PROJECT: DOMAIN MASTER PLAN.

SITE INFRASTRUCTURE AND ASSETS MANAGEMENT.

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SECTION: - SITE INFRASTRUCTURE AND ASSETS MANAGEMENT.

1.0 GENERAL:

1.1 Introduction:

This Infrastructure Report covers the Domain lands that surround the Royal Botanic Gardens Sydney and is a Section of the Domain Master Plan currently being prepared by Mather and Associates Pty Ltd Landscape Architects for the Royal Botanic Gardens and Domain Trust.

The basis for determining the Domains Infrastructure condition as it exists and as may be required to meet the demands of the site relied heavily upon information in Garden records, reports and files as made available by the Gardens Staff. Based in some cases on very limited information this Report set out to document the current situation and vision for the Domain lands.

It is expected that the ongoing investigations and further studies suggested herein into the Domains Infrastructure will provide better and more detailed information that will allow better informed decisions to be made in terms of the ongoing development needs.

The Domain is made up of some 28 hectares of intensively used parkland that surrounds the Royal Botanic Gardens of Sydney on all sides except for the part fronting Farm Cove. The Domain area is managed by the Royal Botanic Gardens and Domain Trust.

Located in the heart of Sydney the Domain is itself bounded on 3 sides by dense urban development. The cities visitor and local population uses the parkland for active and passive recreation purposes. The use of the area for special events and festivals draws massive crowds that tax the Domain in every way.

The Domain Master Plan is intended to provide a comprehensive management approach to promote and protect the Domain's key values and to provide a frame-work for the maintenance, renewal and / or redevelopment of its facilities. The Plan should be the document that guides decision makers to help ensure the area is preserved for current and future generations to use and enjoy as much if not more than current and past generations have.

1.2 Scope of the plan

The Domain Master Plan is a management document that records the Trust's Policies, provides the framework for the day to day operations and acts as a guide for long term decisions and proposals that impact on the Domain's lands.

The Plan should be a living document regularly used and improved as found necessary. It should be developed with imput into management and maintenance strategies from the broader community, help to priorities resource allocation, provide the procedures and supporting details. Such a plan would ensure the aspirations and commitments of the

community and the Royal Botanic Gardens and Domain Trust are capable of being realised and sustained.

The Plan should ideally have 10 – 20 year life span relevance. However, a review of the Plan should be considered at 5 year intervals and undertaken as / if changing circumstances warrant.

Four major components are involved in developing the Plan:

1. Documenting RBG values and policies. (by RBG staff & Consultants)
2. Analysing the sites physical fabric and its cultural heritage. (by Consultants)
3. The Site Master Plan (by Consultants)
4. The Performance Evaluation Plan. (by Consultants)

Works Included:

This Infrastructure Section of the Domain Master Plan considers the range and nature of the Infrastructure assets and outlines RBG Guidelines and Policies relating thereto. The standards to which the facilities are to be maintained is discussed with details of the assets existing condition, its desirable condition, budget requirements and suggests how they may be best managed.

Infrastructure Development Considerations:

- **General:**
  RBG policy and guidelines,
  Existing condition and capacity.
  Desired condition and capacity

- **The Options:**
  What Standards apply or regulations.
  What other reports are applicable
  What new facilities are required
  What existing facilities are no longer required

- **The priorities:**
  For provision and/or renewal of facilities.
  For staging of works

- **The Infrastructure and Assets List:**

Infrastructure:

- Roads Public roads, driveways and pathways including steps..
- Parking For Cars, buses, special vehicles
- Access To and about the site for pedestrian and vehicle traffic.
- Drains For surface stormwater and groundwater
- Water For drinking, irrigation, fountains, firefighting.
- Sewer normal uses, Special events uses.
- Gas BBQ's
- Electricity BBQ's, Features, (security and safety lighting is dealt with by others at section x)
- Telephone public phones

Facilities:

- Garbage bins
- toilets
- bubblers
- playing fields
- exercise areas and equipment
- playgrounds
- Covered areas

Special Considerations:
- Pollution spills, GPT
- Retaining walls,
- fences, batters,
- Train lines
- Major roads
- Fire fighting
- Night Use
- Perimeter fences
- Contaminated soils / groundwater.

2.0 OVERALL MANAGEMENT CONTROLS:

2.1 STRATEGIC POLICY PRINCIPLES.

The General Principles.
(These address the overall objectives and philosophy that form the foundations of the Plan.)

Objectives:
Applies to all the Domains existing and proposed Infrastructure developments:
- To comply with legislation applying to all activities undertaken within the Domain.
- To show a high regard for associated environmental issues.
- To carefully consider all the historical and cultural associations,
- To continuously develop and promote a balanced and holistic ecologically sustainable development approach,
- To build in economic efficiency, and
- To explore cost recovery / sharing opportunities.

Philosophy:
To ensure that existing and future Infrastructure development, planning and management decisions are guided by
- the lessons of history,
- the realisation that infrastructure is a core concern and an essential long-term investment,
- community values,
- budget constraints
- the location, existing and desired condition and maintenance priority for each component of infrastructure.

The Specific Principles
(These directly address Infrastructure Management and Maintenance Strategies.)

Management Strategy

- To question the **need / relevance** for every part and component of existing infrastructure in the Domain (usage v cost), to determine if a continuing need exists in each case and if it does, that it is met in the most appropriate, economic and effective manner.

- To ensure that construction, maintenance and service aspects are effectively provided to meet the **priorities** determined / set for achieving the required quality levels as future budgets may allow.

- To determine the **level of service** to be provided (capacity v demand) by each component of infrastructure, its quality of construction and subsequent maintenance. (actual v desired)

- To develop ways to **rationalise facilities** for multi user benefits (usage fairness), to minimise waste, conserve water and energy and to maximise reuse and recycling of materials.

- To improve and /or construct “needed” facilities to the **quality standard** determined to be appropriate for the particular location and / or use.

- To ensure all works are undertaken, maintained and operated to the **safety standard** determined with due regard at all times to occupational health and safety matters.

- To ensure the general **public perception** of the Domain's infrastructure is that it is appropriately constructed, maintained, safe and clean.

- To encourage staff, consultants and the public to constructively suggest improvements to the infrastructure strategies, policies, practises and facilities of the Domain for the greater **public good and interest**.

Maintenance Strategy.

The actual maintenance and service levels to be adopted at each place should be set by various demands such as the degree of public use, to minimise public risk, to match community values, expectations, perceived importance and to achieve best practice within the set budget constraints.

Accordingly, the maintenance strategy should seek:

- To be pro-active in evaluating the benefit costs of undertaking preventative maintenance rather than corrective maintenance

- To accept that varying levels and priority of maintenance and service may be required for facilities at different locations in the Domain and to develop appropriate programs.

- To undertake the infrastructure maintenance and services programs determined to be required at different locations in accordance with the requirements and priority allocated to them.

SUGGESTED PRECINCT STATUS / PRIORITY:

1. Yurong Precinct
2. Phillip Precinct
3. Macquarie Precinct
4. Woolloomooloo Precinct
5. Crescent Precinct
6. Tarpeian Precinct

It is suggested that the above order reflects the degree of current public use and is a good way of setting the overall relative importance to the community of each Precinct.

Other ways of developing Precinct relative importance are based upon the functions attached to an area. For example the entry to the Domain may be likened to the entry of a grand hotel where it would be unthinkable to have less than the highest standard provided to set the right tone for the entire complex and to best attract cliental. Foyer (gathering) areas would be given similar consideration for the same reasons. Defining "the entry" of the Domain becomes the next problem.

The analogy hotel's entrance, foyers, lifts and corridor areas have little in common with the "real attractions and purpose" of the hotel which is the letting of rooms for accommodation, entertainment and functions. Never the less, such areas are accepted

without question to be crucial to set the tone of and accordingly to determine the success of the hotel.

The roads and the paths of the Domain may be likened to the lifts and the corridors in a hotel. These pragmatic parts of the Domain should for the same reasons be seen by all concerned as the essential and very important introductory elements that are crucial to the success and reputation of the Domain.

INFRASTRUCTURE STANDARDS OF DEVELOPMENT, MAINTENANCE AND SERVICE.

POLICY.

The highest levels **(Priority 1)** of development, maintenance and service should be provided at high use and significance entry and gathering areas and facilities.

Moderate levels **(Priority 2)** of development, maintenance and service should be provided to moderate use and significance areas and facilities.

Low levels **(Priority 3)** of development, maintenance and service should be provided to low use and significance areas and facilities.

Specific Application:

The Domain's **Priority 1** areas are broadly speaking contained in the Phillip Precinct. The Entry at the Art Gallery and Hospital Road intersection and the gathering / Foyer type area at The Art Gallery forecourt. Other important places are located in Yurong Precinct at Mrs Macquarie's Point and Fleet Steps and in Tarpeian Precinct at the area directly overlooking the Opera House. Of these areas the first two mentioned are the more important from the higher usage point of view.

Priority 3 areas are the steep and / or heavily wooded areas generally not accessible to the public and where access, grass cutting and / or other maintenance work are difficult or where natural conditions are to be preserved, such as some areas along the Woolloomooloo Bay foreshore.

Priority 2 areas are all other areas not covered by Priority 1 and 3.

Investment Priority.

The ongoing requirement for re-evaluating the outlay of funds for any works just before works are commenced **(time based)** should become the norm for Management and Staff. Questions to be asked include:

- Should the works be done now or later and why?. What was the basis for deciding the work was necessary in the first place, how long ago was the decision made, is the decision still appropriate. ie Will other needed works "waste" the proposed works when they are undertaken the future.
- Is the investment involved being spent on the most "needed" works at the time. Will a failure to attend to some "other work" today mean a greater proportional cost will be incurred tomorrow. ie Does the original priority still apply ?.
- Are the basic facilities being attended to first. ie Double working should be avoided, do the first things first. ie Are the "foundations" fully in place.

Economic Efficiency.

The ongoing requirement for re-evaluating the outlay of funds for any works just before works are commenced **(Dollar value based)** should become the norm for Management and Staff. Requirements change, information improves, yesterdays best practice may not be valid today.

Questions to be asked include:

- Is the work proposed still the most economic way of meeting the requirements.
- Is a second opinion required to ensure / audit the expert advice given stands up to cross examination. (suggestion; If you are not trained / qualified in the field under consideration the answer is YES seek a second expert opinion.)

Cost Recovery Considerations.

Generally once a facility is established / constructed the maintenance and service activities, such as cleaning and waste management, become the dominant and normal concern demanding repetitive and appropriate resource allocation and staff response.

It seems reasonable to expect that the cost of providing and maintaining facilities that are mostly used by the public should be mostly met by the "Public."

Special Events that require payment of an entry fee held within the Domain restrict the public's normal rights to freedom of entry, use and movement. Such events usually generate additional maintenance costs because of the nature and requirements of the Event. Such additional costs should be met by the proposed event holder / organiser on the basis that those that benefit should meet the associated costs and also provide appropriate compensation to the public for its temporary loss of use of the area involved.

Immediately before and after special Events both maintenance and service requirements may increase for the area concerned. Accordingly, if the appropriate fee is to be sought it is necessary to have accurate records of the historical normal maintenance costs and the extra costs incurred for special events within the Domain.

The "user pays" principle is considered appropriate to be applied to all the special events uses of the Domain.

3.0 INFRASTRUCTURE COMPONENTS:

A. PAVEMENTS.
for public roads, driveways and pathways but excluding steps in rock faces etc.

Two design standards generally apply to these works;

Policies Guidelines and Procedures for Traffic Generating Developments, Traffic authority of NSW.
Pavement Design, Austroads.

The Local Council will also have special requirements for design and construction works that it will be required to take over and maintain.

MAINTENANCE POLICY:

EXISTING PAVEMENTS:

General.
Historically, the pavements of the Domain have been subject to periodic maintenance on an "as needed and as funds allow" basis. However, in 1998 a pavement maintenance program was initiated to help ensure more pro-active, effective and efficient maintenance works were planned / undertaken as was determined by the management system suggested by the consultants employed.

A "Pavement Condition Survey Report" was prepared in October 1998 by the firm Pavement Management Services (PMS). In May 1999 the same firm produced a maintenance strategy as a supplementary report titled "Network Maintenance Assessment". The purpose of the PMS reports was "to clearly identify and quantify the costs [involved]… to upgrade all the … network to a suitable standard of service" over a 5 year period.

It seems the objective of the strategy is to keep all the pavements in a "good to very good" condition as measured by the "pavement condition index (PCI)" which is a **visual condition rating**. A further consideration in determining the final recommendation for the maintenance requirements of the pavements is the "remaining life" expectancy factor. This factor is determined for each pavement from its **structural condition rating / performance** under the "Heavy Weight Deflectometer" test as performed / arranged by the consultants.

The pavement tests undertaken provided an in-situ evaluation of the pavement's condition as measured by the related 3 values obtained. The values are for **CBR** (material strength factor), **characteristic curvature** (a measure of pavement strength and/or thickness) and **deflection** (a measure of subgrade strength / condition).

The number of passes of Equivalent Standard Axels (ESA's) measures pavement loading due to traffic. A standard axel is defined as a single axel with dual wheels that carries a load of 8.2 tonnes. Cars and other lightweight vehicles are not normally considered in the design of pavement thickness.

Pavement life is the Design Period, measured in years, before it should be necessary to undertake the reconstruction of a pavement.

- For new granular pavements the design period expected is 20 to 25 years.
- For new concrete pavements the design period expected is 20 to 40 years.

The PMS reports adopted 3 classes of pavement 1, 2 & 3, which equated to class 1 being heavily trafficked roads, and classes 2, 3 being medium and lightly trafficked paths respectively. The pavement design life was set at 20 years for each class. Traffic use over the 20-year life was set at 100,000, 10,000 and 1,000 Equivalent Standard Axel Load (ESA's) passes respectively. Each ESA adopted has an associated maximum value for the acceptable levels for deflection and curvature. The higher ESA values require lower corresponding values for deflection and curvature.

The remaining / residual life of a pavement is determined by the curvature values obtained by tests and comparing them to the corresponding ESA capacity for that value (obtained from standard charts prepared by Austroads). The chart ESA value may be reduced to equivalent years based upon current and / or expected annual traffic usage rates for the pavement under consideration.

[NB the Current usage of Art gallery Road has been reported by others to be "up to 250 buses per day" which equates to about $1.5 * 10^6$ = 1,500,000 ESA's while the PMS report adopts 100,000 ESA's for the same road]

Accordingly, on the basis of the reported high bus usage, the low number adopted by and the conclusions drawn in the PMS report in regard to remaining pavement life for the class 1 roads should be reviewed.

However, the principles and objectives of the report appear reasonable and offers a systematic approach to the ongoing maintenance of the existing pavements.

NB. The PMS report does not appear to consider the possible effect of and improvement to the environmental conditions that the various roads are located within and that may have a very significant impact on the reported overall pavement performance and lifespan. The investigation of the environmental aspects of each pavement may in some, if not all, cases prove to be a more effective and economic expenditure of short and long-term maintenance funds.

MAINTENANCE OPTIONS:

What Standards apply to maintenance:

Maintenance standards vary between construction authorities and invariably are related to each organisations priorities, the expectations of the user / public and the available funding for such work.

Four levels of maintenance are considered in the PMS report being **preventative, corrective, rehabilitation and reconstruction**. The relative expected cumulative costs over a pavement lifetime are related to the maintenance level adopted and ranges from lowest to highest cost respectively.

Preventative maintenance requires ongoing vigilance to ensure the first stage and relatively minor signs of pavement distress are discovered, monitored and attended to before the normal problems grow more serious to require more costly attention.

Such maintenance is said by PMS to involve the expenditure of some 2.5% of eventual reconstruction costs every 5 years on average. This expenditure accumulates to about 10% over a 24-year lifespan. Accordingly a 24-year budget of about 110% of reconstruction costs is required to provide for maintenance and replacement.

Corrective maintenance applies when the pavement problems have advanced to the stage where physical damage is obvious but can still be fixed economically by attention to the wearing surface of damaged areas only.

Such pavement maintenance is said by PMS to accumulate over a 24-year lifespan to about 30% of reconstruction costs. Accordingly a minimum 24-year budget of about 130% of reconstruction costs is required to be provided for maintenance and replacement.

Rehabilitation maintenance involves repairing more than surface works but not generally the full area or depth of a pavement.

Such pavement maintenance cost is said by PMS to accumulate over a 24-year lifespan to about 60% of reconstruction costs. Accordingly a minimum 24-year budget of about 160% of reconstruction costs is required to be provided for maintenance and replacement.

Reconstruction involves the complete rebuilding of pavements in area and depth.

PMS suggests that if no maintenance is practiced then pavements should require complete reconstruction every 15 years. Accordingly a minimum 24-year budget of about 160% of the reconstruction costs is required to be provided for such replacement. Note poorly maintained pavements after 12 years of life and up to reconstruction are expected to record ever increasing levels of user complaints.

Only under ideal conditions will no “design” or “fault-in-construction” problems arise within a pavements design life (20 years normally) and only normal wear should occur. For such cases PMS and other authorities suggest lifetime maintenance cost of about 10%, 30%, 60% respectively of the eventual reconstruction costs as the likely relative outlays for the above mentioned first 3 levels of maintenance.

By adopting and employing the first two levels of maintenance it can be expected that a “good” pavement standard will be preserved and the lifespan of the pavement will increase from about 16 years, if no maintenance is practiced, to about 24 years. The 3rd maintenance level if practiced is expected to require the outlay of 60% over 24 years of the eventual reconstruction cost. Complete reconstruction is expected to occur, if little to no maintenance is practiced, after 15 years.

Note: Pavements that last longer than the design life are usually explained as being those that have not experienced the traffic levels (ie ESA’s) they were designed for.

The objective of a “rehabilitation” maintenance policy is to minimise interim costs and complaints of service quality loss while a “reconstruction” maintenance policy means enduring for some time ever increasing complaint of the service level provided until reconstruction or close down of the facility is inevitable. A reconstruction only approach should not be considered except for low cost, out of the way and little used facilities.

SUGGESTED MAINTENANCE PROGRAM FOR THE DOMAIN.

The pavement Maintenance Management System proposed by PMS for the Domain encouraged adopting early **preventative** maintenance which seeks to maximise the benefits [in administration, operations and design] and minimise [average and cumulative lifetime maintenance] costs [by 20% to 70%].

If funds are not available to allow / undertake a preventative maintenance programs for all the pavements in the Domain then another practical maintenance approach is to allow different standards to apply to different pavements depending upon their importance in terms of usage and visual exposure level.

To maintain very good (priority 1) to good (priority 2) pavement quality requires preventative to corrective maintenance programs to be adopted. Priority 1 standards could be set for high priority areas with priority 2, corrective or priority 3, rehabilitation maintenance levels being practiced elsewhere in less important areas.

SUGGESTED MAINTENANCE POLICY:

- Develop / maintain pavements and ancillary works at priority 1 or 2 standard depending on location and designated use as defined later herein.

- The standard to which all pavements in the Domain have been constructed should be established before any maintenance standards is adopted or implemented.

Note. In conjunction with any **maintenance policy** there should be an underpinning / associated **construction standards policy.** It would most likely be a very ineffective maintenance process that was implemented without a sound works construction standard to underpin it. Eg a pavement designed and built to take the occasional car would very quickly fail if it were used regularly by buses. Any maintenance plan that was drawn up to keep such a pavement in good condition would prove to be ineffective, very expensive and futile. Such pavement would not fall within the guidelines mentioned herein of expected lifetimes and associated maintenance costs.

Suggested Development Works Standard:

For New pavements and all complete reconstruction works.

Principles:

The establishment of the usage and relative importance of every pavement in the Domain is the first step to help achieve an effective an efficient overall Management Plan.

The identification of key pedestrian / disabled, public, emergency and service vehicle access / circulation routes is also critical to ensure appropriate and economic construction / development standards are applied effectively.

Accordingly, a hierarchy for the various pavement in the Domain is proposed and these it is suggested should be called / classified as Roads, Driveways and Pathways.

Roads classification would apply to the public roads, predominantly used by vehicles, of Hospital Road, Art Gallery Road and Mrs Macquaries Road.

Driveways classification would apply to the pavements used by both pedestrian and vehicles.

Pathways classification would apply to the pavements predominantly used by pedestrians.

Considerations.

This Management Plan proposes to rationalise the levels of use that the various existing pavements in the Domain are exposed to in an endeavour to help achieve better safety, economics and efficiency for them.

As previously explained higher use pavements need greater thickness and/or better quality of construction and materials than do less used ones in order to perform satisfactorily over a reasonable period / lifetime. Put simply, high use pavements that are to provide good service and remain economic to maintain, cost more initially to construct and accordingly should be limited in extent and located to best and economically serve the site needs.

In technical terms, flexible pavements are made up of a **Wearing Surface** (Asphaltic concrete or bituminous seal) constructed over a **Base** material layer (crushed rock), over a **Sub-base** material layer (crushed rock) all of which is supported by the **Subgrade** (compacted existing soil).

The thicknesses of the various pavement layers varies in accordance with the design pavement Loading and the strength / bearing capacity of the underlying soil (Subgrade CBR).

CBR is the acronym / abbreviation of **Californian Bearing Ratio**. CBR is the common way of expressing a road's subgrade strength / capacity. The higher the CBR value the greater is the strength of the material under consideration. For example clays normally have low subgrade CBR values ie 2 to 5 while gravels have high values 40 to 80.

The subgrade soils of the Domain are expected to be a sandy clays with a CBR 10 value being likely. If the subgrade is poorly drained (environmental and construction factors) the expected CBR values could be halved to about CBR 5.

The **Pavement Management Services (PMS)** Report of October 1998 generally indicates the lower CBR values were found to exist for most pavements, this suggests high subgrade soil moisture conditions existed at the time of testing, which is an undesirable condition under a pavement at any time.

Note: In general the PMS reported design values of soil CBR for the Domain roads appears to be too low. The low values suggest something may be wrong, either in the testing results or that undesirable environmental conditions were present. Perhaps groundwater levels were high, the testing may have been undertaken following a period of long / heavy rainfall or irrigation waters may be involved. For the sake of long term economy in maintenance costs and to confirm the veracity of the results reported by PMS they should be compared against the more reliable laboratory test methods of determining the design CBR values.

The high importance of using the appropriate design CBR value of a subgrade may be understood by the following example. In accepting the higher of the PMS design subgrade CBR values of 4 for Mrs Macquaries Road and the PMS traffic loading of 100,000 ESA's means an overlay pavement thickness of some 330 mm is required. If in fact the design subgrade CBR is more appropriately 10 then for the same traffic loading of 100,000 ESA's an overlay pavement thickness of only some 200 mm is required.

Now compare the above pavement thicknesses to the case where a higher actual traffic use of 1,500,000 ESA's occurs. If the design subgrade CBR value is 4 for Mrs Macquaries Road then an overlay pavement thickness of some 460 mm is required. If the design subgrade CBR is 10 then for the same traffic loading of 1,500,000 ESA's an overlay pavement thickness of some 270 mm is required. Clearly there are significant cost implications in adopting a low CBR value.

The rationalisation of all pavement usage should help produce overall economies within a road / pathway construction and maintenance system.

The construction standards suggested for the various pavement classes in the Domain are:

Public Roads:

Design these pavements as high Bus use roads:
Design for $2*10^6$ ESA's wheel loads. (ie equivalent to 250 to 300 buses per day, the approximate environmental and practical limit of the site to cope with such traffic)

A Guide to the required pavement thickness for the above-mentioned traffic use wheel loads and for 3 selected CBR values follows:

CBR 10	CBR 5	CBR 2.5
280 mm	420 mm	620 mm

The design CBR of the public traffic used roads in the Domain are reported by **PMS** as:

Road	Design CBR	[Required pavement thickness (mm) For $2*10^6$ ESA's wheel loads]
Hospital Road	4	480
Art Gallery Road (out lane)	2	680
Mrs Macquaries Road (in lane)	2	680
Mrs Macquaries Road (out lane)	4	480

The economic advantage of further investigating the CBR value and perhaps also to remove excess moisture from the subgrade to achieve the higher CBR values is obvious.

PAVEMENT - CURRENT CONDITION.

The visual and structural condition of the road pavements at October 1998 as detailed herein is extracted from the PMS report. The visual conditions of the pavements at January 2000 reported herein are as observed by this reports author at that time.

Hospital Road. The PMS report recommended pavement corrective maintenance be undertaken in 1998/9 " and gave a 10 to 15 years additional life expectancy.. In October 1998 the surface area appeared in poor condition, it showed 36% patched and 31% potholes, with less than 10% fatigue cracking. The existing pavement strength was considered mostly more than adequate and the subgrade conditions relatively good.

The PMS reports structural data showed a sound subgrade existed but that a pavement weakness extended from chainage 00 to 150 for heavy bus traffic use.

In January 2000 I considered the surface condition to be the only serious pavement problem. Desirably the pavement should have been improved, as advised in the PMS report, by complete resurfacing with a minimum of 25 mm thickness of AC10 asphaltic concrete layer, to prevent further potholes, improve the visual and riding qualities and to minimise ongoing maintenance costs.

Art Gallery Road The PMS report advised “Do nothing” and gave a greater than 50 years life expectancy. In October 1998 the surface area showed 3% patched and 0% potholes, with less than 0% fatigue cracking. The existing pavement strength was found to be mostly more than adequate and subgrade conditions relatively very good. The surface condition was good and no serious problem was evident. A long low maintenance life was predicted.

The PMS reports structural data showed a sound subgrade and pavement existed for the outward bound lane. An isolated pavement weakness was suggested at chainage 205 for heavy bus traffic use.

In January 2000 serious pavement problems were evident along the Art Gallery frontage. In excess of 100 metres of pavement (25%) showed signs of fatigue cracking mainly within the in-bound traffic lane. I suggest the apparent rapid onset of pavement failure should be of great concern as it indicates something drastic has occurred since 1998.

Mrs Macquaries Road (in-bound) The PMS report advised [take] pavement spot “corrective maintenance” in 1999/00 and gave a 7 to 10 years life expectancy. In October 1998 the surface area showed 11% patched and 9% potholes, with 7% fatigue cracking. The existing pavement strength was considered mostly more than adequate and subgrade conditions relatively good. The surface condition was good and no serious problem was evident.

The PMS reports structural data showed a borderline subgrade and pavement existed at 3 places and that pavement weakness was the more serious problem. The suspect areas for heavy bus traffic use occur at chainage 150 to 550, 650 to 700 and 900 to 950.

In January 2000 serious pavement problems were evident. About 300 metres of pavement in the first 570 metres (50%) showed signs of fatigue cracking while about 100 metres in the remaining 400 metres (25%) showed the onset of the same conditions mainly along the high side edge (the low side is protected from bus traffic by parked cars). The extent of the failure should be of concern as it indicates something drastic has occurred since 1998.

Mrs Macquaries Road (out-bound) the PMS report advised [take] pavement spot “corrective maintenance” in 1999/00 and gave a 5 year life expectancy. In October 1998 the surface area showed 21% patched and 12% potholes, with 9% fatigue cracking. The existing pavement strength was mostly more than adequate and subgrade conditions relatively good. The surface condition was good and no serious problem was evident.

The PMS reports structural data showed a borderline subgrade and pavement existed at 3 places and that pavement weakness was the more serious problem. The suspect areas for heavy bus traffic use occur at chainage 50 to 250, 350 to 550 and 650 to 900.

In January 2000 serious pavement problems were evident. About 180 metres of pavement in the first 500 metres (35%) showed signs of fatigue cracking while about 270 metres in the remaining 550 metres (50%) showed the same signs mainly along the

high side edge (the low side is protected by parked cars). The extent of the failure should be of concern as it indicated something drastic had occurred since 1998.

Driveways – Construction Standard.

Design these pavements as service vehicle use roads:

Design for 30,000 ESA's wheel loads for **average use** driveways**.**
($3*10^4$ ESA's wheel loads = 4 / 8.2 tonne vehicles per day),

NB. For subgrades of CBR 10 strength a **pavement design thickness of 150 mm** results.

Design for 50,000 ESA's wheel loads for **heavy use** driveways.
($5*10^4$ ESA's wheel loads = maximum of 8 / 8.2 tonne vehicles per day)

NB. For subgrades of CBR 10 strength a **pavement design thickness of 175 mm** results.

Pathways – Construction Standard..

Design these pavements for very low truck traffic use.
($1*10^4$ ESA's wheel loads = maximum of 1 / 8.2 tonne vehicles per day)

NB. For subgrades of CBR 10 strength a **pavement design thickness of 125 mm** results.

Important related issues:

Pavement service life is a function of many variables, the most important and often mentioned ones being adequate surface and subsurface drainage. Moisture control helps to ensure the optimum strength of a subgrade is maintained by keeping soil moisture about the optimum moisture content level and not allowing it to reach the saturation point level, which invariably leads to a significant strength loss. The judicious use of sub soil drains is the best protection available against excess soil moisture.

Other pavement life factors include properly identifying the existing pavement environment at construction stage, especially the natural variations in subgrade strength due to variations in soil composition, topography and the load that the pavement is expected to carry over its economical life span.

The quality of the materials used to construct the pavement is another significant factor in life expectancy and all materials used should comply with the requirements given in MR form 744, "Specification for the Supply and delivery of Base and Sub-Base Materials for Road Pavements"

CURRENT MAINTENANCE STANDARD:

Reference: Pavement Condition Survey Report – Pavement Management Services - 1998. (PMS)

The road and path pavements within the Domain are currently planned to be maintained in the manner advised in the PMS report.

The PMS Report considers all roads and paths as being equal in terms of the design load they are expected to carry (See Appendix C for confirmation). **A design Load of $1*10^5$ ESA's = 100,000 ESA's (about 16 ESA's per day over 20 years) has generally been adopted for all pavements**,

The PMS May 1999 Supplementary Report refers to 3 Classes of pavement. Class 1 to 3 are respectively noted to mean Heavy and medium trafficked roads and light trafficked paths with ESA's of 100,000, 10,000 and 1,000 respectively. The actual use made of the 3 ESA values in the PMS Reports is not clear as the highest value has been used for all pavements evaluated.

If my current bus traffic information and my assessment of the PMS reports is correct then it would mean that for many, if not all, **paths** in the Domain the design load adopted is excessive while for the **public roads** the design load underestimates the actual loads being experienced.

Accordingly, the PMS report is expected to overstate the need and timing for maintenance of most paths and to understate the same needs for the public roads in the Domain. Accordingly, it is suggested that this aspect of the PMS reports and its conclusions should be reviewed.

Pavement Maintenance should be as required to achieve Priority 1 or 2 standard.

Priority 1 areas require regular **preventative maintenance** to ensure an above 75% Pavement Condition Index (PCI) is achieved for most of the pavement lifespan. This level of maintenance would ensure a **very good / as new condition** is maintained. Pavement sealer and rejuvenator only will normally be required every 5 years following initial reconstruction or rehabilitation to meet the appropriate construction standard.

According to the PMS Report the recommended surface treatments at 5 year intervals should extend the pavement life from the average 16 years minimum, if no maintenance is provided, to 24 years if about 10% 0f the pavement construction cost are expended on preventative maintenance works over the pavements life. Under ideal conditions and continuation of strict maintenance the pavement lifespan may extend to about 40 years.

Priority 2 areas require **corrective maintenance** to ensure a minimum 55% Pavement Condition Index (PCI) is achieved. This level of maintenance, following pavement rehabilitation to meet the appropriate construction standard, would ensure a **good condition** is maintained. Reseal with a thin overlay bitumen surfaces will normally be required every 8 - 10 years and patching of areas that fail would be undertaken on an as required basis.

The PMS Report says that such a maintenance plan would cost 20% to 30% of the Road reconstruction costs over the life of the pavement. [Under such circumstances, and provided funds are available, it would be economically prudent to maintain all pavements to priority 1 standard.]

ROAD GEOMETRY AND COSTS.

1. **Public Roads** in this report means the Domain **roads used by the public** being the Art Gallery Road / Mrs Macquarie's Road and Hospital Road. In the case of one way traffic flow such roads require 6 metres minimum pavement width to allow for parking in one lane (2.5 m) and through traffic in the adjacent lane (3.5 m). If no parking is desired then a minimum pavement width of 4 metres is recommended. Two way traffic flow with no parking would require 7 metres width of pavement.

The lengths of each road and the related estimated reconstruction costs are:

Road Name	**Length (metres)**	**Width (metres)**	**Reconstruction Cost**
Art Gallery Road	396 m	7.0	$ 345,000
Mrs Macquarie's Rd (Ingress)	964 m	6.0	$ 765,000
Mrs Macquarie's Rd (Exit)	1,023 m	6.0	$ 810,000
Hospital Road	446 m	7.0	$ 390,000
TOTAL	**2,829 m**		**$2,310,000**
Preventative maintenance budget at 10%			$ 231,000
Total cost / 24 year Lifetime budget			**$2,541,000**
Average annual budget allocation			**$ 106,000**
Charge for road upkeep (75,000 buses per year)			**$ 1.50/bus**

NB Roads for the en-globo valuation and costing purposes of this report are designated to have widths of 6 metres for one way flow with parking and **7 metres in 2 way flow sections** with no parking. Pavement depths have been averaged to 325 mm which is equivalent to CBR 8 for $2*10^6$ ESA's. Costs are as at march 2000. Budget Costs require annual updating in accordance with CPI movements.

2. **Driveways** are pavements at least 3.5 to 4.5 metres wide that may be used by heavy trucks / service and emergency vehicles.

Driveways, as suggested in a hierarchy system, are shown on Plan No and in some cases have PMS report reference numbers which are shown in brackets.

Precinct	**Road No**	**Length (metres)**	**Width (metres)**	**Reconstruction Cost**	
Crescent	(199)	205	4.0	$ 92,000	
	CP4	150	4.0	$ 69,000	
	CP5	240	4.0	$106,000	**$267,000**
Phillip	(150)	250	4.0	$110,000	
	150 extension.	110	4.0	$ 54,000	
	(156)	90	4.0	$ 45,000	**$209,000**
Woolloomooloo	(200)	115	4.5	$ 60,000	**$ 60,000**
Yurong	(201)	550	4.0	$230,000	
	(202)	375	4.0	$160,000	
	(203)	160	4.0	$ 73,000	**$463,000**
Macquarie	(300)	325	4.0	$140,000	
	2	25	4.0	$ 20,000	
	2	10	4.0	$ 13,000	**$173,000**

Tarpeian	(401)	105	4.0	$ 51,000	
	(402)	80	4.0	$ 41,000	**$ 92,000**
TOTAL		**2,790**			**$1,264,000**
Preventative maintenance budget at 10%				$ 126,000	
Total cost / 24 year Lifetime budget				**$1,390,000**	
Average annual budget allocation					**$ 58,000**

NB Driveways for the en-globo valuation and costing purposes of this report are designated to have widths of 4 metres. Pavement depths have been averaged to 225 mm which is equivalent to CBR 7 for $5*10^4$ ESA's. Costs are as at march 2000. Budget Costs require annual updating in accordance with CPI movements.

3. Pathway pavements should only be subject to foot traffic but have a design capacity allowance of 1 heavy vehicle per day.

Pathways are pavements up to 3 to 4 metres wide that should not be used by heavy trucks / service vehicles but may be used by emergency vehicles.

Pathways, are the pavements in the Domain excluding roads and driveways:

Precinct	**Path No**	**Length (metres)**	**Width (metres)**	**Reconstruction Cost**
Crescent	5 off	550	3.00	$170,000
Phillip	9 off	1505	3.00	$450,000
Woolloomooloo	8 off	1010	3.00	$304,000
Yurong	11 off	1090	3.00	$327,000
Macquarie	3 off	85	3.00	$ 32,000
Tarpeian	1 off	60	3.00	$ 25,000
	TOTAL	**4,300**		**$1,308,000**
Preventative maintenance budget at 10%				$ 131,000
Total cost / 24 year Lifetime budget				**$1,439,000**
Average annual budget allocation				**$ 60,000**

NB Pathways for the en-globo valuation and costing purposes of this report are designated to have widths of 3 metres. Pavement depths have been averaged to 155 mm which is equivalent to CBR 7 for $1*10^4$ ESA's. Costs are as at march 2000. Budget Costs require annual updating in accordance with CPI movements.

In summary The Domain contains a pavement infrastructure valued at about $5.12 million and requires a minimum annual maintenance budget of $51,000, in year 2000 value terms, to maintain that facility in an economic and effective manner.

DEVELOPMENT POLICY:

The Domain is primarily a place for relaxation and contemplation. Accordingly, it should be made as safe and stress free as possible. One way of achieving the ambience sought is to restrict non pedestrian activity to a minimum.

- Public and staff safety is the prime concern.

- Access to most parts of the Domain should be available in an efficient, environmentaly sensitive and pleasant manner.
- The level of access provided should be appropriate to the demand for it, the areas environmental and physical capacity and the economic sustainability of it.

Public Roads.

The obvious incompatibility of vehicular and pedestrian traffic means that public safety in duel use accessways is compromised. Accordingly, roads should be limited wherever practicable to perimeter locations.

The higher maintenance and reconstruction cost aspect of Roads is another reason they should be minimised.

Accordingly it is considered a prudent risk management policy for total road length in the Domain to be minimised and also to minimise, if not completely remove, all non-essential vehicular traffic from them.

Driveways:

To maximise public safety and minimise maintenance and reconstruction costs the service routes within the Domain should also be rationalised and their total length minimised. The service routes selected should avoid high public usage areas wherever possible.

The construction standard of driveway pavements should meet the design usage requirements detailed elsewhere herein.

Driveways should double as Emergency Vehicle access routes and accordingly should provide at least 2 ways of entry / exit to the surrounding public roads.

Pathways:

These should discourage use by service vehicles. Their purpose should be to provide for essentially pedestrian traffic requirements, at the highest level of public safety, to and between places of interest within the Domain.

In order to assist visitors to more easily find their way about the Domain and to recognise paths of significance, those that lead to recognised places of interest, and lessor paths a rationalisation study should also be undertaken for paths only.

Path slopes should not exceed the gradients recommended in Australian standard AS 1428.

Steps within the pathway system should, for safety reasons, be eliminated or minimised. Where steps are unavoidable alternative “steps free” paths should be available and suitable signposted as “Stroller / wheelchair” no steps routes.”

Parking Bays / Areas:

Like public roads these should be minimised to service essential traffic only.

DEVELOPMENT OPTIONS:

ROADS:

The following possible road system development options are suggested:

a. Option 1a – Change Nothing (Current Road System to remains as is)

Both existing road locations and traffic movements, including car parking areas remain as is. Pavement thickness should be capable of coping with current and proposed usage.

Currently some 250 buses per day take tourists to Mrs Macquarie's Point for short duration (20 minutes on average) visits.

The desirability and the environmental capacity of the Domain, in general and at the Point in particular, to satisfactorily accommodate the existing high bus usage are issues that require serious management and community consideration.

For bus traffic alone, the existing level of road usage amounts to about $1.5*10^6$ ESA's over a 20 year lifespan. Such usage requires a heavy duty road pavement to suitably distribute the resulting repeated wheel loads to the underlying soil / rock (subgrade). In engineering terms, for a subgrade strength equivalent to CBR 8, a pavement thickness of some 300 mm is required to meet present and reasonable future needs. Well drained subgrade conditions are also necessary for such a pavement to perform well over its life cycle.

The estimated replacement budget of the existing roads in the Domain is **$2.54 million**, and includes Hospital Road, Art Gallery road and Mrs Macquaries Road which have a combined length of **2,829 metres and widths of 6 and 7 metres**.

b. Option 1b - Road locations remain as is, but lane widths are reduced to allow One Lane – One-way traffic flow, for Service and Bus vehicles only access to the Art Gallery and Mrs Macquarie's Point. (ie no kerb side parking allowed)

The estimated replacement budget of the existing roads in the Domain is **$2.05 million**, and includes Hospital Road, Art Gallery road and Mrs Macquaries Road which have a combined length of **2,829 metres and widths of 4 and 7 metres**.

c. Option 2a –Reduces the length only of Mrs Macquaries Road to the turn around area adjacent to the Andrew (Boy) Charlton Swimming Pool and compensates with Driveways to provide the equivalent access length to Mrs Macquaries Chair.

The estimated replacement budget of this option's pavements in the Domain is **$1.96 million.** The cost includes Hospital Road, Art Gallery Road and Mrs Macquaries Road, which have a combined length of **1,959 metres and design widths of 6 and 7 metres.** The section of Mrs Macquaries Road modified to **driveway** status involves a length of **870 metres.**

d. Option 2b –Reduces the length of Mrs Macquaries Road to the turn around area adjacent to the Andrew (Boy) Charlton Swimming Pool and the width to 4 metres. Driveways compensate to provide the equivalent access length to Mrs Macquaries Chair.

The estimated replacement budget of this option's pavements in the Domain is **$1.83 million**. The cost includes Hospital Road, Art Gallery Road and Mrs Macquaries Road, which have a combined length of **1,959 metres and widths of 4 and 7 metres.** The section of Mrs Macquaries Road modified to **driveway** status involves a length of **870 metres.**

Option 3a Provides for a single 2 lane road to Andrew (boy) Charlton Swimming Pool, and then driveways in lieu to Mrs Macquaries Point etc.

The estimated replacement budget of this option's pavements in the Domain is **$1.76 million.** The cost includes Hospital Road, Art Gallery Road and Mrs Macquaries Road, which have a combined length of **1,432 metres and widths of 6 and 7 metres.** The section of Mrs Macquaries Road modified to **driveway** status involves a length of **1,397 metres.**

Option 4 Provides for Road use as currently exists to the Art Gallery and Driveways thereafter to Mrs Macquaries Point.

The estimated replacement budget of this option's pavements in the Domain is **$1.53 million**, and includes Hospital Road and Art Gallery road, which have a combined length of **842 metres and widths of 7 metres.** The modified to **driveway** status of Mrs Macquaries Road involves a length of **1,987 metres.**

Option 5: Provides for Hospital Road only to remain as currently exists and the other roads, from the entry to Mrs Macquaries Point, to be replaced by Driveways.

This option assumes that the essential and basic purpose of the internal Roads is to provide essential service vehicle only access to the Art Gallery, the Royal Botanic Gardens Administration Centre and Depot, and the Andrew (Boy) Charlton Swimming Pool and that a Driveway will be adequate. The provision of any bus service or public vehicular traffic access to the area is not seen as essential.

The estimated replacement budget of this option's pavements in the Domain is **$1.33 million**, and includes Hospital Road of length of **446 metres and widths of 6 metres.** The modified to **driveway** status of and Art Gallery Road and Mrs Macquaries Road involves a combined length of **2,383 metres.**

B. PARKING AREAS:

General.

1. **Non – articulated buses** require bays some 21 metres long and desirably 3.3 metres wide for parallel parking with a minimum 3.7 metres wide service / through lane beside them.

2. **Cars** require bays some 6.1 metres long and desirably 2.5 metres wide for parallel parking with a minimum 3.3 metres wide service / through lane beside them.

3. **Special vehicles** should be considered specifically and cannot be meaningfully generalised herein and accordingly do not form part of this report.

Objective:

To provide convenient, safe and adequate parking in accordance with the policy adopted for the roads and driveways of the Domain.

Action
If and where parking is decided to be provided then it should comply with the above guidelines and the "policies Guidelines and Procedures for Traffic Generating Developments" published by the Traffic Authority of NSW.

Pavement management and maintenance practice in such areas should be the same as the adjoining pavements used to access them.

C. PUBLIC AND EMERGENCY ACCESS.

Means for the public as pedestrians or in vehicles, and for emergency vehicles such as police, ambulance or firefighting.

Policy: (suggested)

Roads and/or Driveways:
General:
Unrestricted access potential is desirable in all cases and is especially important in emergency situations. Accordingly, access and / or escape avenues to the north, south, east and west for each Precinct are desirable. For as many Precincts as possible such access opportunities should be progressively provided. Where adjoining development or landform does not allow the desirable access level to be established then the next highest level of access should be considered.

In cases other than emergencies high level access choice should be provided to pedestrian traffic only if it can be ensured in a manner that is safe and environmentally acceptable.

As a matter of public safety and risk management it should be policy to restrict crowd - drawing events to those Precincts that have a high level of access choice available. Clearly Phillip precinct comes the closest to the ideal.

Objectives:
Establish a Plan for pavement construction / maintenance that improves safety, convenience, environmental sustainability and compatibility.

Actions:

Undertake the following improvements:

- Establish economic and environmental sustainability by:
  (a) accepting tourist buses as providing the economic lifeblood of the Domain and establish entry fees that pay for all road replacement costs, or
  (b) The bar of buses from the Domain, replacing roads with lower standard driveways and relying on government handouts, or
  (c) Adopting an "in Between" option of (a) and (b), or
  (d) Investigating the viability of establishing a "people mover" system within the Domain and Gardens that could fund the pavement infrastructure involved, or
  (e) Investigating the economic viability of establishing the Domain Carpark as a bus/rail/people mover interchange and thus fund the infrastructure involved.

- Establish economic management by rationalising the resulting road and pathway system into an effective and economic hierarchy.

- Establish Risk management by rationalising emergency / service routes and by ensuring access is provided to the highest level possible to the surrounding public roads.

Pathways:

Action:
Undertake the following improvements:

- Check the grading compliance etc of all paths and steps with the Australian Standard AS 1428.
- Rationalise all paths in terms of purpose and usage..
- Construct a pavement from the Domain Car Park to the Art Gallery.
- Construct a pavement from the Domain Car Park to St Mary's Road.

D. DRAINS STORMWATER AND GROUNDWATER

Policy: (Suggested)

Stormwater
General:
With the exception of Phillip Precinct, all stormwater collected in the Domain flows directly out onto surrounding streets or the ocean. Phillip Precinct also collects stormwater from Hospital Road and conveys it by pipeline into the Botanic Gardens main drainage line and channel. Stormwater flows that discharge directly into Woolloomooloo Bay or Farm Cove have the potential to cause visual and chemical pollution. If such pollution occurred it would be directly traceable to the Domain lands and accordingly would be a Domain management responsibility.

Stormwater systems should be the most economic possible that provide an adequate service, that ensures that public inconvenience is minimised and that public safety is maintained at acceptable levels. The safe passage of flood flows in excess of the design flows must be considered as part of the sites overall risk management.

The public's major use of the Domain is essentially restricted to non-rainy days. However, despite the low public use in wet weather, the need to control flooding to prevent damage and danger remains.

A low degree of surface flooding should not normally pose a threat to public safety. In the Domain pedestrian traffic interests should predominate and accordingly a lower, but none the less safe, standard of stormwater control could apply than say to a typical residential street. Despite this general statement it is imperative that, for every situation where upgrading or reconstruction work is proposed, a review of the specific drainage factors and requirements be undertaken.
The existing stormwater system of the Domain is old and of generally unknown condition. The pits are mainly of the surface inlet type and are generally too small and difficult to access to allow visual inspection of the interconnecting lines.

Objectives:

Ensure stormwater flow control systems are designed, constructed, maintained and managed so as to achieve adequate public, environmental and asset protection.

Action:
Dry and wet weather flow analysis and testing should be undertaken quarterly to record the level of pollution, if any, at ocean outfalls and if the findings are significant appropriate action must be taken.

Ocean outfalls should be provided with silt and debris traps wherever significant quantities of natural or artificial pollutants are captured and transported.

Risk analysis and benefit to cost analysis should be considered for each new line or upgrading of the stormwater system proposed. As a generalisation, considering the generally marginal extra costs involved in erring on the conservative side, the following design standards are suggested:

For roads	5 year ARI design standard.
For driveways	2 year ARI design standard,
For pathways	1 year ARI design standard,

In all low point locations and to allow for the inevitable floodway experience it is recommended that twice the normal facility drainage standard should apply.

It is important that the stormwater flows are capable of being collected by pits despite the inevitable clogging of grates that occurs due to fallen leaves, paper and other debris swept along in storm flows. Accordingly, kerb inlets to pits should always be provided, especially at low points.

Hydraulic grade line analysis of drains, especially for the flatter areas, is essential to ensure the design standard is properly met by the pipeline and pit arrangements in the drainage system.

Regular inspection and cleaning of drainage lines should form part of the system maintenance plan.

Compliance with Australian Standard AS 3500.3 should be made in all works.

Groundwater:

General:
Sub-surface seepage has the potential, if not properly managed, to saturate subgrades and drastically reduce any adjacent pavements service life and performance. Subsoil drains are an effective seepage control if properly installed and maintained.

Subsoil drains should always be provided along the high side of all pavements to cut off subsurface seepage. If heavy irrigation is practiced on both sides of a pavement then subsoil drains should also be provided to the low side.

Objectives:
To prevent subsurface water seepage flows from reducing the service life of new and existing pavements within the Domain.

Action:

Locate all subsoil drains located beside pavements within the Domain and test them for effectiveness.

Record all subsoil drains location, size, depth and condition. It is especially important to record the location of the upstream end inspection point and the lines outlet point to assist in maintenance and testing works.

Where pavements are showing signs of early failure then the location, testing and if necessary the urgent replacement of old, or construction of new, subsoil drains should be arranged to help arrest or minimise the problems.

E Water Supply:
For drinking, irrigation, fountains and firefighting.

Policy: (suggested)
General:
An adequate water supply of suitable quality, flow rate and pressure is essential for public health and safety, for lawn irrigation and the other facility needs of the Domain.

The water used in the Domain comes from the town water supply system. The site demands have been subject to expert investigations and reports. “Irrigation & Drainage Concept – Domain.” Hydro-Plan April 1999, recommends, among other things, that a “future supply of recycled water… to service the total Domain area” be provided for. The irrigation report found the water service to the Phillip and Crescent Precincts to be inadequate. All water supply pipelines in the Domain are reported as being in a poor and fragile condition

Future sources of water will consider the Sydney water reticulation system for potable supply and Busbys Bore and sewage mining for non-potable supply.

Objectives:
To provide an adequate water supply system offering suitable quality, reliability, flow rate and pressure to meet peak demands for all events and the facility in the Domain.

Action:
A water supply Master Plan for the Domain needs to be prepared showing how peak demands are to be met in an economic and effective manner. Existing and proposed pipe layout and sizes are required with fire risk categories for each sub area and valving for breakdown / repair management needs. A system breakdown contingency plan should be developed. All existing and proposed works need to comply with AS 3500.1.

Ideally, an on-site storage facility should provide a minimum supply under breakdown conditions to meet public health and other important facility needs such as the Depots, restaurant and the associated fire fighting needs.

F. Sewerage System.
For normal use and special events.

Policy: (suggested)
General:
The policy for the provision of sewer to the Domain is to ensure the system provides public health, environmental and asset protection.

The sewerage system must be adequately maintained to minimise the risk of failure due to blockage, leaking, crushing or disturbance and to maximise asset life, environmental and public health protection. Meeting the foregoing needs must also be achieved economically and at minimum overall cost from the view of construction, maintenance and management aspects.

Sewer works are provided to serve the needs of maintenance staff and visitors to the Domain. Normally the “user” needs relate to public convenience toilet facilities and Depot based staff amenities. For special events additional temporary toilets are hired in to accommodate the needs of the crowds attracted to the Domain.

The sewer system should be capable of serving the public’s general use of the toilet facilities provided and this historically has been the case.

For special events the additional temporary toilets provided and connected to the system should not overtax the sewer line capacity. To ensure the possibility of overtaxing the system is properly managed it will be necessary to have the sewer line capacity checked at each event connection point and the downstream lines.

Objectives:
Provide a sewerage system that adequately and economically copes with existing and future needs under normal and special event circumstances.

Actions:
Develop a master plan for the provision of an adequate and economic sewerage system to serve the needs of the Domain.

An audit is required to determine the condition of the existing lines. A CCTV inspection of the pipe lines and a visual assessment of access chambers etc is suggested.

Special Events that require temporary toilets, with hand pump flushing, to be connected to the sewer system should be limited to ensure service without surcharge is provided. Such a service will generally mean limiting the number of temporary toilets to a maximum of 20. This number is based upon the assumption that the sewer line being connected to has a diameter of 150 mm, a minimum grade of 1.0% and that it is in good order.

If more than 20 toilets are proposed to be connected then a close study of the likely flow rates and downstream pipe line conditions should be carried out.

A convenience centre should be planned / provided at every “attractor” and other Centres should be provided strategically between the attractors to ensure a high level of service is available to visitors throughout the Domain. Centre spacing should generally not exceed 500 metres.

Attractors mean places such as playing fields, high use viewing areas and pathways. Convenience Centre means a collection of facilities including toilets, bubblers and waste disposal bins located in an adequate environmental setting.

G. GAS BBQ’s

General.

The provision of gas BBQ facilities in the Domain is to be generally discouraged due to the added financial burden imposed in providing and maintaining the facilities. Maintenance of such facilities is usually high if complaints are to be avoided.

Objectives:
BBQ facilities are not to be provided.

Action:
Nil

G. ELECTRICITY
For BBQ's, Features, security and safety lighting,

This aspect does not form part of this report. See associated Electrical Report for details.

I. TELEPHONE SERVICE. public phones

General.
The provision of public phone facilities in the Domain is to be generally discouraged due to the added financial burden imposed in providing and maintaining the facilities. The common use of mobile phones by the public makes the provision of such facilities superflous.

Maintenance of such facilities is usually high if complaints are to be avoided.

Objectives:
Public phone facilities are not to be provided.

Action:
Nil