recreation resource for Sydney. It will be 4.5 times the size of Sydney Harbour and will provide multiple use water based recreation opportunities. High quality residential environments will be developed in association with this resource.

The region probably lacks the high quality shopping facilities required by entrepreneurs and scientists. Parramatta City Centre is now planned as the second CBD of Sydney and shopping facilities are becoming increasingly sophisticated. Similarly, Penrith City Centre is a major regional shopping centre.

The technology precinct could provide special shopping facilities to complement those in the local shopping centres.

5.6 HARD INFRASTRUCTURE

5.6.1 'Very Fast Train'

A proposal to construct an express train linking Sydney and Melbourne is currently being considered. Named the "Very Fast Train" (VFT) it is estimated that it would cut travelling time between the two cities to less than four hours. The proposal incorporates a stop at Canberra and, importantly, it has been noted that the VFT could also have a stop at Sydney's second airport at Badgerys Creek.

The VFT concept is similar to the Japanese "bullet train" which has been recognised as important infrastructure in Japan's technopolis program.

The pre-feasibility study for the VFT has been completed. A detailed feasibility study is expected to commence around the end of 1988.

The potential of the VFT is that it could link the university very efficiently with Sydney, Melbourne and Canberra city centres, as well as the international airports in Sydney and Melbourne.

5.6.2 Road links and public transport

Road and public transport service links within western Sydney are generally poorer than in the eastern areas of Sydney.

The study area is however very well provided with regional transport facilities, particularly those in an east-west direction including:

- The Western Freeway linking Penrith with Sydney's inner west.
- The Great Western Highway linking Sydney with the Blue Mountains
- Main Western Railway.

The north-south road network is generally poor in western Sydney. This will be a constraint on the development of the study area with the following regional roads serving the study area:

- The Northern Road, Bringelly Road linking Windsor and Narellan.
- Mamre Road linking St Marys and Kemps Creek.

Currently, there is no railway line running north-south through western Sydney.

Major regional road proposals which would increase access to the study area include the Castlereagh Freeway linking Castlereagh and Sydney's inner west and the upgrading of Gipps Street/Kent Road to link up with the Second Sydney Airport at Badgerys Creek.

Construction of the proposed railway "Y" link from Merrylands to Harris Park would directly link the Main Western Railway and the South-Western Railway, thereby improving public transport accessibility between western and south-western Sydney.

5.6.3 Telecommunications

Currently, the only regional telecommunications links relate to the supply of telephones for residential and business needs. Telecom plans to upgrade the telephone service in the vicinity of the study area by installing copper cable pairs by 1989/90. (Copper cable has the capability to carry both analog and digital services. Digital services can transmit both voice and data information).

Before Telecom can further upgrade the system, it needs to be informed of the needs of the study area, the type of services required (eg digital/teletext, etc) and the likely demand for these services in a five year timeframe. In all cases, supply is demand driven.

A fibre optic cable has been installed to serve western Sydney and a cable runs from St Marys telephone exchange to Penrith exchange. The technology precinct could be linked to this cable either from a cable joint - which is the easiest, most cost-effective method - or from a new cable running from St Marys exchange. However, a cable would only be installed if:

- Demand is sufficient to make the service cost effective (installation costs are very high)
- Video services are required (in this case, Telecom would provide a cable from the start).

It takes Telecom about 4-6 months to connect a developed area to a fibre optic cable and about 12-24 months in a less developed, mainly rural area such as Werrington. Telecom would coordinate with developers in the provision of all services. It is also worth noting that Telecom will commence construction of a major telecommunications building in 1989 to serve the expanded communications needs of western Sydney and, particularly, Parramatta.

5.6.4 Public utility services

No major constraints or opportunities could be identified at the regional level in the provision of basic public utility services such as electricity, water and gas.

5.7 INDUSTRIAL AREAS

As mentioned in Section 5.3, western Sydney has a strong traditional manufacturing base with substantial industrial areas in all local government areas.

The technology precinct is likely to have a very wide sphere of influence, extending to the whole metropolitan area and beyond. As contacts are expected to be greater within the Penrith subregion, this assessment of industrial areas focuses on this subregion.

The NSW Government's Metropolitan Growth Strategy for Sydney identified Penrith as a sub-regional centre of western Sydney which will have a major role in catering for future growth and development in the region. Consequently, it is anticipated that commercial and industrial activity around Penrith will grow strongly in coming years (Review of Industrial Land Supply, 1988).

The total area of zoned industrial land currently in Penrith is about 760 ha. The four major industrial areas are: Dunheved/St Marys (to the north-east of the study area), North Penrith, South Penrith and Emu Plains.

At Dunheved/St Marys, which is the oldest established industrial estate in Penrith, manufacturing activities include: automotive repairs, panel beating, engineering, and the activities of larger manufactures such as 3M Australia, Formica Plastics, Albion Holdings, Martin Wello, Uniwire and Humes Roofing Tiles.

North Penrith is characterised by large manufacturing establishments on large land holdings such as Crane Enfield Metals, Containers Packaging, Websters, Smorgan Glass Containers and Fibremakers.

South Penrith is characterised by industrial units for light industrial, service and recreational activities.

Emu Plains is characterised by extractive-related activities and larger manufacturing activity. Main companies include Monier Pipes and Visyboard Paper Products.

The industrial land survey (1988) found that about 170ha of vacant industrial land remains (as whole vacant lots) in Penrith, giving Penrith a land supply of about seven years. It also found that a steady increase in manufacturing industry is expected in Penrith over the next 15-20 years as a result of industry relocation, increased resident workforce and competitive property/rental prices.

A local environmental study has been prepared on the South Erskine Park industrial area, 5.5 km south of St Marys railway station. This land covers an area of 504 ha. It could provide about 15-20 years supply of industrial land and is therefore of significance. A draft local environmental plan is about to be submitted for this area.

Penrith City Council is seeking to institute flexible planning controls on this site and to use it for a diversity of large-scale industrial developments (Discussion Paper, 1988). Industrial uses being considered on the site include:

- Industrial estates.
- Retail/industrial development.
- Office park industrial development.

5.8 RESEARCH, SCIENCE, TECHNOLOGY AND BUSINESS PARKS

There are no existing research, science, technology or business parks in western Sydney.

A major business park with some high technology components is planned on the Norbric brickfield in Baulkham Hills Shire Council.

5.9 SUMMARY

The regional strengths/weaknesses assessment is summarised in Table 1.

The major strengths of the region are :

- The development of an international standard university in western Sydney which will lead to an increased number of entrepreneurs and scientists in the region and provide a major new engine for regional economic development.
- The location of the Second Sydney Airport at Badgerys Creek which will provide convenient international travel in the long term. The combined economic potential of the university and the international airport can not be overstated.
- The major potential of living environments in the Blue Mountains and rural residential areas in Orchards Hills and the Mulgoa Valley to attract entrepreneurs and scientists to western Sydney.
- The major potential recreational opportunities of the Nepean River and Penrith Lakes Scheme.
- The Very Fast Train which if linked in with the international airport and university could create a major development axis linking the university, airport and south western Sydney.

Table 1 : Regional strengths, weaknesses and potentials

Requirements	Strengths	Weaknesses	Potential
Human resources			
• Entrepreneurs		XX	
• Scientists		XX	
• Skilled labour	X		
Education/research			
• University		XX	XX
• CAE	X		
• TAFE	X		
• Research/labs/ incubators		XX	XX
• Government research centres	XX		
Regional industrial base			
• High tech industries		XX	XX
• Manufacturing	X		
International air links		XX	XX
Environment			
• Residential		XX	XX
• Rural-residential	XX		XX
• Shopping		XX	X
• Social Infrastructure		XX	X
• Recreation	XX		XX
Infrastructure			
• Very Fast Train			XX
• Roads		XX	XX
• Public Transport		XX	X
• Telecommunications			X
• Public Utilities			X
Industrial Areas	X		

X - Minor
XX - Major

5.10 POTENTIALS FOR TECHNOLOGY PRECINCT BASED ON INTERNATIONAL EXPERIENCE

Table 2 outlines the potential of the technology precinct for the economic development of western Sydney.

Table 2 : Potentials for technology precinct at the university in western Sydney

Facility/requirements	International requirement	Local potential
Facility		
Science/research park	On or adjacent to university campus	Available land near three higher education institutions
Technology park	Private developers available to develop private site	Local business community interest
Incubator centre	Available local finance and low cost facilities	No competitive facilities
Requirements		
International level university research	Internationally known academics	Potential to develop new areas
Quality residential areas	Housing progam association with tech park	Potential to incorporate housing
Special infrastructure	Special international activity	Defence Force infrastructure
Available light industrial space for incubators	Requires facilities and financing for new firms	Potential to build into park
Good international transportation links	International airport or easy access	New second Sydney airport nearby
Access to university	Specific programs for cultural, education, libraries and labs	Can be build into project
Technology firm base	Large numbers of high tech firms	Western Sydney has emerging tech base

6 STUDY AREA STRENGTHS AND WEAKNESSES

6.1 THE LAND

The undulating topography in the study area is uncharacteristic of the Cumberland Plain in western Sydney which is generally flat. This makes the site a unique location for a prestigious university and related technology development.

Two major north-south ridges traverse the study area. The Nepean College of Advanced Education is located on the western ridge and the new university is planned on the eastern one.

The two ridges converge and rise to a height of 92 metres in the south-western corner of the study area in the Orchard Hills area. The Orchard Hills area was an important orchard growing area in Sydney. The area has retained its rural character to a large extent and this, together with the undulating topography, give the area a distinctive character and attractive landscape.

East of these undulating hills, the land is flat and dissected by two creeks: Claremont Creek and South Creek. The creeks converge north of the Great Western Highway where a large area of land east of Werrington Road is flood prone (inundated in the one percent probability flood). The land on either side of the creeks is also flood prone to varying degrees with a large area in the south-eastern part of the study area flooded from South Creek.

6.2 LAND USE

Three factors characterise the land uses in the study area:

- The existing large scale education establishments.
- The fact that the study area is experiencing a transition from rural to more intensive forms of development. This is reflected in pressure to develop large parts of the study area for urban residential development.
- The unique nature of the Orchard Hills area which has resulted in initiatives to conserve these qualities.

Major land uses in the study area include:

- The site for the northern campus of the university which is located north of the Great Western Highway. Earthworks have commenced on this site.
- The Nepean College of Advanced Education (Kingswood Campus).
- Werrington College of TAFE.
- NSW Government Archives.
- The Cobham Remand Centre on the eastern side of the northern campus of the university.
- Army Stores on the western side of the northern campus of the university.

As mentioned previously, in recent years, there has been increased pressure to develop large portions of the study area for residential purposes. Until recently, two large areas in the study area were planned for residential purposes : the South Werrington Release Area and the Caddens Road Release Area.

The first stage of the South Werrington Release area has been developed and Stage 2 is in the planning pipeline.

Following initiatives to develop university related activities in the study area, further development in these release areas was stopped pending completion of the strategic plan for the environs of the university.

6.3 ENVIRONMENTAL PLANNING CONTROLS

There are a large number of planning instruments which control development in the study area:

- Local Environmental Plan No. 181, 1988. This covers the northern campus of the university (north of the Great Western Highway). The aims of this plan are to:

  - Encourage the development of a university which will satisfy the educational needs of the western region of Sydney, with an environment suited to the requirements of those who will use it.

  - Protect the land from development which might prejudice the development of a university.

  - Provide a flexible planning framework to permit a diverse range of development options in conjunction with the establishment of a university.

- Interim Development Order 93 (IDO 93) which applies to a large area of land from the Great Western Highway to the Freeway. This IDO was gazetted in 1980. The zoning in this area is Rural "D" (future urban). Land uses which are permitted in this zone with the consent of Council are agriculture (other than pig keeping or poultry farming), advertising structures, dwelling houses, educational establishments, home occupations, open space, roads and utility installations. Two draft environmental plans fall within this area namely the Draft Sydney Regional Environmental Plan (Orchard Hills) and Caddens Road Release Area (Draft LEP 164). These are discussed below.

- The Draft Sydney Regional Environmental Plan (REP) (Orchard Hills). This draft plan covers a large area bounded by The Northern Road, Caddens Road, and the Western Freeway as well as land south of the Western Freeway. The major aims of this draft plan are to:

  - Identify and protect the prime agricultural land of Orchard Hills and encourage the continuation of the use of that land for the purpose of agriculture.

  - Protect and enhance the scenic landscape quality of the area.

  - Promote Orchard Hills as a rural landscape buffer area along the Western Freeway and between the various residential areas of the City of Penrith.

Submissions have been received on the Draft REP. Many residents have objected to the Draft REP and at this stage, there is no certainty as to the minimum size of lots and the types of uses that may be permitted to locate in the area.

- Caddens Road Release Area (Draft LEP 164). This draft local environmental plan was made to permit the development of a residential area. Subsequently, this area has been identified as having potential for university related uses. It is therefore unlikely that this DLEP will be gazetted. It is therefore assumed that the zoning of this area is Rural (Future Urban) for strategic planning purposes.

- Penrith Local Environmental Plan 96. This applies to a large area of land in the eastern part of the study area between the Great Western Highway and the Western Freeway. The major aim of this plan is to provide for the economic development of the land for residential purposes. The northern-most part of this land has already been developed for standard single detached dwellings. This area was identified as having potential for university related development and for this reason no development has taken place in the southern part of this area, pending completion of the strategic plan for the environs of the university.

The remaining planning instruments do not directly affect potential university related development. They include:

- Penrith Scheme Ordinance which is the general scheme applying to the Penrith City Council area to enable general residential development

- Penrith Scheme Ordinance Amendment No. 4 which permits the development of the Nepean College of Advanced Education and residential development.

- LEP 37 and 139 which generally permit residential development.

- LEP 47 which permits the development of agricultural, residential (minimum lot size 2 hectares), educational establishments, home occupations and open space uses.

- LEP 48 - school purposes.

- IDO 52 and LEP 47 - Technical and Further Education.

- IDO 46 - drive-in theatre and market.

- LEP 120 - medium density housing.

- LEP 175 - bus depot.

- LEP 132 - sportsground.

- LEP 25 - church.

6.4 TRANSPORT

6.4.1 Existing transport conditions

A transport assessment of the study area was undertaken in 1987 (Colston, Budd, Wardrop and Hunt, 1987) to formulate a total transport plan for the university area. The assessment found that:

- The existing road network serving the site is operating at a reasonable level of service.
- The site has good access from the east, west and north-west but improved road connections to the south and north-east are recommended.
- Railway infrastructure is in place but there is a need for a direct link between the Main Southern and Western railway lines which could provide a direct link between student and staff residences and the complex.
- Discrete local bus networks feed the railway lines at key locations and could provide local access to the site from the City of Penrith. However, there is no explicit organisation of bus and rail services to facilitate counter-peak travel.

6.4.2 Future road network

The study recommended a number of measures to provide a high standard of access to the university and its environs. These included:

- Signalise the three intersections with the Great Western Highway at O'Connell Street, University Access, and Gipps Street to provide capacity to the mid 1990s.
- Provide ramps onto the freeway at Kent Road towards the east as soon as possible and towards the west in the medium term.
- In the medium to long term, Kent Road could be extended southwards to serve the proposed Second Sydney Airport. This extension would probably involve the provision of a second carriageway across the freeway in addition to the existing one. Because of the traffic load that the Kent Road freeway ramps would have to carry, consideration would have to be given to also providing direct access from the freeway into the tertiary complex.
- By the late 1990s, consideration should be given to providing a grade separated intersection into the tertiary complex from the Great Western Highway. This intersection would also provide an important internal link connecting the three institutions.

6.4.3 Future public transport

The transport study made the following recommendations on public transport:

- Build a new railway station adjacent to the tertiary education complex to be available from the start of tuition at the university.
- Provide a bus/rail interchange in association with the railway station.

- Improve frequency of train services and provide an all-stops service between Campbelltown and Penrith.

- Augment feeder bus services to the railway stations.

- Introduce a multi-model-modal fare system supported by private bus operators throughout the Sydney region.

6.5 SERVICES

A detailed assessment of servicing requirements should be undertaken following this study. It is expected that there will be some need to augment the water supply, sewerage systems and electricity systems to service the area. It is unlikely that there will be a major constraint to augmenting these services. The major question will be one of cost and who should pay for these services.

No constraints are foreseen in the provision of normal telecommunications services to the area. This is likely to be different as regards the provision of special telecommunications (Optic Fibre Cable) and special electricity services. Consultations should commence with the responsible agencies to provide these services.

6.6 CONCLUSIONS

The following are the salient findings of the assessment of opportunities and constraints in the study area:

- The land stands out in the flat Cumberland Plain because it is undulating and attractive. It is therefore an excellent location for a prestigious university and related technology development.

- Slope is not considered a constraint to development because, although the land is undulating, it is not prohibitively steep.

- Flooding is not a major constraint to development except along the creeks, in the area north of the Great Western Highway and east of Werrington Road and an area in the south-eastern part of the study area.

- Most of the land in the study area is undeveloped which is a major opportunity for integrated strategic planning.

- A constraint to development of university related technology development is the development of the South Werrington release area. There is a need at this stage to minimise this development. Concurrently, there is a need to provide basic services to the inhabitants of the existing community whilst the university is being developed.

- There are a large number of planning instruments which control development in the study area. These should be replaced by one instrument.

- The site is very well located in relation to major east-west arterial roads (Western Freeway, Great Western Highway) and railways (Main Western Railway). Access to and from the freeway is however limited. North-south access is not very good which is a problem generally in western Sydney. The study area is very well located in relation to the proposed north-south arterial route linking up with the Second Sydney Airport.

7 THE UNIVERSITY

7.1 STRATEGIC OPTIONS

Strategic options for higher education in western Sydney were considered by a Commonwealth-State Joint Working Party (1988).

Five options were evaluated. All the options are based on the premise that the Nepean College of Advanced Education and Hawkesbury Agricultural College will become part of the university.

The options are described below:

7.1.1 Option 1 - Independent university

Description

- Abandon present arrangements and legislate to incorporate a new university with a new Interim Council.
- The new Interim Council would be empowered to take over the two existing Colleges of Advanced Education.
- The university would be developed by including and modifying the existing courses of the colleges of advanced education and by establishing a greater range of post graduate and research programs.
- The Interim Council would be fully responsible for managing the development of the university.

Advantages

- Provides western Sydney with an independent regional university.
- Achieves rational capital planning framework for western Sydney.

Disadvantages

- Limitations of academic development of Nepean College of Advanced Education and Hawkesbury Agricultural College at postgraduate level in the conduct of research because of previous role in binary system.

7.1.2 Option 2 - Modified university college model involving the two CAEs

Description

- Werrington Campus would continue to develop as a college of the University of Sydney until the date of autonomy.

- Same form of affiliation would be established between the two CAEs and the University College to coordinate academic and capital planning.

Disadvantages

- No one authority responsible for planning higher education in western Sydney.
- Focal point of planning would appear to remain in central Sydney.
- Opposition by staff of CAEs.

7.1.3 Option 3 - Sydney university as a multi-campus university

Description

Integration of all the existing campuses offering higher education in western Sydney (Werrington, Kingswood, Westmead and Hawkesbury), together with the existing campus of Sydney University, to form a new multi-campus university, responsible to a single Board of Governors charged with the coordination of the resource utilisation and academic planning for the whole network.

Advantages

- Single planning body.
- Academic strength of Sydney University would assist in developing the reputation of the university campuses in the west.

Disadvantages

- Not an independent university for the large and growing population of western Sydney.
- Potential opposition from the University of Sydney to this proposal.

7.1.4 Option 4 - Western Sydney in a state-wide multi campus university

Description

- Integration of a number of well developed colleges of advanced education and an existing university in Sydney to form a new multi-campus complex governed by a single Board of Governors.

Evaluation

Not within the scope of the existing Heads of Agreement.

7.1.5 Option 5 - Sydney university as the academic sponsor

Description

- New university established as an independent corporate entity.
- CAEs would be incorporated as part of university.
- Cross representation in the membership of the governing body of the university and the Senate of Sydney University.
- Governing body would establish a majority of its members appointed by the University of Sydney.

Advantages

- Single authority to control all planning.
- Establishes the new university with its own system of academic governance from the outset.
- University of Sydney continues to exercise definite influence on academic standards during the early years.

Disadvantages

- Potential opposition from Sydney University.

7.1.6 Working party conclusions and recommendations

The Working Party found that only two of the options would meet the requirements:

- Option 3 - Redevelopment of Sydney University as a multi-campus university.
- Option 5 - Sydney University as an academic sponsor during development phase.

According to the Working Party, either option would provide a cost effective course of action.

The option preferred by the Working Party is Option 5. The main reason for preferring Option 5 over Option 3 is the anticipated difficulty of obtaining agreement with Sydney University to Option 3.

7.1.7 The government response

The following is a brief summary of the Government's response as understood by the consultants at this stage:

State Government

The State Government prefers Option 5. The CAEs would be converted into the university in the short term to enable an early opening.

Federal Government

At this stage, the Federal Government has not made public its preferred option.

7.1.8 Comments on strategic options

The following points are made from the perspective of developing university related research and technology activities in western Sydney:

- None of the options incorporated the Multifunction Polis concept presently being assessed by the Commonwealth and Japanese governments. This concept could have a major effect on the strategic options for universities and higher education facilities in the Sydney metropolitan region.

- A concern is the relationship with the University of Sydney. One of the major economic development problems in western Sydney is the fact that many industries in the region are branch plants with headquarters in Sydney or in some other international centre. If the university of western Sydney became a branch of the University of Sydney with headquarters remaining in central Sydney, key research centres and centres of excellence would probably be opposed to relocating to western Sydney. These are the engines of research and development parks, and economic development.

7.2 ACADEMIC PROFILE

Based on a preliminary consideration of regional higher education needs and courses already provided by local institutions, the academic profile of the university could include the components described below (University Interim Council 1988).

7.2.1 Liberal arts

This includes a full range of humanities subjects, including:

- Asian languages relevant to commerce such as Chinese, Japanese and Korean.

- Applied social sciences, including welfare and family studies, regional sociology and industrial psychology.

7.2.2 Sciences

This would include the full range of basic sciences to serve as a foundation for advanced studies and research in:

- Environmental studies and particularly water quality, flood control and land degradation in a rapidly expanding region on the rural-urban interface.

- Biotechnology based on genetics and microbiology with elements of process engineering to complement the food and fermentation biotechnology at Hawkesbury College.

- Building science and construction technology.
- Energy systems, including applications and cost structures.

7.2.3 Engineering

- Electronic engineering with emphasis on theory and applications of solid state electronic devices for use in system control, telecommunications and computing.
- Systems engineering, with particular reference to control systems in manufacturing industry and the analysis of production systems involving human and machine interactions.
- Civil engineering, based largely on strengths developed in environmental studies, building science and local government administration.

7.2.4 Information technology

An approach integrating computer studies, data communications, information management, business systems and general management, leading to the production of information technology professionals.

7.2.5 Commerce/economics

- Economics - pure and applied, including financial studies and some emphasis on regional economic systems.
- Public administration, including government, politics, legal studies and financial management, with a special emphasis on local government administration and regional administration.

7.2.6 Interdisciplinary studies

Although there will be useful opportunities for inter-disciplinary undergraduate studies, it is primarily in the post graduate and research areas that the proposed pattern of development offers the greatest potential for interdisciplinary work. Thus, the undergraduate course in environmental studies would suggest the formation of a research centre for urban studies which, in focussing on the transformation of the region from semi-rural to urban conditions could include not only the natural sciences and building technology, but elements of the applied social sciences and local government administration. Such a centre would be a major regional resource and could be expected to attract significant research funds from local government and private developers as well as the more usual state and commonwealth sources.

7.2.7 Post graduate studies

The initial programs at post graduate level would, in the main, be based on research work leading to degrees at Masters and Doctoral level. An important exception, however, is a proposed MBA course with special emphasis on manufacturing and distributional management which would incorporate some of the concepts of systems engineering and information technology.

7.2.8 Comment on academic profile

The following comments on the academic profile are based on the need to encourage university related research and technology development:

- The university should strive to develop strong science and technology facilities from the beginning related to regional strengths eg. biotechnology, medicine, electronics.
- The university should develop special areas in international relations and in leisure and tourism activities to complement the Multifunction Polis.
- The university should consider specialising in areas which might complement the development of the Second Sydney Airport at Badgerys Creek.

Part C

Strategic Plan

8 INTRODUCTION

The examination of international and Australian models has shown that there are many strategies which have been adopted to encourage advanced technology industrial development. The conclusion drawn from this analysis is that there is no single strategy which will lead to success. The most successful strategies are those which have aimed at developing and capitalising on a region's resources rather than depending on the attraction of technology enterprises from outside the region.

The above analysis and the Advanced Technology Development Strategy for Western Sydney (1986) identified opportunities for the development of a technology precinct associated with a university in western Sydney. This strategic plan recognises that the development of the precinct must be driven by private sector initiative, as there are neither resources, nor a corporate structure, nor experience in the public sector to develop and operate such an enterprise. The university, however, is a key to the precinct success and it must have a role to ensure the development is in keeping with the goals and objectives set for the university and its environment. It will also have a key role in initiating and supporting research and development.

The following sections describe the plan for the precinct. The goals and objectives for the plan are described in Chapter 8. These provide the framework upon which the strategies have been developed in Chapter 9. These strategies are supported by an implementation plan (Chapter 10)which defines the program, development packages, financial requirements, marketing and administrative requirements.

8.1 GOALS AND OBJECTIVES

8.1.1 Goals

The goals of the strategic plan are:

- **To develop a technology precinct of international importance which will act as a catalyst for stimulating further economic development in the western Sydney region.**
- **To make the new university in western Sydney and its environs the centre of that precinct .**
- **To encourage the growth of research and advanced technology development within the technology precinct through local initiatives rather than relying exclusively on attracting development from elsewhere.**
- **To ensure development is compatible with the surrounding environment, including Orchard Hills and adjacent residential areas.**

8.1.2 Objectives

The following objectives support the above goals. Each contains specific statements of intent in support of the objective.

Objective 1: Technology orientated centres of learning
Establish technology orientated centres of learning in western Sydney with links to the technology precinct.

This objective will be met by:

- Developing a technology-orientated university in western Sydney with its main campus at the new university site.
- Promoting course structures within all higher education centres in western Sydney, orientated towards creating awareness of and the application of new technologies.
- Developing within the higher education centres core technologies which have the potential to advance and develop new fields of knowledge and which have the potential to be translated into investment opportunities.
- Developing centres of excellence and research centres directly associated with the university.
- Providing support for the school system in encouraging technology awareness.

Objective 2: Infrastructure support
Provide the necessary infrastructure to encourage technology transfer and development.

This objective will be met by:

- The development of buildings and facilities for teaching, research, incubation or start-up projects within the university and its environs.
- The development of research and development facilities adjacent to the university to be used specifically for advanced technology commercial and industrial enterprises.
- Ensuring all engineering services are planned ahead of development and installed as the demand for land and buildings for new technology enterprises is realised.
- Improve accessibility to the university site and its environs by encouraging the NSW State Government to give priority to upgrading the transportation system within the region and in particular the link between the Great Western Highway and the F4 Freeway, the new university railway station and Badgery's Creek international airport.

Objective 3: Environment
Create a living and working environment associated with the precinct that is conducive to the attraction of intellectual capital, social well-being, and business development.

This objective will be met by:

- Providing facilities and creating conditions within the university and its environs which will attract high quality academic, research and entrepreneurial personnel.
- The university encouraging local authorities in western Sydney to zone areas of land within easy access of the university for a mix of residential developments.
- Encouraging developers to plan and construct a range of high quality residential developments in areas close to the university which offer a choice of living environment to persons associated with the precinct.
- Providing within the university campus and its environments, social, recreation and leisure facilities of a high standard which will be available to university staff, researchers, students, visitors and other persons associated with the technology precinct.
- Developing an international school and childcare facilities.
- Enforcing a high standard of building design and landscaping through town planning controls, covenants and enforcement of environmental performance standards.
- Protecting by planning controls, areas of land with high landscape quality.

Objective 4: Technology image
Develop a technology image for the western Sydney region.

This objective will be met by:

- The development of a technology precinct incorporating research and development, technology and business parks associated with the university.
- Developing internationally acclaimed centres of excellence on the research park and elsewhere in the region.
- Promoting the university environs as a technology precinct.
- Using names and publicity which will become associated with a technology image.

Objective 5: Organisational support
Establish an organisation structure which will support research and technology development by the university.

This objective will be achieved by:

- Establishing a university Research and Development Corporation to manage and promote research and development within the technology precinct.
- Ensuring the such a Corporation has representation from the university, government, research and the private sectors.
- Ensuring that the Corporation is operated on a non-profit basis.

Objective 6: Investment in research and technology development
Provide opportunities and encourage investment in research and technology facilities within the technology precinct.

This objective will be achieved by:

- Ensuring the development at the precinct is primarily driven by private sector investment.
- Offering development packages to the private sector.
- Granting dispensations or deferments on land rentals during an establishment period.
- The reduction of government charges to lower establishment costs for initial investors in research and development facilities.
- The participation of the Research and Development Corporation as equity holders in projects.
- Ensuring a high standard of development is maintained to protect capital investment.
- Deploying surplus funds generated by the Research and Development Corporation into assisting specific research and development projects.

Objective 7: Information and technology transfer
Develop facilities and systems which will assist in the transfer of information and technology and its translation into development opportunities.

This objective will be met by:

- The establishment of a business information and development centre to assist with innovation, marketing, information exchange and business development within the western Sydney region.
- The development of a conference centre and hotel complex within the technology precinct.
- The development of a technology education centre with links to industry, commerce, high school and TAFE education facilities.
- The development of a State information centre in association with the NSW Archives.
- The use of university facilities to run programs, seminars and lectures on technology transfer which will be of interest to the general public, industry and commerce.
- Developing facilities which will encourage informal social and business interaction within the environs of the technology precinct.

9 DEVELOPMENT STRATEGY

9.1 THE TECHNOLOGY PRECINCT

The term technology precinct is used to describe a place where specific facilities are provided to support advanced learning, knowledge transfer, and research into technologies, and to apply these to the development of new products and business enterprises. There are a multiplicity of activities incorporated into such a precinct, all of which are important to the creation of an environment which is conducive to the development of technology.

The technology precinct would cover three distinct areas, or spheres of influence:

Core precinct	- which includes the university, research park and their environs
Ambient precinct	- which includes industry, other research centres, business centres close to the core precinct
Associated precinct	- activities within the region which will utilise the core precinct facilities

The core precinct covers the north and south campuses of the university, the Nepean College of Advanced Education, the Werrington TAFE, New South Wales Archives, Defence land, and the university environs area.

The ambient precinct would include the Penrith subregion and the associated precinct would extend to the whole of western Sydney and beyond.

9.2 LAND USE STRATEGIC PLAN

9.2.1 The general concept

The general concept for the technology precinct borrows widely from international experience. At the same time, it is unique because the university will be developed simultaneously and because it is a response to regional and local opportunities and constraints.

The basic principle of the concept plan is a strong activity centre or spine of common facilities in the geographic centre of the technology precinct. This will be the meeting place for people from academia, industry and the community, and the place where technology transfer will be maximised. Several meeting place functions will be located in this centre, including conference centres; research centres where individuals from academia and industry will work together on research and development projects; cultural and recreation facilities; and informal meeting places, such as restaurants and squares.

A second basic principle of the concept plan is the rich mix of activities which will be located in the technology precinct, including education, research, manufacturing, shopping, housing, cultural and recreation facilities. The focus will be on developing a multiplicity of activities which will enrich the environment and stimulate creative thought and economic development.

This rich mix of activities follows trends in Sweden and Japan, where the focus has been on developing technology villages with a strong emphasis on cultural and recreation activities to enrich the environment. This concept also fits the initial thinking on the Multifunction Polis.

A land use plan is shown in Figure 1. The plan does not show precise boundaries or details of facilities proposed. It is intended only to provide a strategy for planning and future decision making. More detailed plans and architectural designs will need to be prepared later.

The following are the major components of the technology precinct:

9.2.2 Northern campus

A master plan has been prepared for the northern campus of the university. It provides for an east-west orientation of buildings and incorporates historic Werrington House. The northern campus will be developed as the academic and administrative core of the university. The campus site will be attractively landscaped and linked to the road and rail transportation system.

The master plan proposes a link to the southern campus via an avenue crossing over the Great Western Highway. No major changes are recommended to the northern campus plan but it will need to be reviewed from time to time.

9.2.3 The activity centre

The southern campus should be developed as the activity centre for the technology precinct. A mixture of land use activities is proposed. These include:

Campus accommodation

Housing is the quickest means of developing a physical place and activity centre with which people identify. The plan provides accommodation for:

- Student housing, including hostels up to 350 students, shared accommodation and flats.
- Short term academic and research housing.
- Hotel accommodation for business, conference and personal use.

Accommodation facilities will be broken into smaller clusters to give identity to individual housing areas and to encourage pedestrian movement throughout the area during and after business hours. The housing study on student accommodation will provide more details on accommodation needs.

Hotel/conference centre

Conferences, seminars, lectures and displays are important to the technology transfer process and provide a forum for information exchange and social interaction between people with common interests. A conference centre capable of handling 500 delegates or several small conferences at one time should be planned with hotel and catering facilities. A site of five to seven hectares is required for a 250 room hotel/conference centre and its preferred location is adjacent to the Great Western Highway. This location has good access and exposure. The precise requirements of the conference centre/hotel should be addressed in a detailed feasibility study to determine its size and construction date.

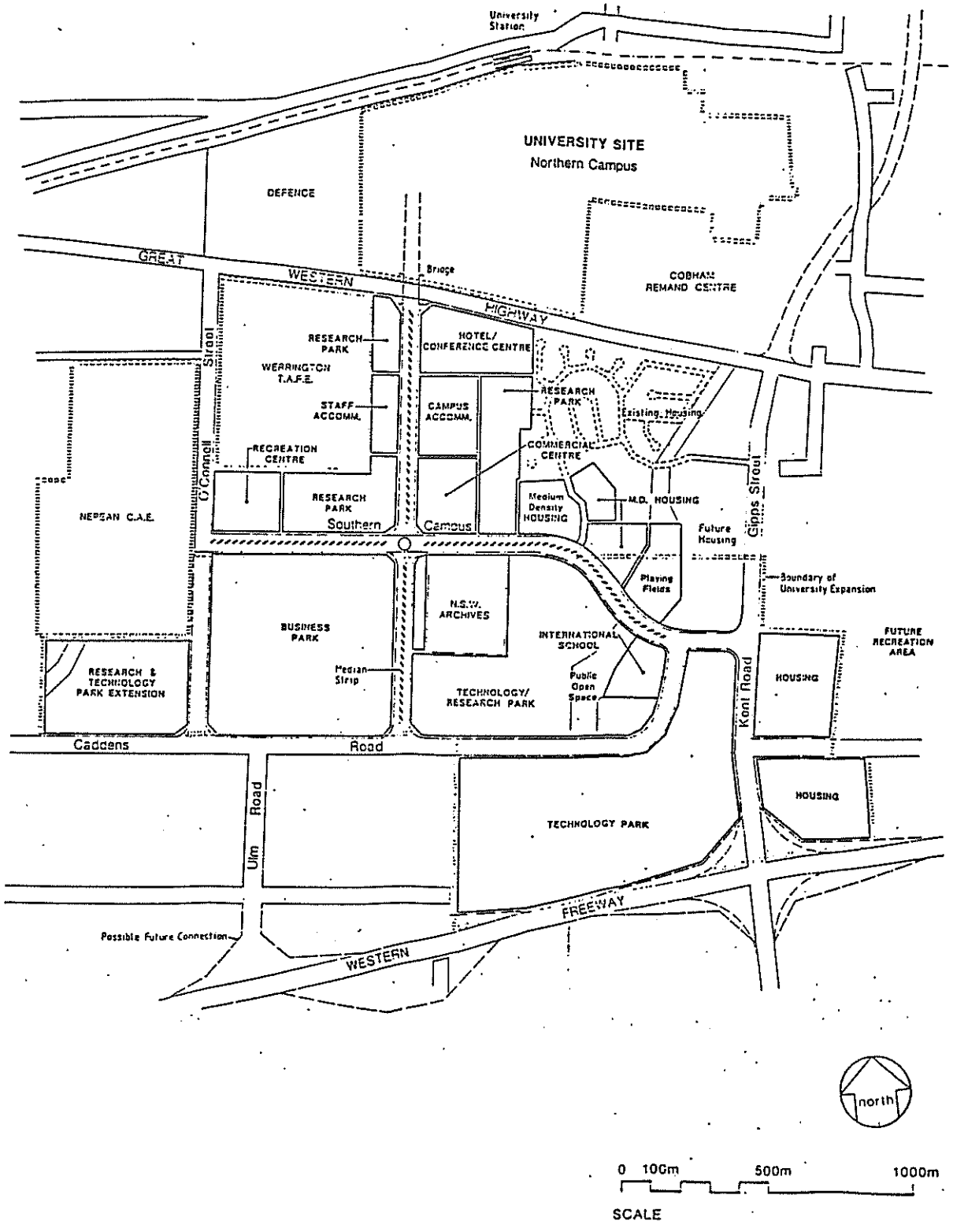


Figure 1 Strategic Plan

Commercial centre

Retail and commercial facilities will be required to serve the student population as well as others working and living in the technology precinct. The centre should not provide for domestic retailing. It should be developed along more specialised lines to serve student, academic, research and business needs. Commercial services such as medical and dental care, banks, postal, insurance, employment agencies and rental agencies should be included in the centre. These should be interspersed with retail and convenience outlets such as bookshops, pharmacies, cafes, restaurants, hotel bar facilities, etc.

Recreation and leisure facilities

Recreation facilities are an important component of the land use activity mix within the activity centre. The northern campus will have outdoor sports fields and some indoor recreation facilities. However, there is a need to balance the recreation facilities on the southern campus to support the recreation needs of Nepean CAE, Werrington TAFE and other land uses within the technology precinct.

There is an opportunity to establish a major sports and recreation centre on or adjacent to the drive-in theatre site. This centre would provide facilities for swimming and other water sports and an indoor centre for court, racquet and ball sports. The centre would play a supportive role in education courses, research and development and also could become a major subregional centre for sport and entertainment.

Cultural facilities

A regional cultural centre should be located in the activity centre. This could be a museum, multicultural centre or centre of international relations. This choice should be made once the university has decided on cultural areas in which it will concentrate. This cultural centre will be an integral part of the activity centre and should contribute substantially to its environmental quality.

Research park

The research park will include a mixture of educational facilities and research centres. The educational facilities will include the extension to the northern campus of the university and centres of excellence from other universities. The major components of the research park will be the business information and technology development centre, incubator centres, research centres and external university research centres. These components are described below.

Business information and technology development centre

The purpose of this centre will be to disseminate information about technology and to assist with the development and marketing of new technology products. Five activities are proposed within the centre, namely:

- **Innovation centre**
  This will be designed to provide services to assist inventors and researches to translate ideas and research into marketable products.

- **Business information bureau**
  The bureau will be responsible for providing information and services to industry, distributing and promoting university research, promoting business development within the region, and selling academic services for research and consulting purposes.

- **Business development centre**
  The centre will provide consultancy services to assist businesses, especially small business, with management, accounting, marketing, promotion and product distribution advice.

- **Employment agency**
  The centre will provide agency services for the employment of students.

- **Technology education centre**
  The purpose of this centre will be to display products which demonstrate the application of technology. The centre will have an important education function and liaise with high schools, advanced and higher education institutions and business. It will also play a major role in promoting awareness of technology amongst primary school age children.

Incubator centres
These will comprise multi-tenanted buildings with commonly shared administrative services. Between six and twenty small business units with floor space areas ranging from 10 to 100 square metres would be located in each centre.

Research centres
Research centres would be used to conduct research, teaching and the development of new or modified technologies and products. Some centres may contain several small businesses. These will range in floor space from a few hundred square metres to several thousand square metres. Buildings may be owned or occupied by public or private research groups. Buildings ranging in size from 200 to 2000 square metres may be required.

External university research centres
An external faculty of an overseas university could become established on the research park independently or on a joint venture project with the university. The research park would provide the ideal location because of the backup facilities which would be available to such a centre.

9.2.4 Technology park

A technology park is proposed within the precinct. The technology park will be primarily orientated to full scale development, testing and manufacture of new technology based products. Manufacturing will be an important component of any enterprise wishing to establish on the technology park, although this component may not occupy a large floorspace area. Sites ranging from 0.4 to 2 ha will mainly be required, although a larger site may be required for some businesses. It is expected that industries requiring larger site areas would locate in surrounding industrial areas. Special infrastructure for water treatment and supply of heavy current electricity may be needed for prototype testing and the manufacturing of some products by some enterprises.

9.2.5 Business park

A business park is proposed to accommodate businesses involved with process and information based technologies. Most of these businesses will have a service or commercial nature with some wharehousing or storage required. The infrastructure requirements for the business park will be different from these of the technology park, with a heavy demand on telecommunication services. It is expected that most of the buildings will be multi-tenanted with only larger premises having free standing office sites.

The principal reason for separating the technology and business parks is the specialised infrastructure requirements. Businesses which have both an information and significant manufacturing component should preferably be located on the technology park.

9.2.6 Residential zone

A large amount of the land in the study area is currently held by the Department of Housing and was intended to be used for residential purposes. The area to the south of Caddens Road has been frozen for housing development pending the preparation of this Strategic Plan. An area of land bounded by O'Connell Street and Gipps Street has not been released for low density residential development. It is recommended that this land be developed for high quality medium density housing at a net density of 25-30 dwellings per hectare and comprise a mixture of duplex, court and town houses.

The land to the eastern side of Gipps Street/Kent Road will be separated from the study area once this road is upgraded to arterial status. In the long-term the land could be used for the technology park extension. Because of its configuration, however, and the restrictions likely to be placed on direct road access, it is recommended that this land be retained for housing.

9.2.7 Education centres

The two education centres adjacent to the university site will have an important role to play in the overall development of the technology precinct. Master plans have been prepared for both Nepean CAE and Werrington TAFE. As these were prepared several years ago and neither considered the impact of the university, there is a need to prepare a new detailed plan which clearly identifies the future land use requirements of these two education centres. Such a plan should link the colleges into one overall plan for the university and its environs.

Nepean College of Advanced Education
The master plan for the College provides for a student population of over 8000 students. The college will soon become an integral part of the university under the proposed multi-campus structure. The College will play an important role in providing technical expertise for the research centres and businesses located in the technology and business parks. The College will be linked directly to the southern campus activity centre with students and staff making use of the facilities in that area.

Werrington TAFE
This is planned to be the largest TAFE college in western Sydney. It is expected that staff and students will make use of the facilities located in the technology precinct. Many staff employed in the precinct at technical and semi-professional levels will be trained at the TAFE. In developing the Werrington TAFE, it is essential that the quality of development and landscaping be of a high standard as this site creates an important visual setting for the university and the technology precinct.

International school
An international school for secondary and primary pupils is proposed to the south of O'Connell Street between creek open space and Caddens Road realignment. The international school will be an important factor in attracting foreign academics, research and business personnel to the technology precinct.

9.2.8 Other land uses adjacent the technology precinct

New South Wales Archives

The New South Wales Archives is an important information centre and has the potential to provide the catalyst for establishing new information based technology enterprises in the precinct.

Werrington Army land

This land will remain as Defence land. However, because it lies adjacent to the university north campus, there is the potential to change its function for research and education purposes. This has the advantage that some facilities could be shared with the university and vice versa.

Cobham Remand Centre

This centre should be utilised for research purposes for studies into corrective behaviour and rehabilitation.

Orchard Hills

Although this area is not within the technology precinct, the Orchard Hills area is of high scenic value and of historic significance. The development of the university will create pressure for subdivision of this land between Caddens Road and the Freeway but it is recommended that it remain as semi rural to provide a high quality living environment close to the university. It is expected that pressure for further subdivision will take place in this area, so that minimum lot size restrictions and other planning controls will be necessary to help ensure that much of its character is retained.

Private land

There are still several parcels of land which have not been acquired as part at the technology precinct. If these cannot be acquired, they should be incorporated into the Strategic Plan and zoned in any new planning instrument prepared for this area. Conditions could also be imposed on development applications which would ensure that development standards are maintained and the general intentions of the technology precinct are adhered to.

South creek

The South Creek area should be investigated as an outdoor recreation area associated with the technology precinct. The flood prone land could be used as a golf course or playing fields. Retention basins could be built into these activities, thereby mitigating flooding downstream if this is a problem. Sporting facilities and particularly golf courses play an important role in the technology transfer process.

9.2.9 Strategic relationships with associated research activities

The Hawkesbury CAE, Department of Defence, CSIRO, industry and commerce are all important land use activities which may become associated with the university and the core precinct. The business information and development centre should play a major role in developing and fostering links with these activity centres and the business community.

9.3 TRAFFIC AND TRANSPORTATION PLAN

9.3.1 Major access roads

The Great Western Highway will provide the principal means of access to the university and technology precinct. Access to the university will be provided directly from the Highway. Long-term planning requirements for the university and its environs will require:

- A grade separated intersection at the bridge across the Great Western Highway giving access to both the south and north campuses.
- Upgrading of O'Connell Street which will involve a change of alignment at the eastern end of O'Connell Street to remove the circular road proposed by the Department of Housing.
- A signalised intersection with O'Connell Street and Gipps Street.
- Development of the north south campus avenue road as shown on the master plan, which will eventually link up with the F4 Freeway through Orchard Hills.
- The connection of the Great Western Highway with the F4 Freeway (the Gipps Street arterial link).
- The connection of Caddens Road with O'Connell Street at the eastern end.

9.3.2 Internal roads within the technology precinct

The Strategic Plan does not define the formal layout of internal roads. As a general policy, priority should be given to a well signposted circular road network, with the development of courts and culs-de-sac where heavy vehicle usage is not anticipated.

9.3.3 Local residential streets

Road layout and traffic management measures should be introduced to ensure that traffic going to and from the technology precinct does not filter through residential areas.

9.3.4 Pedestrian and cycleway system

The university master plan provides for a separate cycleway and pedestrian walkway system running from Bringelly Road to Putland Street via the Nepean CAE, the Werrington TAFE, the university and eastern residential area. A connection across the Great Western Highway to the university and railway station is also proposed.

The Plan retains the pedestrian cycleway network but proposes changes to the alignment and makes additions. A major addition will be to extend the cycleway network southwards through the activity centre, technology and research parks. It is expected that other minor walkways and cycleways will be developed during the detailed planning of the technology precinct.

9.3.5 Railway station

The university master plan proposes that a new railway station be built on the main railway line north of the campus. The State Rail Authority will be responsible for the construction of this new station.

9.3.6 Bus station and shuttle service

A bus station is proposed on the Great Western Highway under the bridge crossing between the north and south campuses. Consideration should also be given to a shuttle bus service between the north and south campus, the major car parking areas and the new railway station. This would be owned by the university using a token payment system. The introduction of a shuttle service will improve overall traffic management within the technology precinct. The possibility of introducing a monorail system should also be investigated.

9.3.7 Car parking

Car parking will become a major occupier of land within the overall complex. While many students will use public transport, the majority of people working or studying in the technology precinct are expected to use private motor vehicles. However, every incentive should be given to encouraging the use of public transport. Larger areas of general car parking should be avoided in preference to smaller well-landscaped areas. Some flood prone land could be utilised for this purpose.

Consideration should be given to angle parking on the main access road between the north and south campus and on O'Connell Road on that section running past the New South Wales Archives. Additional road widening would be required with angle parking broken up into bays.

In the long term, provision will need to be given to multi-storey car parks so that valuable land is not given over to this use. All research centres and companies located in the technology and business park should provide car parking according to standards set down in a development control plan for the area.

9.4 ENGINEERING SERVICES PLAN

Until more detailed development proposals are prepared for the precinct, it is not possible to determine expected requirements for engineering services. Existing infrastructure and services will not meet the demand for the precinct and will require major upgrading. In particular, the precinct will make heavy demands on water, sewerage and telecommunications. Electricity can be augmented without major difficulty. The disposal of solid waste may require the provision of special facilities. Some adjustment to drainage lines and the possibility of further retardation basins south of O'Connell Street may also be required.

An engineering services investigation should be undertaken during the detailed planning of the precinct. This investigation should determine the expected demand for services, the location of major services, staging of construction and cost estimates for the establishment of new engineering services.

9.5 URBAN DESIGN

9.5.1 Spatial arrangement of buildings

The northern campus master plan will determine the site development and building design for that area. No changes are proposed to this plan. The southern campus will complement the northern campus and will become a major activity centre not only for the university but for the region as a whole. It should be designed with many activities and buildings grouped closely together along a series of linked open spaces and pedestrian routes. The activity centre should be linked by pedestrian and cycle path routes to peripheral uses such as the TAFE College, Nepean CAE, research, business and technology parks.

The business and technology parks should be developed as more spacious landscaped areas with buildings constructed of high quality materials to enhance the visual image of the area. The maintenance of the high quality environment will be important in encouraging additional investment and maintaining the property value of existing facilities.

Residential areas for student and short term university housing should be designed as low set buildings up to a maximum of three floors. Some accommodation should be incorporated into the activity centre itself to give a continual presence of people in this area. This residential accommodation on campus will help to support some commercial activities at the early stage of development.

Residential development on Department of Housing land should take the form of mixed medium density houses. The change in density proposed in this area will provide a choice of accommodation close to the university which is different to the low density detached housing recently built in the area.

9.5.2 Landscaping

Landscaping will play a major role in enhancing the visual appearance of the technology precinct. Trees and shrubs provide a softness as well as shade and colour. Small areas of grass should also be provided for use by students and visitors to the area.

Proper consideration should be given to hard landscaping areas - in particular footpaths, entrances and sculpture. Concrete surfaces should be avoided in preference to more natural or reconstituted materials such as brick and ornamental block. A range of surface textures should also be planned to give the variation in relief and use of materials.

Street furnishing and informal gathering areas should be carefully designed with proper attention to seating and shade.

At the detailed development planning stage, a landscape plan should be prepared and design briefs should be issued to architects and developers. This will provide a theme and help to ensure that there is a uniform standard applied to all landscaping work undertaken in the technology precinct.

9.5.3 Signposting

The design and location of signs requires particular thought during the detailed planning stage. Consideration should be given to establishing unique signs throughout the area to add to the identity of the technology precinct.

9.6 REGIONAL DEVELOPMENT STRATEGY

The university will have an influence outside the boundaries of the technology precinct. Conversely, there are some major developments in western Sydney which can have strong interrelationships with the technology precinct.

These include:

- The proposed second Sydney international airport at Badgerys Creek.
- The proposed Very Fast Train linking Sydney and Melbourne with possible connections to the proposed airport at Badgerys Creek.
- The Penrith Lakes Schemes.
- The proposed NORWEST technology and business park in Baulkham Hills Shire Council.
- Parramatta City Centre which has emerged as Sydney's second central business district.
- The North West Sector, Sydney's future growth area.

There is a unique opportunity for long term strategic planning of these major infrastructural components. Although this is beyond the scope of this study, it is important that the technology precinct and Research and Development Corporation be strongly represented on any body responsible for this regional strategic planning.

It also appears that a major development axis is likely to emerge incorporating the university at Werrington, the second Sydney airport and the Camden - Campbelltown area.

Considering the possibilities for the local study area and the potentials of the region, the technology precinct has enormous potential as a future Multifunction Polis. Key ingredients which support this include:

- The development of the major complex of tertiary education establishments to serve the fastest growing region in Sydney.
- The proximity to a future international airport and possibly the Very Fast Train.
- Recreation opportunities associated with the future Penrith Lakes Scheme, the Nepean River and the Blue Mountains.
- Potentially good quality living environments close to the technology precinct.
- Regional strengths in biotechnology and biomedicine which are areas which the Japanese have identified as having particular potential for technology transfer between the countries.
- Proximity to Sydney with its technology and cultural base.

10 IMPLEMENTATION PLAN

10.1 ORGANISATION STRUCTURE

10.1.1 Options

Regardless of the final umbrella organisation that will be established for the new university, the construction and operation of the technology precinct (other than the university) will require the establishment of a separate organisation.

Several models were considered in Section 2.4 including a non-profit corporation, private company or public company.

Because of the limited resources available to the university to establish a research park, the establishment of a non-profit Research and Development Corporation is considered the best organisational structure. Most overseas universities prefer the setting up of a Research and Development Corporation with varying degrees of participation by government and the private sector.

10.1.2 Organisation structure and responsibilities of the Research and Development Corporation

Figure 2 shows the organisation structure for the proposed Research and Development Corporation. The Corporation would comprise a Board with representatives from the university, government and the private sector. A chairman would be independently elected by the university and should ideally be from a business background. The Corporation would have a small secretariat and be located in the business development centre proposed within the research park.

The Research and Development Corporation Board would be responsible for developing overall policy on the development of the areas under its authority - in particular the following entities described below.

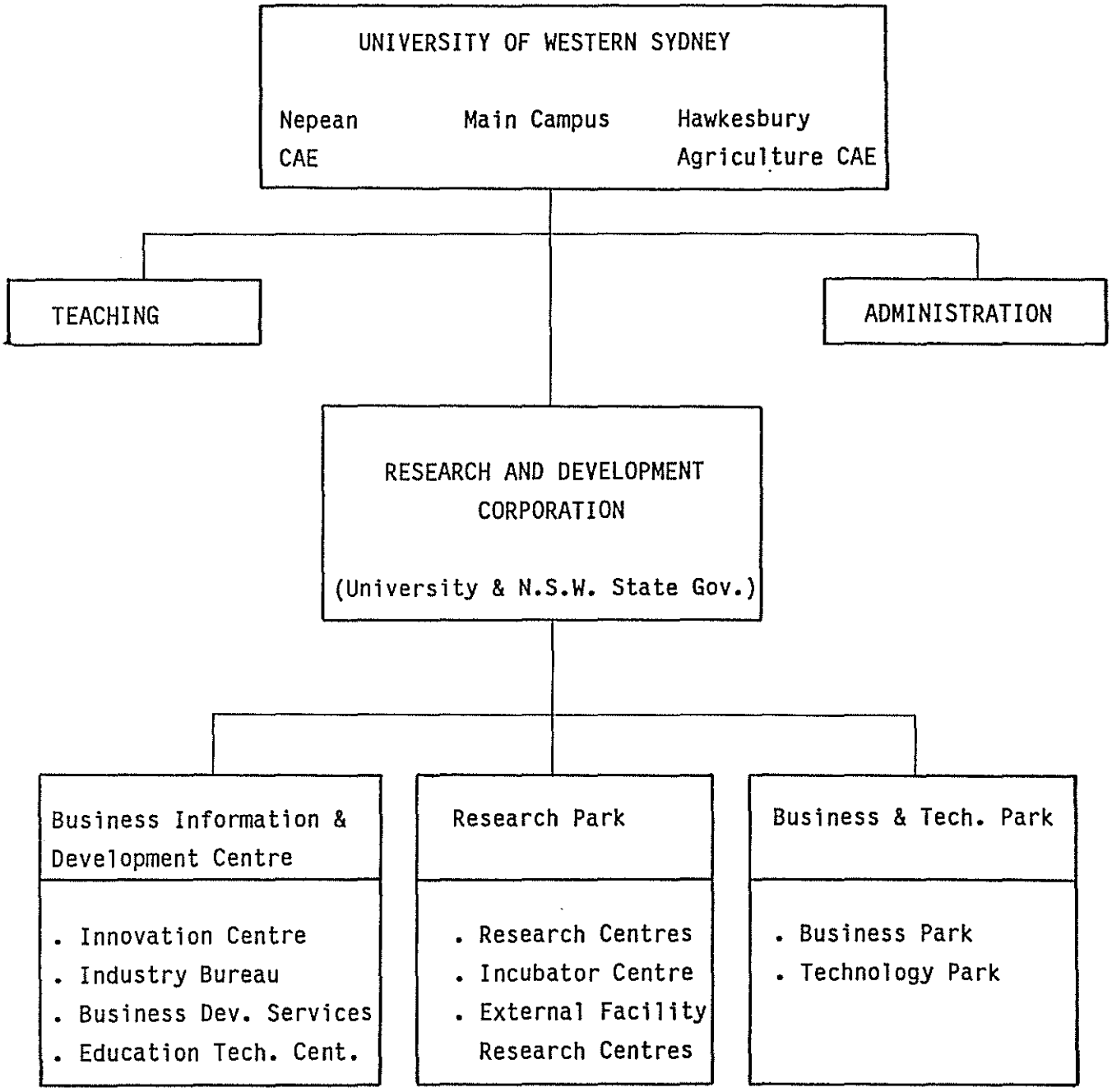
Business information and technology development centre

This centre would be responsible for:

- The day to day operation of the innovation centre.
- Running the industry information bureau.
- Operation of the business development bureau.
- Operation of the education technology centre.
- Running the secretariat for the Research and Development Corporation.
- Information on location and activities of park tenants.

Research park

The Research and Development Corporation would maintain overall responsibility and control for the planning of the research park. It would also be responsible for the day to day operation of facilities in which it has a financial interest.



R & D CORPORATION RESPONSIBILITIES

- Land Development
- Buildings
- Operational Cost
- Sales

- Land Development
- Some Research Centre Buildings

- Land Development

Figure 2 Organisation Structure

It is expected that the majority of buildings in the research park would be constructed by private or joint venture agreement. Where joint venture arrangements are entered into, the responsibility of the Corporation will vary according to its interest in the project.

Technology and business parks

It is not anticipated that the Research and Development Corporation will be involved directly with funding the construction of the technology or business park. These facilities will be developed by the private sector with the Corporation continuing to hold title to the land. The Corporation, however, would also maintain the right to enforce conditions for any development package issued to a private developer.

The Corporation's primary responsibility will be research and development facilities. It could also have responsibility for coordinating the development of other facilities in the technology precinct or southern campus. If these facilities were to be held by the Corporation, this would greatly add to its assets and cash flows.

Several government departments and education establishments will be affected by the strategic plan. Continuing consultation and coordination between these bodies will be required so that their interests are adequately protected. The university as custodian of the Plan should establish a committee to be responsible for its implementation. This committee should also include representation from relevant government departments or organisations which will be affected by actions proposed in the Plan.

Once the Corporation is established, a secretary should be appointed, with initial support staff and facilities provided by the university. The secretariat should be expanded as required with the second senior appointment being a marketing officer. Provision should be made by the university and other government departments to fund the secretariat of the Research and Development Corporation until such time as it has its own facilities and is generating sufficient income to become self funding.

10.2 PROGRAM

There are four stages in the development of the technology precinct. These stages are not fixed and will be closely related to the development of the university itself.

Stage 1

The first step in the development of the technology precinct is to establish the Research and Development Corporation to implement the strategic plan.

Tasks that would require to be undertaken in Stage 1 include:

- Preparation of regional environmental plan and development control plans.
- Preparation of a request for proposals incorporating development prospectus which clearly indicates objectives sought by the Corporation, types of development, expected levels of return and particular conditions which may apply to specific developments.

	YEARS																					RESPONSIBILITY
COMPONENTS OF DEVELOPMENT	1989	90	91	92	93	94	95	96	97	98	99	2000	1	2	3	4	5	6	7	8	9	
STAGE1																						
Open university	•••••••••																					Dept of Education
Adoption of strategic plan	•••••••••																					State Government
Establish R&D Corporation	•••••••••																					University
Preparation of REP	•••••••••																					Dept of Planning
Preparation of DCPs	•••••••••																					Private sector
Preparation of requests for proposals	•••••••••	•••••••	•••••••																			R & D Corporation
Engineering services																						
- Feasibility studies		•••••••	•••••••																			Private sector
- Design and construction			•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	Private sector
STAGE 2																						
Provision of student/staff housing				•••••••																		University
Commercial centre																						
- First stage				•••••••																		Private sector
- Second stage									•••••••	•••••••	•••••••											Private sector
Medium density housing		•••••••	•••••••																			Dept of Planning
STAGE 3																						
Business information and development centre					•••••••	•••••••																R & D Corporation
Hotel/conference centre							•••••••	•••••••														Private sector
Recreation centre							•••••••	•••••••	•••••••	•••••••	•••••••											Private sector
International school							•••••••	•••••••														Private sector
STAGE 4																						
Business park									•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	Private sector
Technology park									•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	•••••••	Private sector

Figure 3 Program

The request for proposals would be released and registration of interest sought from developers and investors for selected projects within the technology precinct. Developers would be invited to submit a range of proposals and options - including the total development of the site, group facilities development or development of individual facilities. The Corporation would examine submissions and, if necessary, request independent assessment. The university would proceed to negotiate with developers on proposals within the precinct and the Corporation would handle all development within the research, technology and business parks.

Stage 2

The first stage of the development program will involve the provision of student and staff housing on the south campus area. This will be funded by government although the possibility of other arrangements involving private interests should be examined.

To provide a small range of recreation and commercial facilities for students attending the university, the CAE and TAFE colleges, the first stage of the commercial centre should be constructed. Registrations of interest for development of the centre should be sought and agreement reached with an appropriate developer to establish the first facilities.

The area of land held by the Department of Housing should be released for medium mixed density housing and 1.5 ha should be purchased or reserved by the university for staff housing. This matter should be discussed with the Department of Housing.

It is recommended that there be a delay of at least two years from the date of opening of the university to the commencement of construction of residential accommodation and other facilities in Stage 2. Detailed engineering design and the calling of tenders would precede construction by six months.

Stage 3

Three years after the university is opened, work should commence on the development of the business information and development centre and one incubator facility centre should be established on the research park. Other sites should be prepared on the research park for private investors who have shown an interest in developing research centres on the park.

Initial planning and investigation work should commence on the development of the hotel/ conference centre. This will be developed and operated privately, although a joint venture arrangement should be investigated. It is expected that it will be between four and five years from the opening of the university that work on the construction of the hotel conference centre will commence.

During this stage, work should commence on the development of the recreation centre and the international school. The responsibility for the construction and operation of the recreation centre should be investigated further. It is expected that the international school will be run privately, although this matter too should be investigated further .

Stage 4

It will be at least six to seven years from the opening of the university before construction of the business and technology park is likely to take place. This period of time is necessary to build up the research capacity of the university, to promote the technology park and to attract investment interest in what must be recognised as a high risk venture.

The commercial centre will be expanded and additional accommodation, recreation and club facilities provided in this area in Stage 4.

It will take up to 20 years to fully develop the technology precinct, given the amount of land available in the study area and expected up take figures which are likely to be in the order of two to three blocks per year. This development period must be recognised in overall planning - especially financial planning as it affects outlays and cost recovery on infrastructure.

10.3 FINANCING

The university is unlikely to have the resources to develop the facilities required in the technology precinct. Even the limited resources which will be available will not allow for an extensive building program. If the development of the technology precinct is to proceed, it will only be achieved through private sector participation, with the university, government and other public sector organisations contributing land and expertise.

The following outlines a general strategy for funding of different components in the precinct.

10.3.1 Business information and development centre

It is proposed that this centre should be funded under a leaseback arrangement with a private sector developer. It will be operated by the Research and Development Corporation and will require some initial government funding until sales from its operation reach a breakeven point. It should be given a mandate to be self funding within five years. Under the leaseback arrangement, the building would revert to the Research and Development Corporation.

Revenues in the first three years of the centre's operation are not expected to be high, but, to cover operational costs. However the services provided by the centre are potentially good revenue earners - provided they are effectively marketed. Revenues are expected to be obtained from the following sources:

Innovation centre - sale of patents, royalties

Business information bureau - advertising, information and public sales.

Business development centre - sale of services to small business, university research services, consultancy services and agency fees from student employment posting.

Education centre - display rentals, room hire, advertising and commissions on sales where products are retailed as part of the display.

Research and Development Corporation Secretariat - university funds and other sources described above and below for a maximum of five years.

10.3.2 Research park

Most incubator buildings constructed for the Corporation for use by the university would be funded on a leaseback arrangement similar to that for the business information and development centre. A government grant will be required to establish the first university research buildings. Thereafter, a leaseback arrangement should be adopted for all new centres. In the long term, it would be expected that revenues generated from leases on land or joint venture arrangements would be expected to offset the running costs of initial university incubator centres on the research park.

10.3.3 Technology and business parks

The technology and business parks will be developed by the private sector. The Corporation will maintain ownership of land and receive revenue from this. A development lease would be issued to a developer, who in turn would relinquish the lease on land sold onto an investor or occupier at a site. The Corporation would not hold any interest in buildings unless it were part of a joint venture project. Leases would be set with appropriate review periods in order to ensure market rates were maintained.

10.3.4 Funding of headworks

The cost of headworks to develop the technology precinct will be significant. Much of these will have to be carried by the public sector because of the long-term nature of the project. Private developers will not be attracted to invest in the technology precinct if faced with significant costs to extend trunk infrastructure services. It must be recognised that development of the type envisaged in the technology precinct is high risk and private enterprise will be looking for incentives to reduce the risk factor.

In proceeding with the preparation of a detailed plan for the university and the other two education centres, the extension of trunk infrastructure services should be planned to accommodate the needs of the technology precinct. This will involve additional upfront costs. However, these costs must be accepted as a marketing cost to encourage investment by the private sector in the technology precinct. These costs should be carefully assessed in an engineering study carried out during the detailed planning of the technology precinct.

10.3.5 General

As many of the proposals set out in the development strategy are conceptual, it is not possible to determine actual monetary commitments that the university and government will need to earmark for various projects. The following commitments should be planned for in future budgets:

- Land costs.
- Establishment and initial running costs for the Research and Development Corporation.
- Equipment and operating costs of the business information and development centre.
- Construction of research park.
- Construction of first incubator facilities.

The development of major trunk infrastructure will require government and local government commitment to and funding of

- Major roads, intersections and bridges providing access to the university.
- New university railway station and site access works.
- Car parking.
- Upgrading of O'Connell Street.
- Upgrading and extension of trunk infrastructure services.
- Guarantees to private sector developers on payments involving lease-back buildings and other facilities within the technology precinct.

The private sector is expected to carry most of the cost of developing facilities in the technology precinct. In some cases, costs may have to be offset against other projects undertaken by the public and private sector. Further studies will need to be commissioned to provide the university with better information on costs, for internal and negotiation purposes.

10.4 MARKETING STRATEGY

Promotion of the university technology precinct will require a carefully developed marketing strategy aimed at attracting publicity and investment. Given the limited resources likely to be assigned to the university, and the poor image of the west, such a strategy must be long term. Key elements of the promotion strategy are described below.

10.4.1 Public consultations/public relations

The first step in marketing the technology precinct is to undertake a program of consultations/public relations with the western Sydney and local community. The aims of this program will be to identify concerns of the local community and to make the local community aware of the benefits for the region and the locality. It will also be important to allay any concerns regarding the research, technology and business parks. It should be communicated that these are not traditional industrial areas but land uses which will be compatible with the surrounding environment. A video would be a useful tool to present to the local community and to interested investors.

10.4.2 Establishing a technology orientated university

If the technology precinct is to have any chance of success, it is essential that the new university in western Sydney has a strong orientation towards science and technology. Significant work has already been undertaken on identifying potential courses which could be offered to students. Further work is required in determining course structures which promote the university as the centre of excellence in specific fields of science and technology.

10.4.3 Promotion of the technology precinct

Following from above, publicity must be given to the promotion of a technology precinct - especially the facilities which will be provided. This is essential to attract investment by the private sector. High priority must be given to establishing some buildings and facilities on the site at an early stage to give credibility to the technology precinct.

10.5 ZONING MECHANISM

As the technology precinct is of regional significance, it is proposed that a regional environmental plan be prepared to control development in the precinct.

In accordance with accepted planning policy in New South Wales, development control will be achieved by objectives for the whole precinct and for each zone within the precinct.

The intention will be to minimise the number of zones and maximise flexibility. General zones could include the northern campus, the activity centre, research park, technology park, business park, residential and education centres.

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