

**Riverside Gardens (west) dredging and landfill,
King William Street, Bayswater**

City of Bayswater

**Report and recommendations
of the Environmental Protection Authority**

**Environmental Protection Authority
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Summary and recommendations

The City of Bayswater proposes to further rehabilitate and develop for passive recreation approximately 12 hectares of existing public open space situated on the former Bayswater Rubbish Tip adjoining the Swan River. The 12ha site is bounded on the eastern side by Milne Street, and on the western side by the Bayswater Main Drain. The area is proposed to be redeveloped by the placing of 600mm layer of sand landfill on top of the existing surface of the site. The existing surface is currently grassed and is used for passive recreation such as walking and golf practice. The fill is expected to provide a root base for trees and shrubs as well as a basis for irrigation and maintenance. It is proposed to add a further 1 metre of fill in selected landscaped areas for contouring and vegetation.

The Environmental Protection Authority determined that the proposal should be assessed at the level of Public Environmental Review, and the associated documentation was released for a public review period of eight weeks which ended April 19, 1991.

The Authority believes that this proposal has three distinct elements to be considered: the filling and planting of the 12ha site; the irrigation of the site; and the acceptability of dredging of the Swan River for fill material.

The Environmental Protection Authority has assessed the general proposal by the City of Bayswater to redevelop, through filling and planting, the western 12ha of the public open space situated on the site of the former Bayswater Rubbish Tip, and has found it to be environmentally acceptable. The proposal would upgrade this community asset by improving the current condition of the existing public open space, through further rehabilitation and landscaping.

Recommendation 1

The Environmental Protection Authority has concluded that the proposal to further fill and landscape the 12ha of public open space situated on the site of the former Bayswater rubbish tip, which is west of the Bayswater Main drain, is environmentally acceptable.

Initially, the Authority was concerned that the redevelopment of the former tip site may increase leachate flow from the former rubbish tip to the Swan River, by intensive irrigation of a site which is currently not irrigated. Information gathered in the PER, and further clarified by the Geological Survey of Western Australia allays this concern. However, the Authority considers that it would be appropriate to monitor the groundwater flow for leachate contamination to make sure that the existing situation does not worsen, and to allow implementation of management techniques should monitoring results indicate the necessity for such action to protect the Swan River.

Recommendation 2

The Environmental Protection Authority recommends that a system of monitoring bores be put into place to monitor leachate flow from the former rubbish tip, prior to the completion of the redevelopment to the satisfaction of the Swan River Trust. Should monitoring results indicate the necessity for implementation for leachate management, the proponent shall undertake such management to the satisfaction of the Environmental Protection Authority and the Swan River Trust.

The City of Bayswater proposed to obtain most of the fill required to develop the site by dredging the Swan River. The section of River proposed for dredging extends almost 1km upstream from the Garratt Road Bridge. It is proposed that 90,000 cubic metres will be dredged and deposited directly as landfill in a period of approximately three months. To obtain 90 000 m³ of spoil the River would have to be dredged, as proposed in the Public

Environmental Review, a further 1m deep along a length of almost 1km for a continuous width of 100m.

This raises two main issues: the principle of using the Swan River as a source of fill material and the precedent which this may set; and the ecological impacts associated with the dredging.

The Environmental Protection Authority believes that the Swan and Canning rivers and their foreshores are unique entities in the Perth region. The city itself, and much of its environs, derives its particular character from these rivers. The Authority's prime objective in its guardianship of the environment of the Swan River is to ensure that it remains 'alive and healthy' and to the greatest extent possible, its integrity is maintained and sustained.

It is considered that the River system is a public trust rather than a resource to be appropriated for the benefit of individuals (EPA, 1987a). Whilst not quantifiable, this value is one to which the Authority must give recognition and expression when evaluating proposals. This value also places a heavy onus on any proponent of change to the waterways to justify that change. In justifying change to the waterways, proponents of dredging proposals must not only satisfy the Authority that they will not cause adverse impacts to the River system, but must go further and demonstrate that the dredging will be either environmentally beneficial to the River, or necessary for the maintenance of existing River activities.

The primary motivation for dredging the River in this instance is not to improve the River, but rather is to obtain spoil to facilitate the further filling and redevelopment of a partly rehabilitated site, which currently serves as public open space for passive recreation.

This proposal, if allowed, would set an unacceptable precedent for other similarly motivated dredging proposals, a possibility which is evidenced by the City of Belmont's submission on this proposal which states "A monitoring programme to evaluate the effects of the dredging would provide valuable feedback on the accuracy of the predicted effects indicated in the P.E.R. Such monitoring would also provide base information if similar dredging operations were to be proposed in comparable situations in the future".

The principle that the River can be used as a quarry for development material is not acceptable.

With regard to ecological impacts, the Public Environmental Review has not demonstrated that dredging would be environmentally beneficial to this section of the Swan River.

The reason for dredging the River, that is to obtain spoil to be used as fill, does not justify the change to the ecological system which may result from that dredging.

Recommendation 3

The Environmental Protection Authority recommends that the proposal to dredge the Swan River to obtain 90 000 m³ of spoil to be used as fill in the further redevelopment of the public open space which exists on the former Bayswater Rubbish Tip site, is environmentally unacceptable.

Whilst the Authority does not believe that the dredging of the Swan River to obtain spoil for fill is acceptable, it does support the general proposal to complete the rehabilitation of the former Bayswater Rubbish Tip site. The Authority is in agreement with the City of Bayswater's belief that the redevelopment of this area will improve it, and provide an improved community asset. However, as obtaining fill from dredging is not acceptable, alternative sources of fill and possibly alternative designs for the redevelopment will need to be considered.

Trucking in of dry fill would cause a significant though temporary impact on the residents of the area. However, this impact would be temporary, and at the end of it, there will be a long term gain in that public open space on the former rubbish tip site will be further redeveloped for the community.

The Bayswater City Council may also wish to consider redesigning their proposal so that the amount of fill required, and therefore the impact of trucking, is reduced. It may be possible to

use less than 600mm layer of fill over the entire 12ha if the type of irrigation equipment to be used is reconsidered. It also may be possible to use much less broadacre fill, and to fill more in areas selected for landscaping, much as is planned in the current PER, but on a lesser scale. The trucking in of fill would not necessarily have to be completed within the shortest time possible. Council may wish to consider importing fill over an extended period of time, so that the intensity of associated impacts is lessened.

Recommendation 4

The Environmental Protection Authority recommends that if the proponent chooses to truck in sand for top dressing, they should prepare a management plan for the trucking operations in consultation with the local community. The management plan should consider preferred routes and preferred frequencies of trucking and should be prepared before starting the work.

1. Introduction

The proposal to further develop 12ha of public open space situated on the former Bayswater Rubbish Tip site, King William Street, Bayswater, was referred to the Environmental Protection Authority for assessment in late June 1990. The Authority required that a Public Environmental Review (PER) of the proposal be undertaken and guidelines to assist the proponent in the preparation of the relevant documentation were issued by the Authority in early August 1990. The PER was available for an eight week public review period which ended April 19 1991.

The Authority considers that this proposal has three distinct elements to be considered: the filling and planting of the 12ha site; the irrigation of the site; and the acceptability of dredging the Swan River for fill material. Each element has been considered in this report.

2. Description of proposal

The City of Bayswater proposes to further rehabilitate and develop for passive recreational use, approximately 12 hectares of existing public open space situated on the former and partly rehabilitated rubbish tip on the Bayswater foreshore of the Swan River. The 12ha is bounded on the eastern side by Milne Street, and on the western side by the Bayswater Main Drain. The area is proposed to be redeveloped by the placing of 600mm layer of sand landfill on top of the existing grassed surface of the site. This fill is expected to provide a root base for trees and shrubs as well as a basis for irrigation and maintenance. It is proposed to add a further 1m of fill in selected landscaped areas for contouring and vegetation. The total volume of fill proposed is 100 000 m³, that is, 90 000 m³ of 'ordinary' fill and 10 000 m³ of quality 'topsoil' fill.

The City of Bayswater proposes to dredge the Swan River in order to obtain most of the fill required for the redevelopment of the site. The section of River proposed for dredging extends almost 1km upstream from the Garratt Road Bridge. It is proposed that 90,000 cubic metres will be dredged and deposited directly as landfill in a period of approximately three months of day time six-day-week work.

To obtain 90 000 m³ of spoil, the River would have to be dredged, as proposed in the Public Environmental Review, a further 1m deep along a length of almost 1 kilometre for a continuous width of 100m.

3. Public submissions

Comments were sought on the revised proposal from the public, community groups, conservation groups and local and State Government authorities. The Public Environmental Review prepared for the proposal was available for an eight week public submission period which ended on 19 April 1991. The proponent's response to these submissions is included in Appendix 2.

4. Environmental impacts

4.1 The site

The general proposal by the City of Bayswater to provide a community asset by further improving the existing condition of the public open space situated on the section of the former rubbish tip site subject to this proposal, through rehabilitation and landscaping, is commendable and is supported by the Authority.

Recommendation 1

The Environmental Protection Authority has concluded that the proposal to further fill and landscape the 12ha of public open space situated on the site of the former Bayswater rubbish tip, which is west of the Bayswater Main drain, is environmentally acceptable.

Initially, the Authority was concerned that the redevelopment of the former tip site may increase leachate flow from the former rubbish tip to the Swan River, by intensive irrigation of a site which is currently not irrigated. Information gathered in the PER, and further clarified by the Geological Survey of Western Australia allays this concern. Geological Survey of Western Australia had advised that the nutrient fluxes in the area are too small to warrant the creation of a leachate collection scheme, and that the mass of nitrogen and phosphorus discharges to the River each year could probably be more readily reduced by increasing the density of vegetation along the River foreshore in the area. However, the Authority considers that it would be appropriate to monitor the groundwater flow for leachate contamination to make sure that this situation does not worsen, and to allow implementation of management techniques should monitoring results indicate the necessity for such action to protect the Swan River.

Recommendation 2

The Environmental Protection Authority recommends that a system of monitoring bores be put into place to monitor leachate flow from the former rubbish tip, prior to the completion of the redevelopment to the satisfaction of the Swan River Trust. Should monitoring results indicate the necessity for implementation for leachate management, the proponent shall undertake such management to the satisfaction of the Environmental Protection Authority and the Swan River Trust.

4.2 The Swan River

The Environmental Protection Authority believes that the Swan and Canning rivers and their foreshores are unique entities in the Perth region. The city itself, and much of its environs, derives its particular character from those rivers. The rivers are of greater value to the community than the sum of the individual benefits they provide, such as fishing, aesthetics, recreation, navigation, and material source.

The Environmental Protection Authority considers that the Swan and Canning rivers system has a particular set of environmental values are recognised and held in special regard by the community. Maintenance of these values is a yardstick against which the Authority has and intends to assess proposals, develop policies and set standards. The environmental values include:

- aesthetics and landscape amenity;
- conservation of and the maintenance of the ecological health of the River system and its foreshores;
- the maintenance of water quality such that the range of non-consumptive uses and sustainable and manageable consumptive uses which are presently engaged are not prejudiced;
- private uses will not be favoured against community uses; and
- proposals which impact on the Swan and Canning rivers system will not just be measured against those environmental quality parameters but will also be measured against the resilience of the system to cope with any changes and the consequential affect of any changes upon beneficial uses of the River.

The Authority is also concerned with cumulative effects upon the River system (EPA, 1987b).

Due to the particular environmental values that the community has placed on the Swan and Canning River system, and recognising the role of the Swan River Trust, the Authority considers that it has a responsibility for public guardianship with regard to the River. The Environmental Protection Authority believes that its prime objective in its guardianship of the environment of the Swan River is to ensure that it remains 'alive and healthy' and to the greatest extent possible, its integrity is maintained and sustained. This means that a full complement of ecological functions must be retained. It also means that the integrity of the system, as something to be enjoyed by the widest numbers of persons possible and as a sustenance for continuing interrelationships between the rivers and the community, should be preserved.

The guardianship role requires the Environmental Protection Authority to articulate general community and environmental concerns about the River system. These concerns themselves are partly based on the notion that the River system is a public trust rather than a resource to be appropriated for the benefit of individuals (EPA, 1987a). Whilst not quantifiable, this value is one to which the Authority must give recognition and expression when evaluating proposals. This value also places a heavy onus on any proponent of change to the waterways to justify that change. In justifying change to the waterways, proponents of dredging proposals must not only satisfy the Authority that they will not cause adverse impacts to the River system, but must go further and show that the dredging will be either environmentally beneficial to the River, or necessary for the maintenance of existing River activities.

The City of Bayswater proposes to obtain most of the fill required to develop the site by dredging the Swan River. The section of River proposed for dredging extends almost 1km upstream from the Garratt Road Bridge. It is proposed that 90,000 cubic metres will be dredged and deposited directly as landfill in a period of approximately three months. To obtain 90 000 m³ of spoil, the River would have to be dredged, as proposed in the Public Environmental Review, a further 1m deep along a length of almost 1km for a continuous width of 100m.

This raises two main issues: the principle of using the Swan River as a source of fill material and the precedent which this may set; and the ecological impacts associated with the dredging.

The Environmental Protection Authority developed in 1986 guidelines for dredging in consultation with industry and other Government agencies (EPA, 1986). These guidelines, although not a statutory policy, have a wide cross section of support, having been developed by a committee with representatives from the Swan River Management Authority (now Swan River Trust), development interests, yacht clubs, local government, environmental consultants, academia, the Fisheries Department, and Marine and Harbours. The guidelines were adopted as a policy of the Swan River Management Authority and more recently the Swan River Trust, and have been used to assess dredging proposals.

The guidelines state that there are two acceptable reasons for dredging. One is for maintenance purposes, subject to environmental controls, and the other is for developmental purposes, subject to environmental impact assessment. The former is for maintenance of navigable channels, boat pens and so forth, and the latter is for the development of new water-based facilities. As can be seen, dredging the River for spoil to use as fill does not fit either of these two categories. This type of dredging could be regarded as opportunistic, in that it is not being done for maintenance purposes, for direct water based development purposes, nor for the benefit of the River itself. The primary motivation for dredging the River in this instance is to obtain spoil to facilitate the further development of the existing public open space situated on the former rubbish tip site. The proposal would seem unacceptable on this basis.

This proposal, if allowed, would set an unacceptable precedent for other similarly motivated dredging proposals, a possibility which is evidenced by the City of Belmont's submission on this proposal which states "A monitoring programme to evaluate the effects of the dredging would provide valuable feedback on the accuracy of the predicted effects indicated in the P.E.R. Such monitoring would also provide base information if similar dredging operations were to be proposed in comparable situations in the future".

The principle that the River can be used as a quarry for development material is not acceptable.

With regard to ecological impacts, the Public Environmental Review process has not demonstrated that dredging would be environmentally beneficial to this section of the Swan River.

The fact that portions of this section of River have been dredged twice before is not relevant to this proposal. Without true understanding of the physical changes which may result from the dredging, there can be no guarantee that the system will survive a third dredging, and there is certainly no indication that the dredging will actually be beneficial to the River.

The uncertainty over the potential environmental impacts associated with the River leads back to the reason for the dredging, and the principles and policies associated with this. As stated in the preceding discussion, the River is a public trust and is not a resource to be appropriated for the benefit of individuals. Whilst the proposal to redevelop the existing public open space situated on the former tip site is a commendable community spirited initiative on the part of the City for Bayswater, the proposal to dredge the Swan River for spoil to provide fill to facilitate the redevelopment, is not environmentally acceptable. Further, the Authority considers that the reason for dredging the River does not justify the change to the ecological system which may result, and is not in keeping with established policy.

Recommendation 3

The Environmental Protection Authority recommends that the proposal to dredge the Swan River to obtain 90 000 m³ of spoil to be used as fill in the further redevelopment of the public open space which exists on the former Bayswater Rubbish Tip site, is environmentally unacceptable.

An element of the redevelopment proposal for the site is to create an embayment of the foreshore. The Authority considers that this embayment would be acceptable provided that it is excavated from the land, rather than via dredging.

5. Alternatives

Whilst the Authority does not believe that the dredging of the Swan River to obtain spoil for fill is acceptable, it does support the general proposal to further develop the existing public open space which is situated on the former Bayswater Rubbish Tip site. The Authority is in agreement with the City of Bayswater's belief that the redevelopment of this area will improve it, and provide a valuable community asset. However, as obtaining fill from dredging is not acceptable, alternative sources of fill and possibly alternative designs for the redevelopment will need to be considered.

The main alternative means of obtaining the required fill would be to bring it in by truck from another location. As part of the Public Environmental Review process, the City of Bayswater and its consultants carried out extensive community consultations. The community groups were asked to consider two main options for obtaining fill, trucking and dredging, and with regard to trucking, were asked to consider possible routes and preferred frequencies of truck operations. The workshops held revealed that if the fill were to be trucked to the site, they would strongly prefer that it be trucked over the shortest possible time and that they wanted the trucking to be routed as far away from homes, and their own homes in particular, as possible and incorporating the least number of turns possible for loaded trucks in order to maximise safety (O'Brien & Associates, 1991).

Trucking in of the dry fill would cause a significant though temporary impact on the residents of the area, which would take the form of noise, dust, and vibration. However, this impact would be temporary, and at the end of it, there will be a long term gain in that the existing public open space situated on the former rubbish tip site will be further developed into a valuable and attractive asset for the community. Should trucks use King William Street they will also bring temporary disruption to the birds which use the Bird Sanctuary, however,

studies of other wetlands show that the disruption will also be relatively short lived. Previous studies of noisy model boat activities on Herdsman Lake showed that birds that were affected by the noise were only temporarily affected (Bamford *et. al.* 1988). In addition, Booragoon Lake which supports a large waterbird population, is situated right next to Leach Highway which carries a high volume of cars and consequently is a significant source of noise and pollution.

It is noted that extensive filling has already taken place in the vicinity of the Bird Sanctuary. In addition, the current proposal calls for 10 000 m³ of top soil to be imported to the site by truck.

Bayswater City Council may also wish to consider redesigning the Riverside Gardens West proposal so as to reduce the amount of fill required, and therefore the impact of trucking. It may be possible to use less than 600 mm layer of fill over the entire 12ha if the type of irrigation equipment to be used is reconsidered. It also may be possible to use much less broadacre fill, and to fill more in areas selected for landscaping, much as is planned in the current PER, but on a lesser scale. The trucking in of fill would not necessarily have to be completed within the shortest time possible. Council may wish to consider importing fill over an extended period of time, so that the intensity of associated impacts is lessened.

Recommendation 4

The Environmental Protection Authority recommends that if the proponent chooses to truck in sand for top dressing, they should prepare a management plan for the trucking operations in consultation with the local community. The management plan should consider preferred routes and preferred frequencies of trucking and should be prepared before starting the work.

6. Conclusion

The Environmental Protection Authority considers that the general proposal to redevelop the existing public open space situation on the site of the former Bayswater Rubbish Tip by filling and planting, is environmentally acceptable. The irrigation of the site is also environmentally acceptable provided that the recommended monitoring programme is put in place. The proposal to dredge the Swan River to obtain fill to use in the redevelopment of the site, is not environmentally acceptable.

7. References

- Bamford M, Davies S, and Van Delft R, (1988) Model Boats: Their effects on waterbirds at Herdsman Lake, Royal Ornithologists Union Report No. 48, Victoria.
- Environmental Protection Authority (1986) Guidelines (and explanation) for dredging and disposal of dredge material from the Swan River System (draft), Perth, Western Australia.
- Environmental Protection Authority (1987a) Annual Report 1986-87, Perth, Western Australia.
- Environmental Protection Authority (1987b) Submission by the Environmental Protection Authority to Mr C L Zelestis regarding the inquiry into the legislative framework for the management and development of the Swan and Canning Rivers. Perth, Western Australia
- O'Brien, Brian J and Associates (1991) Public Environmental Review for the proposed Riverside Gardens (West) dredging and landfill, King William Street Bayswater. Perth, Western Australia.

** Copies of the "Guidelines (and explanation) for dredging and disposal of dredge material from the Swan River system" are available from the EPA Library, 1 Mount Street, Perth.

Appendix 1

Proponent's commitments

9. SUMMARY OF COMMITMENTS BY PROPONENT

A draft of this PER was submitted to the Bayswater City Council in mid-January. This draft was closely examined, with the consultants, at an Advisory Committee meeting on January 30 which recommended its adoption at the Special Council Meeting to be held on February 4.

The proponent makes commitments with regard to potential environmental problems, so as to either avoid or minimise the problem or correct it if it occurs to any significant extent.

As a result of deliberations held on the draft PER the following commitments were made by the proponent, the City of Bayswater, who will be responsible for all work undertaken, in consultation with and to the satisfaction of other Authorities as follows:

1 WATER AUTHORITY OF WESTERN AUSTRALIA

The present conditions of licence of the bore will be met.

2 SECWA

Construction and maintenance work near the gas pipe-line easement will be carried out consistent with SECWA requirements, viz:

- 2.1 No building construction work i.e. toilet blocks, barbecues, etc. shall be located within five meters of the registered SECWA easement.
- 2.2 No vibratory compaction equipment shall operate within 20m of the pipeline.
- 2.3 Any heavy earthmoving machinery crossing the alignment of the pipeline during filling operations must do so using temporary paved access ways, the details of which shall be submitted to SECWA for approval prior to construction commencing.
- 2.4 No tree planting should be carried out on the SECWA easement nor within 3m of the pipeline.
- 2.5 No barbecues or storage of flammable substances shall be permitted within the 5m easement.

3 DEPARTMENT OF MARINE & HARBOURS

The dredging plant will be fitted with navigation and warning devices to the satisfaction of the Department of Marine & Harbours.

4 SWAN RIVER TRUST

Category A: General

The Swan River Trust will continue to have a membership and voting rights of two representatives on the City of Bayswater Foreshore Advisory Committee, whose regular meetings will provide opportunities for the Trust to be kept advised formally of progress on the entire Riverside Gardens project, and which will allow the Trust to assist and play an active role in responsible development of this important area.

Category B: Specific tasks.

A number of commitments are made by the City of Bayswater (see below) where detailed design and engineering and work controls cannot be specified either at this stage or until work commences. For example, some actions will depend on the weather conditions and rainfall, and optimising the work and minimising environmental impact will be assisted by flexibility.

For all these commitments, the City of Bayswater provides the broad commitment to carry out such broad classes of work, as indicated below, to the satisfaction of the Swan River Trust, as being the State Government authority charged most directly with responsibility for the Swan River and its immediate involvement.

River-bank stability

Dredging design will broadly follow the guidelines:

From RL 0 down to RL -1.0	10 horizontal to 1 vertical slope
From RL -1.0 down to RL -2.0	7 horizontal to 1 vertical slope
From RL -2.0 to bottom dredging	4 horizontal to 1 vertical slope

Benthic buffer zone

A buffer zone of approximately 10metres from the foreshore will be maintained, except in the embayment area.

Dredging depth

As a general guideline, and with due regard to the present irregularity of the riverbed, dredging will take approximately 1 metre of sandy material from the bottom while evening up the existing riverbed to an RL of AHD -4.0 to -4.5m approximately.

Dredging length

Dredging will extend approximately from the prolongation of Milne Street in the west to approximately the prolongation of Epson Avenue in the east.

Extension of dredging

Any extension of dredging will be to the east (upstream), where the river shallows over a thick sandy bed.

Navigation dredging

Extension of dredging will assist navigation, and will be carried out in consultation with the Department of Marine and Harbours.

River "holes".

The present riverbed has "holes" of concern to the Swan River Trust. While such "holes" below the dredging depth of -4.25m cannot be infilled during dredging, the general thrust of dredging will be to produce a level bottom, with gentle gradients at the upstream and downstream terminations. At the upstream, the river slope will be left as no steeper than 1 in 10 longitudinally. At the downstream, any new slopes will be no steeper than 1 in 10.

Existing River Use

Where appropriate, sufficient portions of dredge pipes will be located on the riverbed to permit river passage and to minimise interference with existing river use by water craft.

Timing of Project

The work will be undertaken during late autumn and winter months, which is the environmentally optimum period.

Bund Construction

The area to be covered with dredged fill will be isolated by constructing a temporary sand bund around the perimeter of the area. The area will be further divided into cells by subsidiary bunds as the work proceeds.

Bund location

The riverside boundary of the main bund will be located as an extension of the existing slope, on the rubbish and not on the immediate foreshore.

Bund stability

The sides of the bund will be treated by methods such as hydromulching.

Final bund treatment

At completion, the bunds will be merged into the landscaping, in accordance with the landscape Master Plan when detailed design is completed.

Settling ponds

At least two settling ponds will be provided.

Turbidity

Overflow from settling ponds will be via steel outlet pipes, discharging settled water below river level. Nominal settling time will be several hours.

Monitoring of turbidity

Should signs of excess turbidity appear in the discharge water, so that spoil is being excessively lost from the site, the settling ponds will be increased to allow longer settling times.

Discharge of waste waters

Discharge of waste waters into the river will be below river level, with scouring minimised if necessary by temporary protective concrete or other cladding at the outfall.

Foreshore

The existing foreshore will be left basically in its present state except in the area of the embayment. Minor cosmetic work such as removal of litter will be undertaken in conjunction with the community after completion of this project.

Construction of embayment

- a. All surface rubbish together with vegetation will be stripped from the site prior to dredging, and relocated.
- b. The perimeter bund adjacent to the embayment area will be constructed prior to any dredging work commencing.
- c. Any subsurface rubbish will be removed by dry excavation, utilising conventional earthmoving equipment. Rubbish of a minor extent will be buried on site prior to dredging work commencing. Any larger items of rubbish encountered such as old car bodies will be removed from the site.
- d. All useful topsoil from the area will be stripped and stockpiled for subsequent reuse.
- e. The dredging of the embayment area will establish a gentle 1:10 beach slope.

Tree preservation

All substantial existing trees will be preserved with the exception of one in the embayment area. The major bund will be constructed so as to exclude fringing trees from direct contact with wastewater and spoil discharges.

Tree planting

As part of the final landscaping design, approximately 1,000 native trees and shrubs will be planted.

Avon Descent

As far as practicable, specific arrangements will be made for Avon Descent participants in 1991 to have additional use of Hinds Reserve, if this project appears likely to interfere with the normal program.

Bayswater Sea Scouts

As far as practicable, minimum interference will occur with Sea Scouts and other traditional uses of the foreshore area to the west of the site.

Dust

The top surface and exposed outside banks of the bund will be seeded to minimise any temporary dust problem.

Nutrients

After dredging and landscaping are complete, at an appropriate time soil analysis will be carried out as part of the landscaping design, to optimise nutrient selection and planning.

Community Information

The City will continue its present program of informing the community about the development of Riverside Gardens.

Information Signs

The City will erect informative signs to maximise both community understanding of the project and its purposes, and to assist in safety.

Safety

Vehicular access will remain restricted and pedestrian access will be strictly managed and monitored during the works for safety reasons.

Appendix 2

Proponent's response to submissions

SUMMARY OF SUBMISSIONS ON THE PUBLIC ENVIRONMENTAL REVIEW FOR RIVERSIDE GARDENS (WEST) DREDGING AND LANDFILL, KING WILLIAM STREET BAYSWATER

The following is a summary in point form of the issues raised in public submissions received by the Environmental Protection Authority. Wherever possible, the submitters own words are used. Issues which are not of direct environmental concern have not been summarised. Copies of submissions by the Department of Land Administration, Department of Marine and Harbours, Health Department, City of Belmont and the Water Authority have been reproduced in full. The Authority expects that the proponent will respond to each of these individually.

Heavy Metals (RESPONDED TO BY POINT 5 IN PROPONENT'S RESPONSE)

- Concerns that not enough research has been done on the sediments in the river to see how the heavy metals from the nearby Bayswater Main Drain are held, either in organic compounds or in compound with the clay. By changing the environment of these sediments it is possible that these metals will become reactive and be released into the groundwater and further contaminate the soils and the river.
- Advice sought from an environmental scientist, indicated that it is imperative to find out what type of compounds contain the heavy metals. It is considered that if the metals were contained in organic compounds and exposed to acidic solutions such as dissolved fertiliser they could become reactive. It was suggested that past and present industries along the drain should be investigated to see if any metals other than those quoted on Page 36 of the PER would be likely to occur in the sediments. For example, mercury and arsenic levels have not been investigated. Also the zinc and chromium levels in the sediments (PER P37 and 38) are higher than the accepted levels for soils. By removing these sediments to the land we could be introducing unacceptably contaminated soils to the foreshore.
- It is suggested that the existing unreticulated grassland remain in those areas required as grassland and only sufficient fill be placed in areas designated for native shrubs and trees. This fill could be landscaped to provide contours and is already allowed for in the 100mm of topsoil proposed in the PER.

Monitoring (RESPONDED TO BY POINT 1 IN PROPONENT'S RESPONSE)

- The dredging proposal should be supported. This viewpoint recognises that there are certain environmental risks involved in disturbing the benthic layer. It is to be hoped that the full range of fauna in the area will be able to re-establish itself following the completion of the dredging. A monitoring programme to evaluate the effects of the dredging would provide valuable feedback on the accuracy of the predicted effects indicated in the PER. such monitoring would also provide base information if similar dredging operations were to be proposed in comparable situation in future.

Questions contained in the Authority's correspondence of 17 May 1991 also require response.

City of Belmont

215 Wright Street, Cloverdale, W.A. 6105
Telephone (09) 478 0222 Fax: (09) 478 1473
Depot Fax: (09) 478 0210

All communications to be addressed to
The Town Clerk P.O. Box 379,
Cloverdale W.A. 6105



Our Ref

SCM/03:FE

Your Ref

Enquiries

Mr P Stephens

8 April 1991

The Chairman
The Environmental Protection Authority
1 Mount Street
Perth WA 6000

Attention: Mrs Jackie Boyer

Dear Sir

PUBLIC ENVIRONMENTAL REVIEW - PROPOSED RIVERSIDE GARDENS, (WEST) DREDGING AND LANDFILL KING WILLIAM STREET, BAYSWATER

Thank you for the opportunity to comment on the Public Environmental Review for the above project. Having read the Review and attended the public workshop the City of Belmont is of the view that on balance the dredging option should be supported. This viewpoint of course recognises that there are certain environmental risks involved in disturbing the benthic layer. It is to be hoped that the full range of fauna in the area will be able to re-establish itself following the completion of the dredging. A monitoring programme to evaluate the effects of the dredging would provide valuable feedback on the accuracy of the predicted effects indicated in the P.E.R. Such monitoring would also provide base information if similar dredging operations were to be proposed in comparable situations in future.

In regard to the overall question of whether the redevelopment and landfill of the Western Flats should take place, the City of Belmont agrees with the observation made in the P.E.R. that the area at present is degraded and of little use. The work proposed will rehabilitate the area and transform it into a valuable recreational and landscape asset and should therefore be given strongest support.

If you have enquiries regarding this matter please direct them to Council's Planning Department by telephoning 478 0222.

Yours faithfully

N DEAGUE
CITY PLANNER

45/5/91

①

RECEIVED
MAY 1 1991

SS/90/ JBO 6 ✓



Western Australia

Health Department of Western Australia

Environmental Health Branch

Your Ref PF/76
Our Ref 90/8996
Enquiries O Ashby (222 4960)

(2)

The Chairman
Environmental Protection Authority
1 Mount Street
PERTH WA 6000

Attention : Mrs Jackie Boyer

85	90	1	Initials
			JBO ✓

Dear Sir

RE: PROPOSED RIVERSIDE GARDENS (WEST) BAYSWATER

I refer to your letter of 22 February 1991 in relation to the Public Environmental Review for the above project.

The report has been examined and the issues identified for comment are:

- The ablation block to be built on the filled site is of no consequence.
- The Radiation Health Section requests to sample the dredged material from the river to analyse it for possible radioactive material. Please contact Dr B Hartley (389 2261) to discuss this aspect.

Thank you for the opportunity to comment on this report.

Yours faithfully

Brian Wall
DIRECTOR
ENVIRONMENTAL HEALTH

24 May 1991
(105210A1:SM6)

Your Ref:
Our Ref: MC/5/94/90
Enquiries: Mr M Crawford

ENVIRONMENTAL	
- 7 MAY 1991	
File No. 85/90/1	Initials JBO

DEPARTMENT OF
MARINE & HARBOURS
WESTERN AUSTRALIA



1 ESSEX ST., FREMANTLE
P.O. BOX 402 FREMANTLE, W.A. 6160
TELEPHONE (09) 335 0888
TLX: 94784 FAX: 335 0850

Executive Director
Environmental Protection Authority
1 Mount Street
PERTH WA 6000

③

Att: Mrs J Boyer

**PER OF PROPOSED RIVERSIDE GARDENS (WEST) DREDGING & LANDFILL,
KING WILLIAM STREET, BAYSWATER**

Please find our submission on the above report below.

In this case you may utilise our comments as suggested in the City of Bayswater's letter of 22 February 1991.

COMMENTS

1. For all practical purposes, the proposal can be viewed as maintenance dredging of the Swan River. The proposed deepening by 1m on average will increase depths to RL-4.25m. This represents a marginal deepening of the waterway and no change in its course. All spoil will be disposed of as land fill.
2. Side batters of the proposed dredged channel are about 1:4 and appear to be no greater than existing riverbed side slopes. Their impact on foreshore slope stability needs to be checked, as required by the EPA guidelines.
3. The impact of the proposal on river hydrology was not specifically investigated by the PER. However, tidal flushing of this portion of the river can be expected to increase marginally as a result of the proposed works.

W S ANDREW
A/DIRECTOR ENGINEERING

3 May 1991

(c01emc.st)

40009

Your Ref:
Our Ref: MC/5/94/90
Enquiries: Mr M Crawford

DEPARTMENT OF
MARINE & HARBOURS
WESTERN AUSTRALIA



1 ESSEX ST., FREMANTLE
P.O. BOX 402 FREMANTLE, W.A. 6160
TELEPHONE (09) 335 0888
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ENVIRONMENTAL PROTECTION AUTHORITY

20 MAY 1991

③

Executive Director
EPA
1 Mount Street
PERTH WA 6000

Att: Mrs Jackie Boyer

RIVERSIDE GARDENS - BAYSWATER

Further to our telephone conversation of 14 May, 1991 requesting clarification of maintenance dredging referred to in our submission of 3 May 1991, we advise the following:

- (1) This portion of the Swan River is maintained as a navigable channel for recreational craft and shallow draft ferries.
- (2) It is difficult to determine the rate of siltation in this area from existing records.
- (3) There is at present sufficient water depths for navigation of small craft and ferries in the area.
- (4) Some of the previous dredging in the area was for the purpose of flood control.

We trust this is of assistance to you.


W S ANDREW
A/DIRECTOR ENGINEERING

16 May 1991

(c16emc.st)

43554

Your Ref
Our Ref
Enquiries
Tele Direct

A23774
D Hopkins
4202938

629 NEWCASTLE STREET
LEEDERVILLE W.A.
Postal Address: P.O. Box 100 Leederville
Western Australia 6007
Telephone: (09) 420 2420 Telex: AA 95140
Facsimile: (09) 328 2619

Environmental Protection
Authority
1 Mount Street
Perth WA 6000

ATT Mrs Jackie Boyer

Dear Jackie,

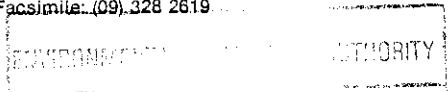
RIVERSIDE GARDENS (WEST) PER

The above Public Environmental Report (PER) has been examined by the Water Authority and the following comments are provided.

1. The Bayswater Main Drain which runs parallel to King Edward Street is maintained by the Water Authority and the Water Authority will continue to require a maintenance access way to the Drain.
2. It is not considered that private users of groundwater in the area will be affected, however it would be desirable if the developer could carry out a bore survey of the neighbouring lots before construction commences. This would establish some baseline data to assist if complaints are recieved.
3. The proponent is planning to use artesian groundwater for irrigation of the area through an old groundwater licence. Licence #4615 expired on 31 Dec 1990 and replacement licence #36828 has been issued with a reduced allocation of 13,500 m3 pa. This licence does not allow for the irrigation of the proposed landfill area as proposed by the proponent. The Water Authority would prefer that the shallow groundwater resources and drainage waters in the area were developed in preference to the artesian aquifer and that water use was minimised by the use of water conservation techniques in irrigation and landscape design.
4. From a floodplain point of view there are no objections to the proposed dredging and landfill. I have enclosed a copy of a letter relating to floodplain management which was sent to Brian J.O'Brien and Associates on 4th April 1990.

You may provide the above submission to the proponent and reproduce it in the EPA's assessment report.

K J Taylor
A/MANAGER GROUNDWATER AND ENVIRONMENT
8th May 1991



85/90/1

JBO

4

12
WAW

30/02

COPY



**WATER
AUTHORITY**
of Western Australia

Your Ref
Our Ref A 19776
Enquiries P L George
Tele Direct 420 2903

629 NEWCASTLE STREET
LEEDERVILLE W.A.
Postal Address: P.O. Box 100 Leederville
Western Australia 6007
Telephone: (09) 420 2420 Telex: AA 95140
Facsimile: (09) 328 2619

Brian J. O'Brien & Associates Pty Ltd
12 Caithness Road
FLOREAT PARK WA 6014

Dear Brian

Your letter dated March 14, 1990 refers.

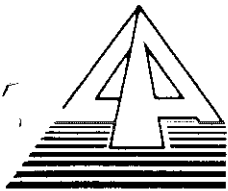
From a floodplain management viewpoint there is no objection to the type of dredging proposed by you should this option proceed.

With respect to adding approximately 600 mm to the present surface, there is no objection to such filling as its effect on increasing flood levels is within acceptable limits. The 100 year flood level increase rises from 70 mm (which is the increase in flood level due to existing and future downstream developments) to 110 mm. This increase is within the acceptable increase of 150 mm which is the criteria applied along all other reaches of the river.

The structures and landfill shown on your concept plan are therefore considered acceptable developments in the floodplain.

Patrick L. George
Supervising Engineer
Floodplain Management Section

4 April 1990
pgeo33



Department of
LAND ADMINISTRATION

Your Ref:

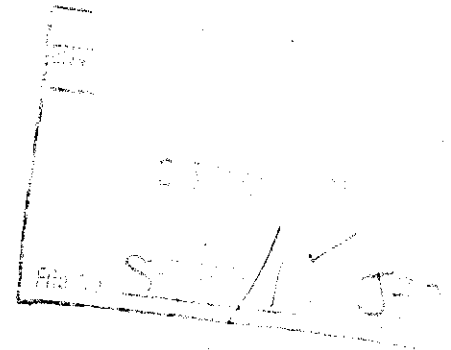
Our Ref: 2083/958V3 KE:BJ

Enquiries: KEVIN EMROSE

Telephone: 323 1289

THE CHAIRMAN
ENVIRONMENTAL PROTECTION AUTHORITY
1 MOUNT STREET
PERTH MAILWEST

ATTENTION MRS JACKIE BOYER



**PER - PROPOSED RIVERSIDE GARDENS (WEST) DREDGING AND LANDFILL, KING
WILLIAM STREET, BAYSWATER**

Recently the City of Bayswater forwarded a copy of their Public Environmental Review (PER) for the above mentioned area. After perusal the following comments are made:-

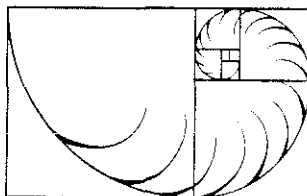
- a) the Department is in agreement in principle to the proposal,
- b) the closure and consolidation of that portion of Leake Street affected by the proposal into adjoining freehold lands can be resolved by negotiation between Council and this Office,
- c) in regard to item 3.5.2 of the PER, the current Mining Act, 19 8 does not differentiate between uses for sand (sand is classed as a mineral) when on Crown land. Therefore any removal or exploitation would require the approval of the Hon. Minister for Mines. As part of this approval process the comments of the Hon. Minister for Lands are sought under Section 25(2)(b) of that Act. Accordingly it is suggested that the comments of the Department of Mines is sought on this PER.

H. FARRAR
A/ASST. REGIONAL MANAGER METRO
LAND OPERATIONS DIVISION

March 21, 1991

48370

03L0083B

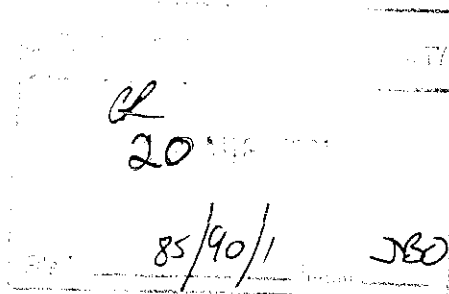


Brian J. O'Brien & Associates Pty. Ltd.

19 August, 1991

A.C.N. 008 980 916

Mr G French
A/Assistant Director
Evaluations Division
EPA
1 Mount St
PERTH WA 6000



Dear Graeme,

BAYSWATER FORESHORE PER

Further to our discussions and your Fax of 14 August, 1991, as amended by phone message, I am pleased to provide a two-part response to the EPA relating to issues raised by the public, Government instrumentalities and the EPA itself, following the 8-week public comment period.

This response is complete except for the fact that the EPA did not forward, for comment and response, any questions raised by the Swan River Trust.

You will be aware that initially it was believed that the Trust and the Authority would submit a joint report to Hon R J Pearce as Minister for the Environment. However, it is understood that separate reports will now be made by the two statutory authorities.

Accordingly, as issues have been raised by the Swan River Trust we have dealt with it direct, including several meetings with the Trust itself, its Environmental Quality Committee and its officers. These meetings have been very useful, and it is assumed here that the EPA is being kept fully informed of the Trust deliberations, and vice versa. While there is some overlap in questions, the issues of river quality were pursued in detail only with the Swan River Trust.

Therefore, what follows deals in Part 1 with questions and comments from the public and statutory bodies *other than the Swan River Trust*, while Part 2 deals with questions posed by the EPA itself.

I look forward to hearing of further developments.

Yours sincerely,


Brian J. O'Brien

c. Kevin Sproat

CRN 49224

PART 1

BAYSWATER PER - RESPONSE TO SUBMISSIONS AND QUESTIONS

In response to the 8-weeks' period for public comment on the Public Environment Review, the EPA has forwarded copies of submissions by 4 State Government authorities (Dept of Land Administration, Dept of Marine and Harbours, Health Department and the WA Water Authority) and 1 Local Authority (City of Belmont), a Summary of Submissions, including the one submission from the community, together with a set of 10 specific Questions posed by the EPA on 17 May, 1991.

This Part 1 response deals with each of the first items in turn, while Part 2 deals with the EPA questions.

1. City of Belmont.

The City of Belmont, which has jurisdiction over the opposite side of the river to the subject land, has the view that "on balance the dredging option should be supported". In addition, while raising the possibility of monitoring, the City states that the present area "is degraded and of little use", and that the work proposed "will rehabilitate the area and transform it into a valuable recreational and landscape asset and should therefore be given strongest support."

Such strong support from the neighbour local authority is welcomed and adds significant weight to the City of Bayswater proposal.

2. Health Department.

No specific comment was made.

3. Department of Marine & Harbours. (Letter 3 May).

The Department states that "for all practical purposes, the proposal can be viewed as maintenance dredging of the Swan River. .. Side batters of about 1:4 appear to be no greater than existing riverbed side slopes. Their impact on foreshore slope stability needs to be checked, as required by the EPA guidelines. "

The opinion of the Dept of Marine and Harbours is that, as a result of dredging, "Tidal flushing of the river can be expected to increase marginally." This is in agreement with the opinion of the proponents, but is apparently not accepted by the Swan River Trust.

It is apparent that the Department views the proposed dredging as routine. The proposed side batter slope of 1:4 has to be viewed in the context of three facts. First, it is no greater than existing riverbed side slopes - in fact it is appreciably less than existing slopes even in the immediate vicinity - see Figures 8B and 8C of the PER. Second, closer to the shore the slope is graduated, first to 1 in 7 and then, closest to the shore, to a very gentle 1 in 10, which will give adequate dampening of any effects. Third, the 1 in 4 slope is proposed for depths some 2 metres below water level, where wave motions will be considerably damped.

4. Water Authority.

Two prime issues involve this Authority, viz the flood plain and water supplies.

The Authority confirmed that it had earlier (1990) given written approval.

When the PER was being produced, the existing licence #4615 for the King William Street deep bore allowed an annual throughput of some 360,000 kilolitres, as stated in the PER (page 56). This licence had been in place for many years, and was based on the reserve area (about 36 hectares) and an assumed annual irrigation requirement of some 10,000 kilolitres per hectare. It had not been used to its full allowance, pending the development of the land to be suitable for efficient irrigation, as per this proposal.

The old licence expired on 31 December, 1990, and was renewed without discussion with City of Bayswater, as to needs, at a new allowance of only 13,500 cubic metres, approximately the amount used in the past to top up the Eric Singleton Bird sanctuary.

It is the understanding of the City of Bayswater Technical Services Directorate that the licence can be extended to the former full amount, or negotiated towards that amount, as part of the technical development of the proposal.

The City will negotiate where appropriate, and will certainly minimise water use by conservation techniques in irrigation and landscape design.

It is appropriate to mention that as a matter of management of the river itself, it may be more useful to irrigate using the Leederville aquifer as initially proposed and planned for many years, than to interfere with the existing groundwater flow into the river.

5. Public response.

It is understood that only one comment was received from the public during the 8-week period of public comment.

The EPA sought a response to a concern voiced by an environmental scientist with regard to heavy metals in the sediments, and possible chemical processes exacerbating their effects if they are included in the landfill.

In response, one can first question the methodology whereby this issue has been brought forward again, because it is answered in the PER. A member of the public phoned an environmental graduate student at Murdoch and sought his comments. These were phrased in strong language ("imperative" etc) in the comments transmitted by the EPA.

However, in pursuit of the matter, it was found in the proponent's investigations that [REDACTED] was not told that any measurements had been made, he has seen no reports and he has no specifics. He says "I don't know much about it."

Second, and technically, the issue is fully resolved quite simply because the measurements reported in the PER refer to **total** content of heavy metals, not merely "environmentally available" concentrations (see page 36.) [REDACTED] indicated that if he had been told of this fact, he would have not expressed any concern. No hypothetical chemical process, such as the alleged effects of fertiliser, can increase the concentration of a heavy metal over and above its total value.

This issue was explained repeatedly in workshops and other forums.

The attempt to draw this proposal into the discussion about the future amelioration of the Bayswater Main Drain contents also denigrates the significant efforts being made by the Integrated Catchment team. The work by the Swan River Trust, also reported in the PER (page 36-37), found levels "well below human health risks" and also took samples both upstream and downstream of the drain, with little significant difference.

The suggestion that unreticulated grassland remain was examined in the development of the Concept Plan, exposed for public comment a year before the PER was prepared. The policy decision was made, on the basis of the high amenity value of the foreshore, and on the basis of years of experience of the engineering team of the City of Bayswater, that such a non-development would be totally unsatisfactory.

The City of Bayswater has considerable practical experience in matters of this kind. Within the City there are 250ha of land set aside for parks and gardens. That area is comprised of:

6 Civic Gardens	100% developed
24 Active Reserves	100% developed
134 Passive Reserves	65% developed ¹

Consequently the views of this team must be given overwhelming consideration.

The Director of Technical Services has advised, in response to an EPA question whether the need for landfill might be reduced by outcropping rubbish being picked up by community groups:

Absolutely not! The outcropping rubbish is not comprised of small, loose items but large immovable (except by heavy machinery) objects (steel, concrete, etc).

¹ The remaining 35% of the area set aside for Passive Reserves will be developed as such in the future and much of this area is located within the Special Foreshore Development Zone.

PART TWO

ANSWERS TO SPECIFIC EPA QUESTIONS

The following answers are provided to the EPA in response to questions posed by the EPA on 17th May, 1991. The delay in providing answers was due to detailed technical discussions taking place with the Swan River Trust to clarify various issues which seemed to overlap several of these questions. This process was completed when the Swan River Trust wrote to the City of Bayswater on 16th August, 1991.

Q1. *Given that the redeveloped rubbish site would be reticulated, how does the City of Bayswater propose to manage leachates generated from water percolating through the profile to the groundwater?*

A1. As discussed in the original Concept Plan and the PER, the leachates generated from water percolating through the old tip, comprising largely old building material, will be very small in comparison with other effluent sources into the river elsewhere. Furthermore, there will be no significant change in the leachates over and above what has prevailed since the tip closed in 1967, because the irrigation regime will be conservative and tuned to the exact requirements of the finished landscape, which will be designed with water conservation as an aim.

Nevertheless, recognising the need to minimise such leachates, no matter how small, a water and nutrient management programme will be designed. As explained in the PER, this cannot be designed until soil analysis can be carried out on the final spoil and landfill on the site. This commitment has already been given by the City of Bayswater (page 117 of the PER).

It may be useful to note that the Swan River Trust enquiries on this issue resulted in the Geological Survey finding that such effluents were about 20 times less than the Trust had been advised, so that the Trust concerns on leachates have now been allayed.

It may also be that this question was posed because of misunderstandings about the site itself (see A2).

Q2. *How would surface run off be managed if the proponent is required to detain stormwater flows, say up to a 1 in 5 years storm event, on site?*

A2. This question is similar to an issue raised by the Swan River Trust, and may also be based on misunderstandings of the existing site. It is understood the question was formulated on the assumptions a) that there is a clay bund, and b) that there is an underlying impervious clay layer at shallow depth. Neither assumption is correct, as shown in the text of the Concept Plan, PER and the bore hole data.

No reason is given by the EPA why such a hypothetical requirement might be made, but if the proponent were required to detain stormwater flows, it could be done for example by creating an artificial lake and giving up some of the useable dry land. The present slope of the ground generally towards the river could be reversed or otherwise shaped so that drainage over the 10 hectares led to accumulation of water in the hypothetical retention pond or ponds. This would require complete redesign of the landscaping of the Concept Plan, and generally significantly inhibit the overall design of the area. Other means of retention could be designed at even greater undesirable impact and considerable cost, eg drainage into a holding pond plus electrical pumping to a high reservoir.

The question postulated a potential "requirement", but no reason is given in the EPA question. One assumes that it arose when there was misunderstanding about the clay bund, a particular bore hole, and a clay layer. Presumably the advice from the Geological Survey, to the effect that "the nutrient fluxes in this area are too small to warrant the creation of a leachate collection scheme," has removed the need for the question.

It is concluded that there is no known advantage to the idea posed by the question, and that it is no longer being contemplated for this site.

Q3. *Will water quality in the embayment area to be created meet the criteria set for EPA Bulletin 103 Water Quality Criteria Beneficial Use Number 1, that is suitable for direct human contact?*

A3. Water quality criteria in EPA Bulletin 103 Water Quality Criteria Beneficial Use Number 1 are primarily matters of human health. The proposal for the embayment was cleared with the Health Department before being incorporated into the Concept Plan, a year before the PER. Furthermore, the Health Department did not raise the issue in its comments on the PER.

However, the brief answer to the question is that there is no reason to believe that the water in the embayment area will be significantly less suitable for direct human contact than at other popular swimming or paddling areas along the Swan River, such as at the Hinds Reserve just above Garratt Road bridge, some 400 metres downstream of the embayment.

It should be noted, of course, that creation of the embayment is largely contingent on dredging for landfill. If dredging were not permitted, provision of the embayment would need to be reconsidered, in terms of cost effectiveness and efficiency of design. Its deletion from the design would be an undesirable consequence.

Q4. *It is discussed in the PER that sediment loads resulting from dredging will be kept within normal winter standards. How will this be done, and what are normal winter standards?*

A4. Normal winter standards in this context means turbidity which is easily detectable as a brown colouration of river waters flowing beyond the Narrows Bridge. It is purely a subjective judgement. Sediment loads will be kept to such reasonable levels by control of the rate and duration of retention in the holding ponds.

It may not be readily appreciated that it is in the proponent's best interests to minimise sediment loads, because any sediment returning to the river represents lost landfill.

Therefore, quite apart from the environmental responsibility which will be exercised during dredging, there will also be an obvious economic incentive to minimise spoil loss and turbidity. The technical means of achieving this are given in the PER.

Q5. *What criteria were used to enable the judgement that 10m would provide a wide enough buffer to protect the benthic population in this area?*

A5. The expert judgement of the Murdoch University researcher carrying out the benthic fauna studies was that only a metre or two, or at most 5 metres, from the bank would be an adequate buffer.

Consistent with the conservative nature of this proposal, the figure of 10 metres was then chosen.

Q6. *Will it be possible to establish and maintain protective fringing foreshore vegetation in the embayment to be created, as envisaged in the PER?*

A6. The embayment is foreseen as being a sandy beach largely for passive recreation like paddling.

Although final landscape design is obviously not yet complete, there is no expected problem in maintaining appropriate vegetation. This already occurs at Hinds Reserve and many other sites, and it will be made easier at the embayment because the increased river width and indentation will make it somewhat more protected from such features as erosion by wash from power boats.

It should be noted that the area proposed for the embayment is presently where vegetation is sparse, and is the site previously occupied by commercial sand-processing equipment.

Q7. *How will the final dredged profile compare to the river bed profile immediately upstream and downstream of the operations area?*

A7. As discussed in the PER and in later clarifying discussions with the Swan River Trust, the final dredged profile will be generally an improvement on the upstream and downstream profiles. Indeed, were it practicable, one might recommend some further maintenance and cosmetic profiling outside the dredged area.

There is presently discussion proceeding with the Swan River Trust as to the technical effects of dredging. Although broadly the PER suggested dredging to lower the river depth uniformly to about 4.25m, later studies have shown that by extending dredging further upstream, a uniform depth of RL AHD -3.7m would provide sufficient landfill.

Such a depth is appreciably shallower than several deep holes in the vicinity. Engineering advice is that because these holes are reasonably small, they could easily be filled as part of the dredging operation should this be required.

Q8. *How will changes in final bathymetry impact upon water quality, specifically, salinity stratification, water column mixing, bottom dissolved oxygen levels and consequently, potential future nutrient release in the event of deoxygenation of the sediments?*

A8. This aspect is discussed more completely in the Supplementary Report, prepared for the Swan River Trust and developed as a result of technical discussions with the Trust and its officers.

In summary, it is anticipated that dredging will improve or at least not worsen the water quality because of at least two beneficial effects.

First, the existing cliff-like barriers to smooth water flow, such as the sandbar near the extension of King William Street and the up-stream edge of previous (1977) dredging near Milne Street, will be removed as the river profile is smoother without significant deepening of the present deep portions. A deep and isolated hole just upstream will be eliminated.

Second, significant silt sediments containing an estimated 60 kilograms of phosphorus and 2 tonnes of nitrogen will be removed to become part of the landfill, where nutrients can foster growth of grass instead of algae. (see PER).

The removal of such a significant reservoir of nutrient-loaded sediments from the river bed is environmentally desirable, but could never be justified economically except on grounds of beneficial end-use such as in this project.

The results of the 42 grab samples indicate that relatively little sediment has accumulated since dredging in 1977, but what sediment there is will thus be removed. This inevitably improves the river. It effectively removes the source of nutrients which otherwise might be activated by deoxygenation which may occur in deeper, more saline waters.

It is noted that the Department of Marine and Harbours agrees with the proponent that "tidal flushing of this portion of the river can be expected to increase marginally as a result of the proposed works." However it is understood that the Swan River Trust disagrees.

Q9. *What is the current cost of importing fill, both sand and black topsoil, to the site by truck?*

A9. No firm cost estimates more recent than those given in the PER can be given.

The final costs are obviously dependant on detailed commercial tendering processes and negotiations to be carried out by the City of Bayswater under normal practices. Final costs will depend on market considerations which in turn depend on the schedule of works.

Q10. *Have the costs of dredging as outlined in the PER changed, and if so, what are they?*

A10. See answer to Q9. The issue of competitive costs is an issue to be decided by the City of Bayswater.