Harvey Basin Surface Water Allocation Plan

Water and Rivers Commission

Advice to the Minister for the Environment from the Environmental Protection Authority under Section 16 (e) of the Environmental Protection Act 1986

This is not an assessment of the Environmental Protection Authority under Part IV of the Environmental Protection Act 1986

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Summary and Recommendations

The Harvey Basin Surface Water Allocation Plan was written as an overall strategy for the development and management of the water resource in the Harvey Basin. The Plan identifies proposed water allocations to the environment and surface water available for consumptive uses. One of the purposes of the Water and Rivers Commission in developing the Plan was to seek advice from the EPA, at an early stage, as to whether the proposed environmental water allocations and allocations to consumptive uses would meet Environmental Protection Authority's environmental objectives.

The Environmental Protection Authority has prepared this response to the Harvey Basin Surface Water Allocation Plan under Section 16(e) of the Environmental Protection Act. The report considers the environmental issues likely to be important in the allocation of water to the environment and development of the water supply options contained in the Water Allocation Plan. Environmental approval for an individual source option identified in the Water Allocation Plan is not being sought at this stage. Environmental approval for any future source development in the Harvey Basin will be subject to separate referral and consideration under Part IV of the Environmental Protection Act.

The Environmental Protection Authority supports the approach adopted by the Water and Rivers Commission in proposing environmental water requirements and environmental water provisions for the significant environmental values of the Harvey Basin. In particular the Water and Rivers Commission has proposed environmental water provisions to meet the demands of the key ecological features of the entire lowland catchment of the Harvey River. Additionally the Water and Rivers Commission propose to restrict development of currently unregulated streams in the Harvey Basin.

The Plan presented four options for harnessing the water resource in the Harvey River for public water supply after allocation of environmental and social water.

> Option A - direct injection to the Perth Metropolitan Water Supply Scheme (PMWSS) from the existing Harvey Weir and reservoir.
>
> Option B - new Harvey Dam with a full supply level of between 70 - 90m.
>
> Option C - as for Option B but with public water supply from Stirling Dam via a pipeline.
>
> Option D - raising the height of Stirling Dam.

It is understood that Options B and C, involving a new Harvey Dam are likely to be preferred by a water service provider over Options A and D. These options propose the construction of a dam on the Harvey River, 800m downstream of the existing weir. Based on the information available, the EPA considers the following are the environmental issues likely to be relevant to Options B and C:

(a) impacts from modified streamflow downstream on riparian vegetation and aquatic fauna;
(b) impacts from inundation and pipeline construction on terrestrial flora and fauna;
(c) impacts on social surroundings; and
(d) impacts on cultural and heritage values.

The EPA has provided advice in the report on the potential environmental impacts associated with these issues and the further studies and actions which would be required to enable formal environmental assessment of any development proposal.

Conclusion

The EPA has considered the proposal by WRC to allocate water from the Harvey Basin resource to the environment and to a water service provider for public consumption and advises that, in principle, it expects that further water could be allocated from this resource without compromising EPA environmental objectives.

A dam with a full supply level of 80m or greater on the Harvey River is unlikely to meet EPA environmental objectives and may therefore be environmentally unacceptable. A dam of 78m or less may meet EPA environmental objectives, however this will be dependent on the results of the recommended studies and assessment of the proposal under Part IV of the Environmental Protection Act 1986. In particular there are environmental values that may constrain a development (eg vegetation) and any proposal should clearly examine those values in a local and regional context.

Recommendations to the Minister for the Environment

Recommendation 1

That the Minister for the Environment notes that the EPA has provided environmental advice in this report on the proposal by the WRC to allocate water from the Harvey Basin water resource to the environment and for public consumption to assist the WRC and a water service provider in their further planning for the resource.

Recommendation 2

That the Minister for the Environment notes that the EPA advice in this report covers issues related to impacts of modified streamflow downstream on riparian vegetation and aquatic fauna, impacts from inundation and pipeline construction on terrestrial flora and fauna, impacts on social surroundings and cultural and heritage values.

Recommendation 3

That the Minister for the Environment notes that the EPA has included advice that a series of studies and further actions should be undertaken for each issue, as identified in Section 3 and summarised in Section 4.

Recommendation 4

That the Minister for the Environment notes that the EPA has concluded that, in principle, further water could be allocated from this resource for consumptive use without compromising EPA environmental objectives provided the environmental water provisions identified in the Harvey Basin Water Allocation Plan are maintained and the mitigation measures implemented. The acceptability of the source of the water will depend on the results of the recommended studies and assessment of the proposal under Part IV of the Environmental Protection Act 1986.

Recommendation 5

That the Minister for the Environment note that the EPA considers that a dam with a full supply level of 80m or greater on the Harvey River is unlikely to meet the EPA environmental objectives and may therefore be environmentally unacceptable. A dam with a full supply level of 78m or less may be able to comply with EPA environmental objectives, however the Minister for the Environment should note that there are environmental values that may constrain a development (eg vegetation) and that any proposal should clearly examine local and regional values.

Recommendation 6

That the Minister for the Environment notes that the construction of a pipeline to link the water resource to the PMWSS or the infrastructure required to treat and pump water has not been considered in this advice, and that such developments should be referred to the EPA for consideration under Part IV of the Environmental Protection Act 1986.

Contents

Tables

Figures

Appendices

1. Introduction and background

The water resource contained within the Harvey-Waroona area was identified by the former Water Authority of Western Australia (WAWA) as a potential future water source for the Perth Metropolitan Water Supply Scheme (PMWSS) in Perth's Water Future Strategy (WAWA 1995).

The water allocation process developed by the Water and Rivers Commission (WRC) in its response to the Perth's Water Future Strategy involved three phases: i) consideration of the overall scheme supply strategy for Perth at a regional level, ii) resource investigation or subregional water resource allocation plan and iii) source development (WRC 1997). The water allocation process also introduced a framework for the integration of environmental assessment into the water allocation and source development process of the WRC and water service providers. The environmental assessment process for this three phase water allocation process was proposed by the EPA in its report and recommendations for the Perth's Water Future Strategy, published in August 1998 (Bulletin 903).

The WRC accepted that the Harvey Basin water resource was a potential water source for Perth (WRC 1997). In line with phase ii) outlined above, the Harvey Basin Surface Water Allocation Plan (the Plan) was compiled by the WRC to identify environmental parameters requiring environmental water provisions, analyse social issues and to establish a policy framework for future allocation of water from the Harvey Basin.

The Minister for the Environment requested the EPA to provide advice on the Plan under Section 16(e) of the Environmental Protection Act, and this report forms the basis of this advice. The Plan was released for public comment for a period of eight weeks, closing 25 May 1998.

The Harvey Basin Water Allocation Plan cannot be considered a 'proposal' within the meaning of Section 38 of the Environmental Protection Act and therefore cannot be formally assessed under Part IV of the Act. The advice to the Minister for the Environment provided in this report is prepared pursuant to Section 16(e) of the Act. The EPA reserves the right to formally assess under Part IV any specific source development proposal proposed in the Plan.

Details of the environmental water allocation process and source development options presented by the WRC for the water resource of the Harvey Basin are presented in Section 2 of this Report. Section 3 discusses environmental issues relevant to the proposed environmental water allocation and development options. A summary of suggested environmental management and studies required by the WRC or a water service provider to enable formal assessment of any development proposal is contained in Section 4. Section 5 presents the EPA's advice to the Minister for the Environment.

A list of people and organisations that made submissions to the EPA is included in Appendix 1 and references are listed in Appendix 2.

The Department of Environmental Protection's (DEP) summary of submissions and the proponent's response to those submissions has been published separately and is available in conjunction with this report.

2. The Harvey Basin Surface Water Allocation Plan

2.1 Strategy for management of Harvey Basin

The Harvey Basin Surface Water Allocation Plan was written as an overall strategy for the development and management of the water resource in the Harvey Basin. The Plan identified, after allocation to environmental factors, surface water available for consumptive uses. The scope and objectives of the Plan were very broad and encompassed a number of issues. These included:

- identification of the existing and potential ecological, social and economic values and beneficial uses of water in the Harvey Basin,
- identification of environmental issues that require environmental water provisions,
- identification of allocation from water resources in the Harvey Basin potentially available for consumptive beneficial uses,
- the provision of a policy for the issuing of allocation licences by the WRC from the Harvey Basin.

One of the WRC's purposes for developing the Plan was to seek advice from the EPA, at an early stage, as to whether the allocation of further water to consumptive uses was likely to meet EPA's environmental objectives. In addition, the WRC sought advice on further investigations into environmental factors that may be required before the EPA could consider specific proposals.

2.2 Historic and present surface water balance in Harvey Basin

The Harvey Basin is approximately 2000km^2 in area and includes both coastal plain and forested catchments (Figure 1). Around 925km^2 of the Basin has been cleared for agriculture, the bulk of which has occurred on the coastal plain.

Prior to the development of the Harvey Basin for agriculture, the coastal plain segment of the Harvey River was an extensive wetland, with river channelisation poorly defined. The flatness of the coastal plain in this area impeded the flow of the river, resulting in a continuum of wetlands along the river length to the mouth at the Harvey Estuary. Drainage of the coastal plain portion of the Harvey Basin has been extensively modified since the turn of the century to allow agriculture on the naturally waterlogged soils.

The Harvey weir was constructed on the Harvey River in 1916, and in 1930 the river downstream of the weir was re-directed westward by the construction of the Harvey Diversion Drain.

The major components of the drainage network include the Harvey River (now also referred to as the Harvey Main Drain for the first one-half of its length) and the Harvey Diversion Drain. The Harvey Main Drain conveys water to the Harvey Estuary from the coastal plain segment of the Harvey River and streams north of the Harvey River, and the Harvey Diversion Drain discharges water from the forested catchments of the Harvey River upstream of the weir and the Wellesley and Wokalup Creeks to the Indian Ocean at Myalup.

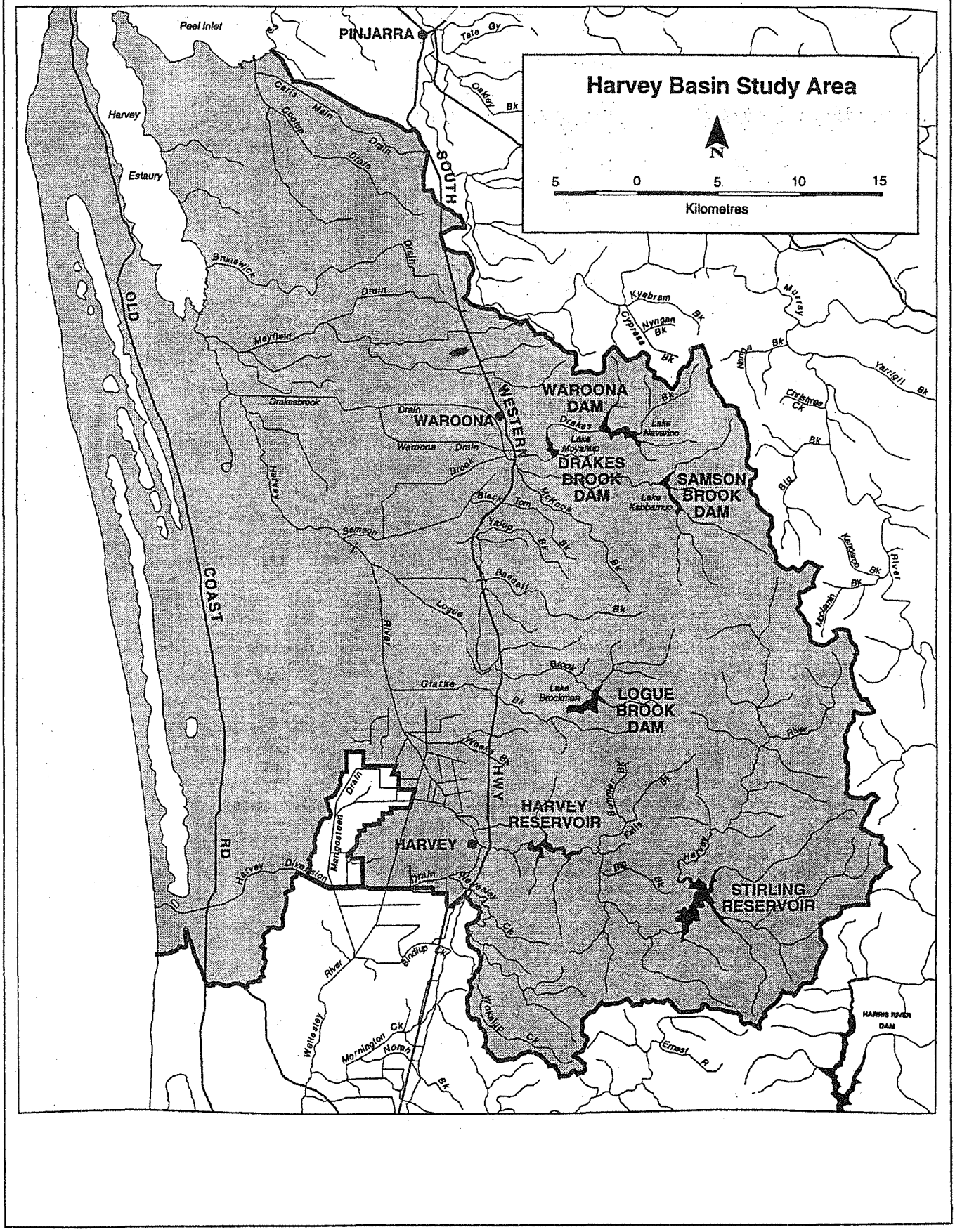

Figure 1. The Harvey Basin.

Rivers and streams in the forested catchments of the Harvey Basin include:

- Harvey River
- Bancell, Samson, Drakes, Logue, North Yalup, South Yalup, Clarke, McKnoe and Black Tom Brooks, and
- Waterous Formation, Wokalup and Wellesley Creeks.

The Harvey River and the Bancell, Samson, Drakes, Logue and South Yalup Brooks are currently dammed, with water from these dams used for irrigation.

A water balance model using historic, current and projected annual streamflow data has been developed by the WRC to determine pre-European streamflows, and those considered likely to occur in the event of a new Harvey Dam. The modelling has demonstrated a significant change in the water balance of the Harvey Basin since European settlement, including the relative contributions of each catchment to the streamflow of the Harvey River (Figure 2).

Average annual streamflow entering the Harvey Estuary from the Harvey Basin has risen from 142 gigalitres (GL) a year in pre-European times to 202 GL/yr today. The current streamflow to the Estuary from the coastal plain is around three times greater than in pre-European times, while streams in the Darling Range catchments now contribute only 16% of the annual flow to the Harvey Estuary, in contrast to their original contribution of 60%. Streamflow from the Harvey Weir, Stirling Dam and Wellesley Creek catchments, now diverted to the Harvey Diversion Drain, comprises around 80% of the average annual flow of the Diversion Drain.

2.3 Environmental water provisions and environmental water requirements

In developing the Plan, the WRC gave consideration to the early identification and allocation of water to water-dependent ecological systems, consistent with water policy reform principles outlined in the Council of Australian Governments (COAG) Agreement on Water Resources Policy (COAG 1994). In addition, the National Principles for the Provision of Water for Ecosystems developed by ARMCANZ & ANZECC in 1996 provide principles to be applied by water resource developers for the water regimes needed to sustain the ecological values of aquatic ecosystems. In accord with phase ii) of the water allocation process, the WRC has applied those principles and identified environmental factors that require the quantification of environmental water provisions (EWPs) and environmental water requirements (EWRs) in the Harvey Basin.

The water resources of the Harvey Basin are already highly developed. The Plan proposes to restrict further significant water source development in the Harvey Basin to the Harvey River and Wellesley Creek. The majority of streamflow of the currently unregulated and semi-regulated Darling Range streams of the Harvey Basin are proposed to be allocated to the environment. In addition, no further significant development of the regulated streams, other than the Harvey River and Wellesley Creek is proposed until environmental water provisions are established for these streams. Release strategies from existing storages are proposed to be developed to maximise the benefits of future river restoration.

Because of the proposed further water supply development of the Harvey River and Wellesley Creeks, the emphasis of the Plan is on determining EWRs and EWPs for these resources.

Important ecological values of the Harvey River downstream of the Harvey Weir were identified by Streamtec Pty Ltd for the WRC. In the absence of historic records, Streamtec modelled the pre-European flow regime of the coastal plain segment of the Harvey River using the existing flow record data and simulating flows associated with a full vegetation complement, zero dieback and the natural drainage frequency of streams and rivers.

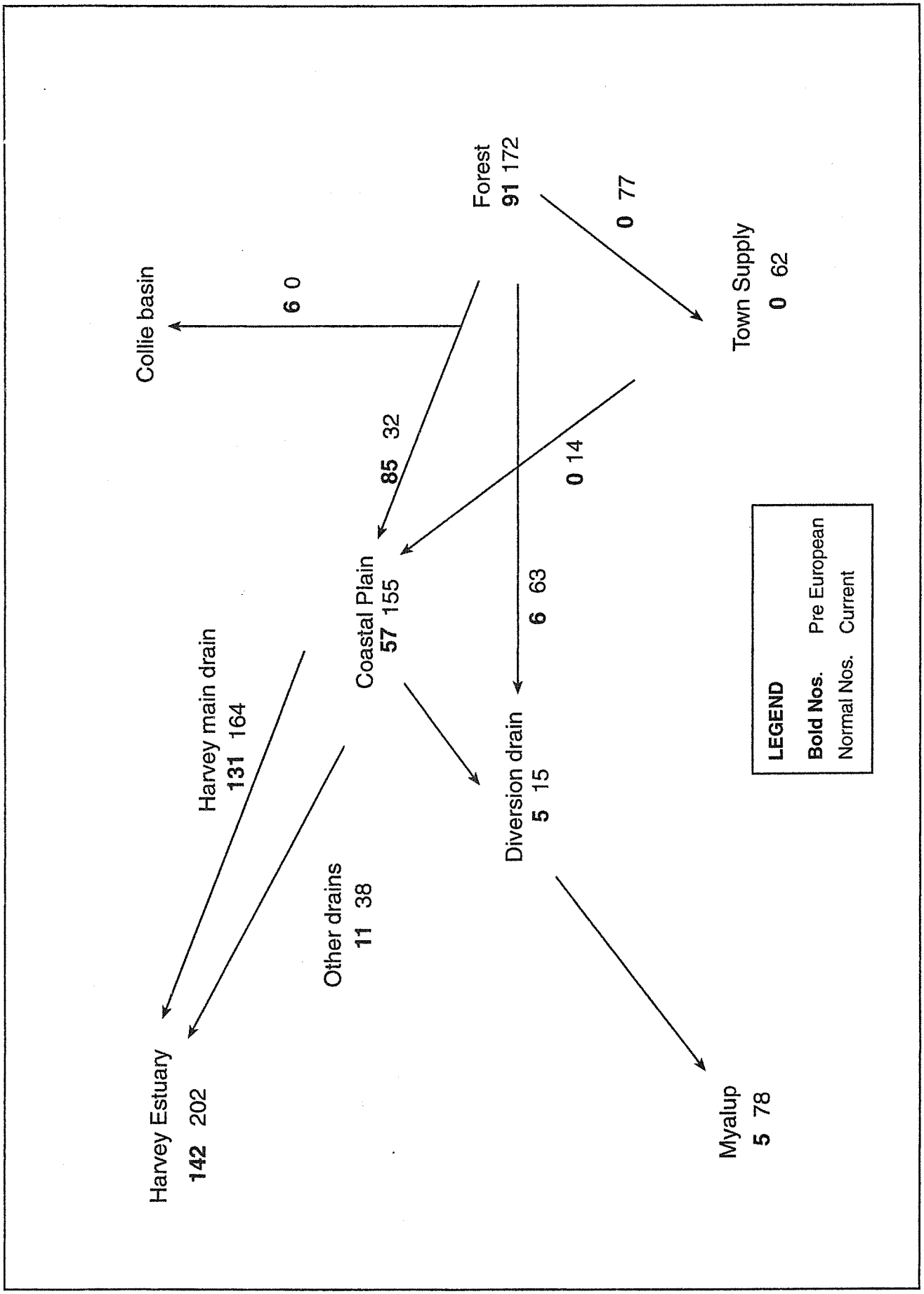

Figure 2. Pre European and current annual stream flows (GL) in the Harvey Basin under average climatic conditions.

An holistic approach was taken by the WRC when proposing EWRs and EWPs. Water was provided to sustain the identified environmental values of the riverine system, with only water in excess of environmental requirements diverted to consumptive use. The WRC regards EWPs as non tradeable.

EWRs for individual components of riverine ecosystems were derived from knowledge of the life-cycle requirements of those components, with a view to maintaining the river's biota and function at a spatial and temporal scale resembling the natural flow regime. EWPs for the Harvey River were proposed as monthly flows regimes that satisfied the requirements of the ecosystem component with the greatest demand for a particular month (season). The EWPs proposed for the Harvey River also recognise the need for water provision for aesthetic and recreation flows.

2.4 Development options proposed

The focus of water supply development options of the Plan is for the Harvey River. The WRC presented four options for harnessing the water resource in the Harvey River for public water supply after allocation of environmental and social water requirements (Figure 3):

Option A - direct injection to the Perth Metropolitan Water Supply Scheme (PMWSS) from the existing Harvey Weir and reservoir.

Option B - new Harvey Dam with a full supply level of between 70 - 90m.

Option C - as for Option B but with public water supply from Stirling Dam via a pipeline.

Option D - raising the height of Stirling Dam.

Option A utilises the existing Harvey Weir as a pumpback site to contribute water to the PMWSS. Two sub-options were considered:

- direct injection to the PMWSS, requiring a 65km pipeline to link with the PMWSS; and
- direct injection with storage at South Dandalup Dam, requiring a 80km pipeline to the South Dandalup Dam.

Water contained in the Harvey Weir has a high degree of turbidity and would require extensive treatment to meet public water supply standards. The bulk of the Harvey Weir catchment has been cleared and there is currently uncontrolled stock access along watercourses.

This option results in the least environmental and social impacts of the options presented. The only development required would be construction of a pumping station and a pipeline. However this option has limited potential as a water resource, and provides little opportunity for yield enhancement in the future. The existing storage capacity of the Harvey Weir (9 GL) is proposed as a pumpback site, with the option of storage at South Dandalup Dam.

Options B and C involve the construction of a new dam on the Harvey River 800m downstream from the existing weir. Under Option B, water would be provided from the dam for both irrigation of agriculture and horticulture on the coastal plain, and the PMWSS. Option B provides the highest overall additional resource yield of all the options, in addition to potential for yield enhancement via a pumpback facility on Wellesley Creek. As with Option A, a high degree of water treatment would be required to comply with public water supply standards.

Full supply levels for a new dam of 70m, 80m or 90m have been proposed, with potential impacts varying with the height of the wall.

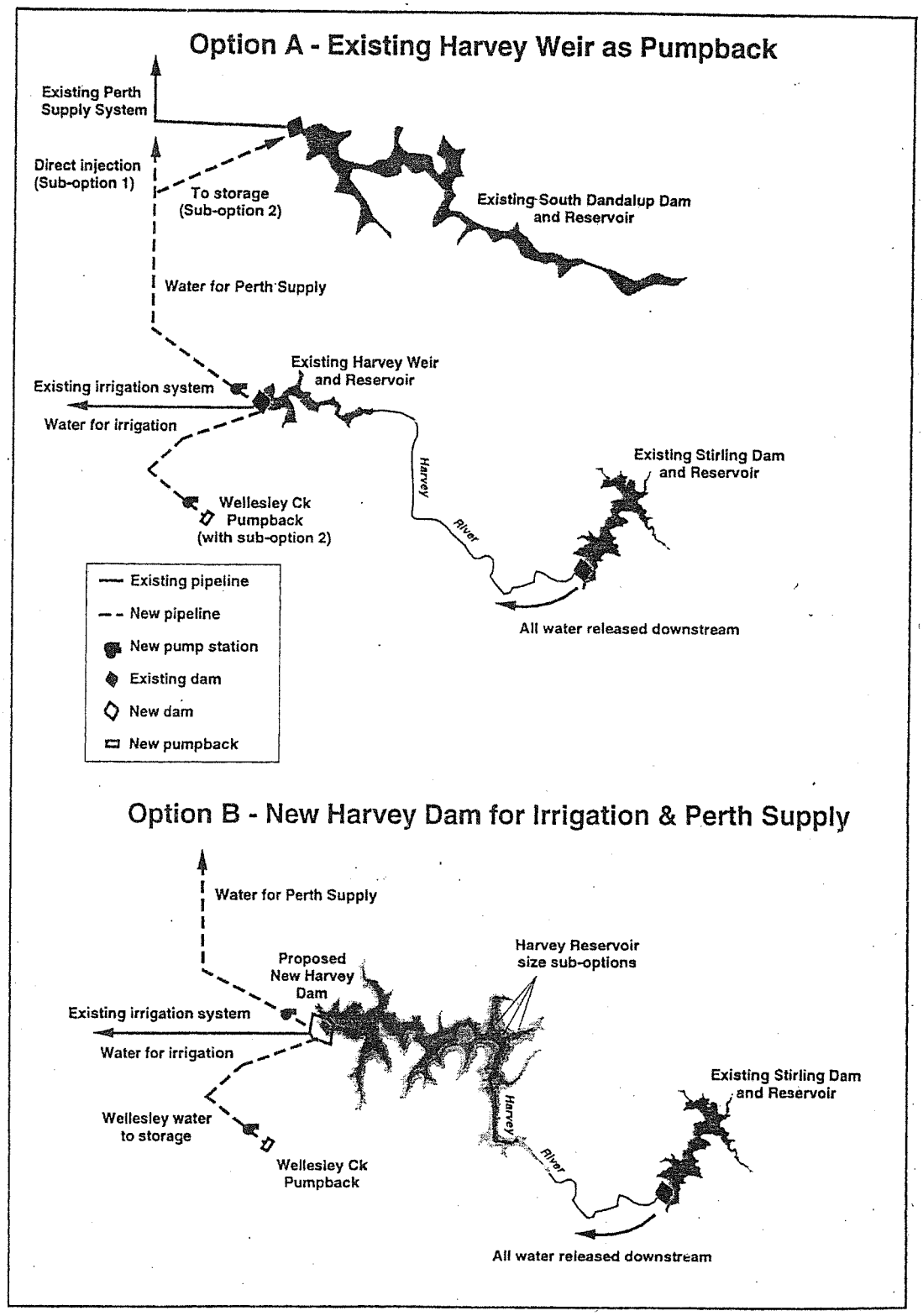

Figure 3 a-b. Development options for the Harvey Basin water resource.

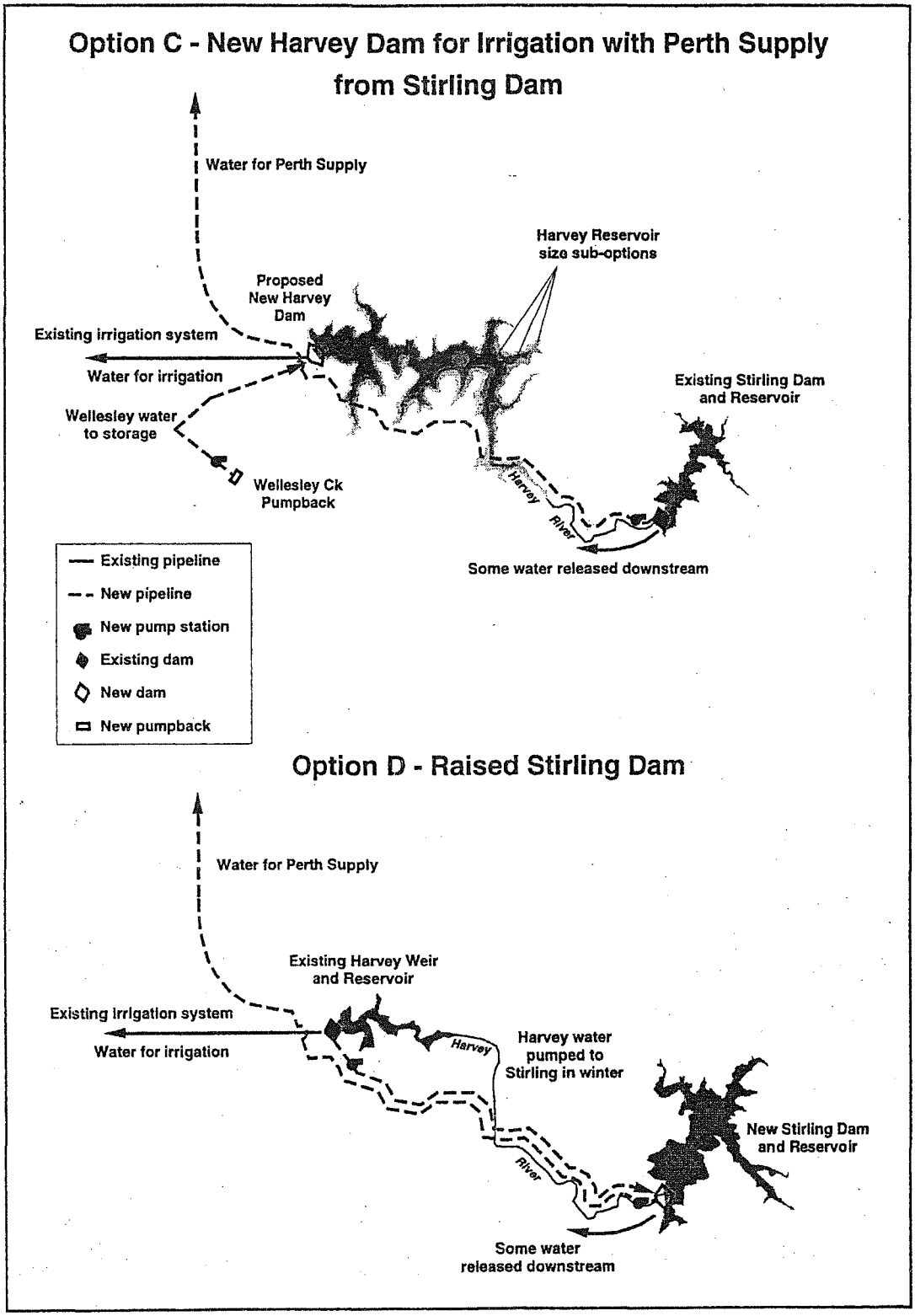

Figure 3 c-d. Development options for the Harvey Basin water resource.

Option C allows the provision of good quality water from the Stirling Dam to the PMWSS via a pipeline from this dam to the new main supply line on the coastal plain. The poorer quality water from the new Harvey Dam would be used only for irrigation. As with Option B, the opportunity exists for yield enhancement by a Wellesley Creek pumpback, however potential for trading of surplus water from the Harvey Dam would be limited as tradeable water would be irrigation quality only.

Option D involves raising the height of the existing Stirling Dam. Harvey Weir would be unaffected. A new pumping and dedicated pipeline facility would be required to pump excess water from the Harvey Weir to the Stirling Dam in winter. This option has a higher unit cost than the other options and a lower potential allocation to PMWSS. Surplus irrigation water may be available for trading under Option D although there is little potential for yield enhancement in the future.

It is understood that Options B and C, involving a new Harvey Dam are likely to be preferred for development over Options A and D.

The main characteristics of each option are summarised in Table 1.

Table 1. Summary of key proposal characteristics.

	Option A	**Option B (80m dam)**	**Option C (80m dam)**	**Option D**
Storage (GL)	9	70	70	< 130
Yield GL/yr	18.5 no storage 27 pumpback	34 full supply	34 full supply	28.5 full supply
Cost c/kL	59 no storage 80 pumpback	59 no storage 52 pumpback	52 no storage 48 pumpback	68
Future yield enhancement	Limited	Potential 9 GL/y with Wellesley pumpback	Potential 5 GL/y with Wellesley pumpback	Unlikely
Future water trading	Limited	Yes	Limited	Limited
Water treatment	Yes	Yes	No	Yes
Road relocation	No	Yes	Yes	No
Pipeline Stirling - Harvey (km)			15	2 x 15

3. Environmental issues likely to be important

3.1 Important environmental issues

The focus of further water supply development options of the Harvey Basin in the Plan is for the Harvey River. The EPA has therefore concentrated its advice in this report on the environmental water allocation and other environmental impact issues associated with the proposed development options of the Harvey River.

In the EPA's opinion and having regard for the views of government agencies and interested parties in Appendix 1, and other relevant information identified in the text and referenced in Appendix 2, the following are the environmental issues likely to be of importance in environmental water allocation and development of the water supplies of the Harvey River:

(a) impacts from modified streamflow downstream on riparian vegetation and aquatic fauna;

(b) impacts from inundation and pipeline construction on terrestrial flora and fauna;

(c) impacts on social surroundings; and

(d) impacts on cultural and heritage values.

A summary of the relevant environmental issues is provided in Table 3.

The construction of an extension of the main trunkline to transport water from the Harvey Weir/Dam to link with the PMWSS is common to all options. The most likely route is parallel to the South Western Highway within existing road reserves. Details have not been addressed in the Plan.

The primary impacts of Option A relate to the construction of the pump station and associated infrastructure. Little information has been provided in the Plan with regard to location details or size of any proposed development, consequently impacts likely to arise from the implementation of this option have not been considered in detail in this report.

An increase in the height of the Stirling Dam would further inundate the State Forest in the area. Modelling of the zone of inundation has not been conducted whereby calculations of the area to be affected can be made. No detailed mapping of the vegetation has been done. The WRC advise that if Option D was to be considered by a water source developer, further review by the Commission would be required to determine an acceptable full supply level. As with Option A, consideration of the environmental impacts of this option have not been assessed in this report.

Consideration was given to dams with a wall height of 70m, 80m or 90m full supply level under Options B and C. Discussion of impacts of a dam in this report relate predominantly to a dam with a full supply level (FSL) of 80m. After consideration of a number of aspects, WRC has indicated that a 78m FSL dam is the preferred scenario. Consequently, impacts arising from a dam of 80m may be conservative.

The environmental and social issues associated with the development of a new Harvey Dam of approximately 80m FSL as included under Options B and C are discussed in Sections 3.3 to 3.6 of this report.

3.2 Impacts from modified streamflow downstream on riparian vegetation and aquatic fauna

Aspects

As a consequence of the drainage system and impacts of agriculture on the Harvey river system downstream of the current weir, few ecological values of the river on the coastal plain remain. Discharges from the coastal plain (including irrigation returns) have increased threefold since European settlement, resulting in water in excess of existing ecological water requirements (Figure 2).

Table 3: Identification of Relevant Environmental Issues

ISSUE	RELEVANT AREA	EPA OBJECTIVES	PROPOSAL CHARACTERISTICS	MANAGEMENT COMMITMENTS	ADVICE TO MINISTER ON EPA OBJECTIVES AND ENVIRONMENTAL MANAGEMENT
Impacts from modified streamflow downstream on riparian vegetation and aquatic fauna	Coastal plain portion of Harvey River system	• Maintain the integrity, functions and environmental values of watercourses. • Maintain the abundance, species diversity, geographical distribution and productivity of aquatic fauna.	Few ecological values of the river on the coastal plain remain intact. The restoration of the Harvey Main Drain, Wellesley and Wokalup Creeks on the coastal plain has been proposed by the WRC as ecological compensation for a new Harvey Dam.	• the WRC has established environmental water requirements to meet the demands of the key ecological features of the entire lowland catchment of the Harvey River • environmental flow provisions have been established for the key ecological features of the Harvey River • the proposal by WRC to restore the riverine areas of the Harvey River and tributaries on the coastal plain, through the establishment of a Harvey River Restoration Trust; • that a scientifically-based procedure for determining EWRs for ecosystems dependent on surface water in Western Australia has not yet been developed; • the WRC has proposed environmental provisions for unregulated, semi-regulated and regulated streams in the Basin, including: • no less than 95% of the present annual streamflow in unregulated and semi-regulated streams should be provided to the environment; • no further significant development of these streams should occur until EWPs have been established; • release strategies from existing storages should be developed to maximise the benefits of future river restoration	It is likely that allocation of water from a dam of the Harvey River can be managed so as not to compromise EPA environmental objectives with regard to riparian vegetation and aquatic fauna. The EPA notes the commitment by WRC to establish a Harvey River restoration trust with the aim of restoring and rehabilitating the upper reaches of the Harvey River and tributaries on the Swan Coastal Plain. The EPA further believes the following studies be undertaken by WRC or a water service provider: 1. A program should be established to monitor the efficacy of EWPs of riparian vegetation and aquatic fauna that may be affected by the diversion of surface water from the Harvey River Basin.

Impacts from inundation and pipeline construction on terrestrial flora and fauna	Zone of inundation and pipeline routes	• To maintain the abundance, diversity, geographic distribution and productivity of terrestrial flora, • To maintain the abundance, diversity and geographic distribution of terrestrial fauna, and • To protect declared rare and priority flora and Specially Protected (Threatened) fauna consistent with the provisions of the Wildlife Conservation Act 1950.	A dam of 80m will potentially inundate 140ha of remnant vegetation. Four vegetation complexes will be affected to varying degrees, two of which are poorly reserved. One priority plant species occurs in the area.	• The WRC recommends that the full supply level of a new Harvey Dam be no greater than 78m so as not to impact the water resource and nature conservation values of Falls Brook Nature Reserve • The WRC recommends a developer of a new Harvey Dam prepare a management plan for the Western Ringtail Possum • The WRC requires a vegetation protection plan for remnant vegetation in the vicinity of a new Harvey Dam • The WRC would require compliance with the above recommendations as a pre-condition to obtaining a take and use licence for the Harvey River Hills water resource.	It is likely that water from the Harvey Hills can be allocated without compromising environmental objectives with regard to terrestrial flora and fauna. The acceptability of a specific development proposal however will depend upon the results of the following studies; 2. Additional Declared Rare Flora survey work should be carried out in spring in areas likely to be inundated to maximise the likelihood of detection of all significant flora. 3. Vegetation survey results should be analysed at plant community level, and analysis/comment provided to enable comparison of the vegetation at this level to areas outside of the study area. 4. The floristic relationship of the Forrestfield vegetation complex in the proposed inundation area should be compared to areas of the same complex below the Scarp. There is a possibility that while structurally similar to vegetation of the same complex below the Scarp, that the vegetation of the Forrestfield complex in the inundation area is floristically different. 5. Measures should be identified to offset the loss of conservation values of vegetation that would be impacted by any development proposal. Ideally, this would involve the securing of equivalent areas of the same vegetation types for protection in appropriate reserves. Alternatively, vegetation of similar scarcity should be protected or a larger area of vegetation of lower conservation value. 6. A developer of a new Harvey Dam would be required to locate pipelines outside sensitive riverine areas. 7. The population size should be confirmed and recommendations outlined for management of any remnant populations of Western Ringtail Possum present in the study area. 8. In the event of inundation of declared rare fauna habitat, a relocation strategy for individual animals affected by the inundation will be required, to comply with Conservation and Land Management Policy Statement No 29 Translocation of Threatened Flora and Fauna.

Impacts on social surroundings	Catchment of Harvey River above the proposed dam	• Ensure that development complies with statutory requirements and that changes to the physical and biological environment resulting from the development do not adversely affect social amenity of the area • Ensure that recreational uses as developed or proposed by planning and other agencies are balanced with the needs for high quality water and low levels of water treatment.	A total of 16 properties will be affected by a dam of 80m, including five dwellings, two with full-time residents. The existing Harvey-Quindanning road will be inundated in parts, requiring relocation of a portion of the road.	• a procedure for land acquisition is to be developed by a developer of a new Harvey Dam that promotes an open and transparent process; • a developer of a new Harvey Dam adequately compensates landowners for loss of property or amenity; • the WRC recommends that provision for whitewater canoeing releases below the Stirling Dam, and an aesthetic flow in the Harvey tourist precinct be made; and • the existing irrigation allocation from the Harvey and Logue Rivers to SW1 is maintained.	It is likely that allocation of water from a dam of the Harvey River can be managed so as not to compromise EPA environmental objectives with regard to social surroundings, provided the following studies are undertaken: 9. A policy for protection of water quality should be developed in consultation with affected landowners; 10. A reservoir recreation plan should be developed that considers existing and potential recreation values of the resource; 11. A review of policies for the recreational use and development of reservoirs in the Harvey and Waroona Shires should be undertaken; and 12. Options for a Harvey-Quindanning Road re-alignment should be arranged in consultation with affected landowners.
Impacts on cultural and heritage values	Zone of inundation	• To ensure the development complies with statutory requirements in relation to areas of cultural or historical significance; • Ensure the proposal complies with the requirements of the Aboriginal Heritage Act 1972; and • To ensure that changes to the physical and biological environment resulting from the development do not adversely affect cultural associations with the area.	Four buildings of historic value will be inundated by a dam of 80m, with the possibility of a fifth. Two sites of archaeological significance to Aboriginal people exist in the zone of inundation.	• consultations between local Aboriginal people and the developer of the Harvey River Hills water resource would take place during the detailed design phase of a new Harvey Dam; • the WRC would require compliance with the Aboriginal Heritage Act as a pre-condition to obtaining a take and use licence for the Harvey River Hills water resource.	It is likely that allocation of water from a dam of the Harvey River can be managed so as not to compromise EPA environmental objectives with regard to cultural and heritage values, provided the following studies are undertaken: 13. Further archaeological and ethnographic surveys of the Harvey Basin should be undertaken prior to development of a new dam; and 14. Heritage values should be salvaged to the best of the ability of a developer of a new Harvey Dam, on advice from the Heritage Council.

Key water-dependent ecosystems of the Harvey River were identified as:

- riparian vegetation;
- flood-plain wetlands; and
- samphire flats.

Streamflow from the Harvey River catchment upstream of the existing weir does not contribute to the maintenance of these ecologically significant areas as flow from this catchment is diverted down the Harvey Diversion Drain to the ocean. Portions of the lower Harvey River support woodlands of wetland vegetation, and a number of swamps and seasonally inundated depressions retain stands of *Melaleuca rhaphiophylla* and associated understorey.

The indigenous riverine fish fauna of the southwest of Australia is species poor, but contains a high degree of endemism and genetic variability (Pusey *et al* 1989). Upland aquatic fauna found in forested reaches are considered to be of higher conservation value than those of temporary streams and lowland reaches.

Fish species contained in the Harvey River on the coastal plain include the western minnow (*Galaxias occidentalis*), the nightfish (*Bostockia porosa*) and the introduced mosquitofish (*Gambusia holbrooki*). Each of these species has differing requirements for their lifecycles, and are affected by the current system of barriers such as weirs and reservoirs.

Aquatic macroinvertebrates require particulate carbon as a food source, supplied from the forested catchments on the escarpment. The majority of aquatic macroinvertebrates inhabit the streambed, and are susceptible to both spatial and temporal changes in river flow.

The increasing recognition worldwide of the ecological damage incurred by the construction of dams was raised in public submissions. One submitter was concerned with the mention of further regulation of streams and the future regulation of untouched streams.

Consideration

The area considered for assessment of these issues is the coastal plain portion of the Harvey River system.

The EPA's objectives in regard to this environmental issue are to:

- maintain the integrity, functions and environmental values of watercourses; and
- maintain the abundance, species diversity, geographical distribution and productivity of aquatic fauna.

The provision of water to the environment as proposed by the WRC is considered adequate to accommodate the ecological values remaining downstream, and deprivation of water to the environment will not occur as a result of allocation of water to consumptive use from the water resource of the Harvey River.

As outlined in Section 2, the streamflow of the Harvey River downstream to the Peel-Harvey Estuary from a new Harvey Dam is not expected to be affected by an impoundment, as runoff from the coastal plain and streams to the north of the Harvey River contributes the bulk of current streamflow to the Harvey Estuary. Water-dependent ecosystems are presently maintained by this streamflow, and prescribed water releases from an impoundment are not considered appropriate for their continued survival.

Impoundments affect fish in a number of ways, including inhibition of upstream fauna migration, modification of natural flow regime and alteration of the downstream movement of particulate carbon from forested catchments to the coastal plain.

The existing streamflow along the Harvey River is sufficient for the maintenance of samphire, fish passage and estuarine flows. A minimum depth of 8cm is required to ensure passage of riverine fish along the river length (Streamtec 1998). This depth is also considered sufficient for migration and spawning of both riverine and estuarine fish species in the Harvey River and Estuary.

Dam and weir construction in the Harvey Basin have resulted in reduced exchanges between the forested and coastal plain segments of the Harvey River. The particulate carbon required to sustain the aquatic fauna is now provided by unregulated streams that originate on the escarpment to the north of the River, and ultimately link into the Harvey River on the coastal plain.

The WRC proposes that regulated streams to the north of the Harvey River be quarantined from further development until environmental water provisions have been established for these streams. Environmental water provisions proposed by the WRC for unregulated and semi-regulated streams include no less than 95% of the present annual streamflow be provided to the environment and release strategies from existing storages should be developed to maximise the benefits of future river restoration.

The restoration of the Harvey Main Drain, Wellesley and Wokalup Creeks on the coastal plain has been proposed by the WRC. Restoration would initially be achieved by rehabilitation of in-stream habitat, riparian vegetation and channel stability. The WRC proposes the establishment of a Harvey River Restoration Trust, into which water supply developers would contribute funds, to offset the loss of riverine and wetland systems arising from water supply developments. The Trust is proposed to be administered by the WRC, in conjunction with an advisory board comprising representatives from local land conservation district committees, the community and the water resource developer.

The EPA notes that:

1. the WRC has established environmental water requirements to meet the demands of the key ecological features of the entire lowland catchment of the Harvey River:
2. environmental flow provisions have been established for the key ecological features of the Harvey River:
3. the proposal by WRC to restore the riverine areas of the Harvey River and tributaries on the coastal plain, through the establishment of a Harvey River Restoration Trust;
4. that a scientifically-based procedure for determining EWRs for ecosystems dependent on surface water in Western Australia has been developed, but not yet proven;
5. the WRC has proposed environmental provisions for unregulated, semi-regulated and regulated streams in the Basin, including:
    - no less than 95% of the present annual streamflow in unregulated and semi-regulated streams should be provided to the environment;
    - no further significant development of regulated streams should occur until EWPs have been established; and
    - release strategies from existing storages should be developed to maximise the benefits of future river restoration.

In considering aspects of impacts from modified streamflow downstream on riparian vegetation and aquatic fauna for a development proposal for the Harvey River the following studies and further actions should be undertaken by the WRC or a water service provider.

Study and further action to be undertaken by the WRC or a water service provider

1. A program should be established to monitor the efficacy of EWPs of riparian vegetation and aquatic fauna that may be affected by the diversion of surface water from the Harvey River.

3.3 Impacts from inundation and pipeline construction on terrestrial flora and fauna

Aspects

A dam with a FSL of 80m would inundate a total of 650ha at full supply level. Of this area, around 140 ha is remnant vegetation, including 80ha of System 6 area C 79 (Reserve 15515 for water supply, vested in the Minister for Water Resources).

Six areas of significant remnant vegetation likely to be inundated by construction of a new Harvey Dam of various heights were identified by the WRC based on aerial photographs. The flora and vegetation values of these areas were assessed by Mattiske Consulting Pty Ltd. Details of the areas of remnant vegetation surveyed are provided in Figure 4 of this report, and Figure 18 and Chapters 7 and 13 of the Plan.

Mattiske Consulting Pty Ltd identified four vegetation complexes (Heddle *et al* 1980) that would be affected by inundation to varying degrees. These include:

- Lowdon complex. Occurs on major valley slopes and scarps with little laterite and mainly exposed surfaces. Comprises predominantly open forest of *Eucalyptus marginata - Corymbia calophylla* and low open forest of peppermint (*Agonis flexuosa*).
- Darling Scarp. Occurs on steep rocky escarpments with skeletal soils. Vegetation ranges from low open woodland to lichens. Woodland comprises *E. wandoo* accompanied by *E. laeliae* in the north and *E. haematoxylon* in the south and *C. calophylla* throughout.
- Forrestfield. The complex in this area comprises open forest of *C. calophylla - E. wandoo - E. marginata* on heavy gravelly soils, to open forest of *E. marginata - C. calophylla - Allocasuarina fraseriana - Banksia* spp on sandy soils, to fringing woodland of *E. rudis - Melaleuca rhaphiophylla* in gullies.
- Helena. Occurs in major valleys with steep slopes containing shallow red and yellow earths. Comprises open forest of *E. marginata - C. calophylla - E. patens* on the lower slopes and valley floors, to heaths on upper slopes to herblands and lithic complex on granite rocks.

The Forrestfield complex is normally associated with the Ridge Hill Shelf fringing the base of the scarp. The complex represented in the study area is confined to an area around the Harvey Weir, in a narrow strip between the weir and a site cleared for past gravel extraction. Thirty hectares of this complex occur in the System 6 area C79, with 160ha in the Darling Range. A new dam would inundate 17 ha of this complex.

Details of the vegetation complexes likely to be impacted by a new Harvey Dam with a full supply level of 80m are provided in Table 2.

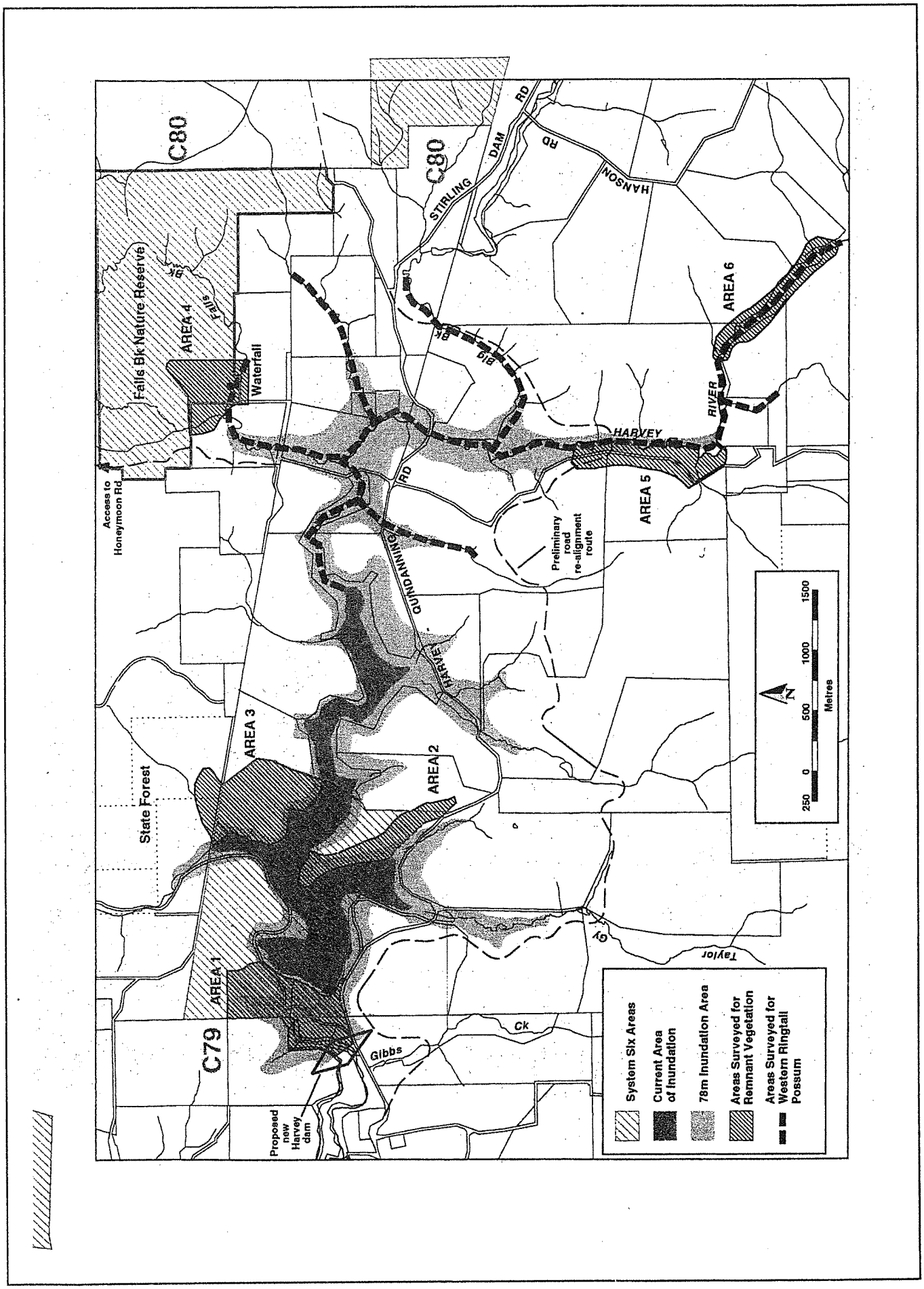

Figure 4. Areas of remnant vegetation in the surrounds of a new Harvey Dam.

Table 2. Area affected and conservation status of vegetation complexes likely to be impacted by a new Harvey Dam.

Complex	Area inundated (ha)	Complex in Sys 6 C79 (ha)	Complex in Darling Range (ha)	Complex in reserves
Forrestfield	17	30	160	0%[1], 7%[2]
Lowden	75	421	18700	0.23%
Darling Scarp	5	2800	26500	1.5%
Helena	40	5100	17000	27%

[1] Representation in reserves in the northern jarrah forest (Havel 1989)
[2] Representation in reserves on the Swan Coastal Plain (DEP 1998)

The Lowdon complex occurring throughout the study area is the northern-most occurrence of this complex in river valleys, and the northern-most representation in a reserve. This complex is only present in small patches of varying condition. Of 421ha present in System 6 area C79, a total of 75 ha would be impacted by the proposed inundation, comprising 50ha of Lowdon riverine and 25 ha of Lowdon midslope.

A Priority 4 plant species *Hibbertia silvestris* is also known from the area of proposed inundation. Nine populations of this species were identified in the vegetation survey, five of which would be inundated.

The pipeline route contained in Option C connecting Stirling Dam to the PMWSS pipeline on the coastal plain would also largely pass through substantially modified landscape. The route for the pipeline has not yet been finalised.

The zone of inundation of the dam is within the former range of a number of priority fauna species, including the chuditch, quenda and quokka. A population of a declared rare species, the western ringtail possum, was discovered during a survey conducted in the study area by CALM. The population size was critically low, and may not be viable.

A number of submissions from the public expressed concern about the loss of remnant vegetation through inundation, in addition to the cumulative impacts that may arise as a result of loss of stream zone habitat. The impact of inundation on terrestrial native animal habitat and the effect of disruption of linkages was also raised in a number of public submissions.

Consideration

The area considered for assessment of these issues is the zone of inundation of the proposed Harvey Dam and pipeline routes.

The EPA's objectives in regard to these environmental issues are:

- to maintain the abundance, diversity, geographic distribution and productivity of terrestrial flora;
- to maintain the abundance, diversity and geographic distribution of terrestrial fauna; and
- to protect declared rare and priority flora and Specially Protected (Threatened) fauna consistent with the provisions of the Wildlife Conservation Act 1950.

The bulk of the area to be inundated by a new dam has been highly modified by clearing. The land is currently used for agricultural purposes, predominantly pasture, orchards and exotic pine plantations.

The vegetation complex that will be the most significantly impacted by a new Harvey Dam is Lowdon (75ha). This complex occurs on fertile soils and has been targeted for clearing for agriculture in the past. Both Lowdon and Darling Scarp vegetation complexes are poorly represented in conservation reserves. The Lowdon complex is relatively rare in general, and although poorly reserved is well represented in State Forest. The Lowdon and Darling complexes to the west of the inundation area have been disturbed by clearing and exotic pastures and plantations. Both the Helena and the Darling complexes retain high proportions of their original extent.

The report by Mattiske Consulting has highlighted the significance of the area of the Falls Brook Nature Reserve for the Lowdon vegetation complex. Old growth values of the Murray vegetation complex may also be present in this area. WRC has recommended that the FSL of a new Harvey Dam should be limited to 78m, to avoid impacts on this reserve.

The location of the Forrestfield vegetation complex is also of particular conservation significance, as it indicates that this vegetation unit can develop in a different geomorphic position to the areas of the complex below the Darling Scarp. As this vegetation complex is not well reserved and is highly cleared, this adds to its conservation significance.

The final route of the pipeline contained under Option C is still to be determined. When determined, the route and the degree of modification or clearing of the landscape required to bury the pipes will need to be addressed in the environmental assessment of the water source, if this option is chosen by a proponent of the source development.

Two Declared Rare Flora species noted in the Mattiske report as recorded for the Harvey region are orchids. Such species may not have been detected due to the timing of the surveys (August and January). Additional species may be detected if a further flora survey were to be conducted in spring.

The Western Ringtail Possum population present in the study area of a proposed Harvey dam may be at a critically low density and may not be viable, according to the CALM survey. Further surveys to more accurately determine population numbers present in the zone of inundation are recommended. The vegetation complex most impacted by a new dam is also favoured habitat for the Western Ringtail Possum.

An Interim Recovery Plan (IRP) has been written for the Western Ringtail Possum in the southwest, and populations are managed in accordance with recommendations contained in the IRP.

The EPA notes that:

1. the WRC recommends that the full supply level of a new Harvey Dam be no greater than 78m so as not to impact the nature conservation values of Falls Brook Nature Reserve;
2. the WRC recommends a developer of a new Harvey dam prepare a management plan for the Western Ringtail Possum;
3. the WRC requires a vegetation protection plan for remnant vegetation in the vicinity of a new Harvey dam;
4. the WRC would require compliance with the above recommendations as a pre-condition to obtaining a take and use licence for the Harvey River Hills water resource; and

In considering aspects of inundation and pipeline construction impacts for a development proposal for the Harvey River the following studies and further actions should be undertaken by a water service provider.

Studies and further action to be undertaken by a water service provider

1. Additional Declared Rare Flora survey work should be carried out in spring in areas likely to be inundated to maximise the likelihood of detection of all significant flora, including orchids.
2. Vegetation survey results should be analysed at plant community level, and analysis/comment provided to enable comparison of the vegetation at this level to areas outside of the study area.
3. The floristic relationship of the Forrestfield vegetation complex in the proposed inundation area should be compared to areas of the same complex below the Darling Scarp. There is a possibility that while structurally similar to vegetation of the same complex below the Darling Scarp, that the vegetation of the Forrestfield complex in the inundation area is floristically different.
4. Measures should be identified to offset the loss of conservation values of vegetation that would be impacted by any development proposal. Ideally, this would involve the securing of equivalent areas of the same vegetation types for protection in appropriate reserves. Alternatively, vegetation of similar scarcity or a larger area of vegetation of lower conservation value should be protected.
5. A developer of a new Harvey Dam would be required to locate pipelines outside sensitive riverine areas.
6. The population size should be confirmed and recommendations outlined for management of any remnant populations of Western Ringtail Possum present in the study area.
7. In the event of inundation of declared rare fauna habitat, a relocation strategy for individual animals affected by the inundation will be required, to comply with Conservation and Land Management Policy Statement No 29 *Translocation of Threatened Flora and Fauna.*

3.4 Impacts on social surroundings

Aspects

The construction of a new Harvey Dam could result in significant social impacts for residents and landowners of areas likely to be affected by inundation. A detailed analysis of the social impacts of each option was conducted for the WRC by Beckwith and Associates Environmental Planning.

Social impacts as a result of development of a new Harvey Dam may arise from:

- inundation;
- infrastructure;
- road relocation;
- land use restrictions;
- recreational restrictions; and
- dam construction.

The most significant social impacts would arise as a result of inundation of private property by a new Harvey Dam, requiring relocation of affected residents and landowners. A total of 16 properties will be affected by a dam of 80m, including five dwellings, two with full-time residents.

The relocation of the Harvey-Quindanning road would be required for Options B and C, as the existing road would be inundated in parts. The re-location will not only directly affect residents who will no longer have direct access to the new route, but will also result in fragmentation of farming land.

Agricultural activities in the region will be disrupted, as the use of productive agricultural soil would be lost through inundation. In addition, Priority 2 (water source protection area) land use restrictions are likely to apply in the catchment.

Whitewater canoeing on the course immediately below the Stirling Dam is a significant recreational pursuit in the Harvey area. Water is released in the irrigation season down the Harvey River from the Stirling Dam to the Harvey Weir, where irrigation releases are made to properties on the coastal plain. Traditionally, up to 40 releases for whitewater canoeing occur over the irrigation season.

Releases of water for whitewater canoeing are believed to cause erosion in some downstream areas, as they introduce a flow regime outside the scope of the natural flow for the river. Most releases occur when the water level in the channel is low, resulting in abrupt bankfull flows. Erosion is most acute in sections of the river where farming practices have resulted in the removal of riverine vegetation and uncontrolled stock access to the water's edge.

A large number of submissions from both private individuals and public organisations requesting retention of water releases for whitewater canoeing were received. The issue of the maintenance of a constant water level of the current weir was also raised, and concern expressed regarding the ugliness of mudflats that will be exposed as a result of fluctuating water levels of a new dam. A number of landowners expressed concern on the potential impacts on operations and future developments of properties within the inundation zone, in addition to the uncertainty of allowable land uses in the catchment.

Consideration

The area considered for assessment of this issue is the catchment of the Harvey River above the proposed Harvey Dam.

The EPA's objectives in regard to this issue are to:

- ensure that development complies with statutory requirements and that changes to the physical and biological environment resulting from the development do not adversely affect social amenity of the area; and
- ensure that recreational uses as developed or proposed by planning and other agencies are balanced with the needs for acceptable quality water supply.

A policy to promote an open and transparent process for the acquisition of land potentially affected by inundation has been proposed. The purpose of this policy is to ensure that landowners are adequately compensated and not financially disadvantaged by the construction of a dam.

A policy to determine acceptability of private and public land uses for the purposes of water quality protection within the catchment area has yet to be developed. The WRC proposes a water quality protection plan to ensure no increased risk of pollution results to the Harvey and

Stirling reservoirs from inappropriate land use in the area. In developing the policy, the WRC expects to accommodate the majority of large scale land uses that presently operate in the Harvey Dam catchment. Intensive farming practices may be curtailed or modified to comply with the protection plan.

Releases of water from the Stirling Dam for canoeing have a high community value and are believed to bring significant economic benefits to the Town of Harvey. The Harvey River whitewater course is considered by the Australian Canoe Federation as the best in Australia, and the course has received international recognition.

The WRC believes that the social value of canoeing is high and supports continued water releases from Stirling Dam, conditional upon a satisfactory strategy being devised and implemented by a developer to mitigate possible river bank erosion. In addition, the WRC believes that a provision of water to whitewater canoeing can be accommodated provided the WA Canoeing Association adopt a release strategy to reduce release events.

The EPA notes that:

1. a procedure for land acquisition is to be developed by a developer of a new Harvey Dam that promotes an open and transparent process;
2. WRC proposes an approach to developing catchment management plan in consultation with affected landowners;
3. the WRC recommends that provision for whitewater canoeing releases below the Stirling Dam, and an aesthetic flow in the Harvey tourist precinct be made; and
4. the existing irrigation allocation from the Harvey and Logue Rivers to South West Irrigation Management Co-operative is maintained.

In considering aspects of impacts on social surroundings for a development proposal for the Harvey River the following studies and further actions should be undertaken by the WRC or a water service provider.

Studies and further action to be undertaken by WRC or a water service provider

1. A policy for protection of water quality should be developed in consultation with affected landowners;
2. A reservoir recreation plan should be developed that considers existing and potential recreation values of the resource;
3. A review of policies for the recreational use and development of reservoirs in the Harvey and Waroona Shires should be undertaken; and
4. Options for a Harvey-Quindanning Road re-alignment should be arranged in consultation with affected landowners.

3.5 Impacts on cultural and heritage values

Aspects

European heritage

A heritage assessment of the Harvey Hills recognised the historic and cultural significance of the area to Europeans at both the State and local level (Hocking 1997, DPUD 1992). Four buildings of historic and heritage value would be inundated by a dam with a full supply level of 80m, with the possibility of a fifth. These buildings are not currently listed on the State Register of Heritage Places or the Register of the National Estate, but are pending assessment by the Heritage Council of Western Australia and the National Trust.

Aboriginal heritage

Ethnographical and archaeological surveys have been conducted to determine the importance of the Harvey Hills to Aboriginal people (O'Connor 1998 and Quartermaine Consultants 1998, cited in WRC 1998). Two sites of archaeological significance exist in the zone of inundation.

A developer of a new Harvey Dam will be required to comply with the *Aboriginal Heritage Act 1972-80*, and obtain necessary approvals for disturbance of these sites. The EPA considers that further surveys of the areas downstream of the proposed dam should also be conducted, to locate and identify any further sites of Aboriginal significance that may be affected by the proposed restoration program.

Consideration

The area considered for evaluation of this issue is the zone of inundation of the proposed Harvey Dam.

The EPA's objectives in regard to this issue are:

- to ensure the development complies with statutory requirements in relation to areas of cultural or historical significance;
- to ensure the proposal complies with the requirements of the *Aboriginal Heritage Act 1972*; and
- to ensure that changes to the physical and biological environment resulting from the development do not adversely affect cultural associations with the area.

The EPA notes:

1. that buildings of historic and heritage value may be affected;
2. consultations between local Aboriginal people and the developer of the Harvey River Hills water resource would take place during the detailed design phase of a new Harvey Dam; and
3. the WRC would require compliance with the *Aboriginal Heritage Act* a pre-condition to obtaining a take and use licence for the Harvey River Hills water resource.

In considering aspects of impacts on cultural and heritage values for a development proposal for the Harvey River the following studies and further actions should be undertaken by a water service provider.

Studies and further action to be undertaken by a water service provider

1. Further archaeological and ethnographic surveys of the Harvey Hills should be undertaken prior to development of a new dam; and
2. Heritage values should be salvaged as far as is practicable by a developer of a new Harvey Dam, on advice from the Heritage Council.

4. Summary of suggested environmental management and studies/action required by WRC or water resource developer

The EPA supports the approach adopted by the WRC in proposing EWRs and EWPs for the significant ecological values of the Harvey Basin. In the development of the Plan, WRC proposed a wide ranging approach to the management of the water resource contained in the Harvey Hills, including allocations of water to environmental and beneficial consumptive uses. The EPA's interest is to ensure the protection of the environment and, while further studies are required, the EPA considers the following recommendations of the WRC would mitigate environmental impacts that may arise from development of the resource, and are endorsed in principle:

- quarantine of currently semi-regulated and unregulated brooks from future regulation,
- no further significant development of regulated streams should occur until EWPs have been established,
- reservation of possum habitat and relocation of threatened population to comply with Conservation and Land Management Policy Statement No 29 *Translocation of Threatened Flora and Fauna,*
- reservation of remainder of Forrestfield vegetation complex in the study area for conservation purposes,
- reservation of remainder of Lowdon vegetation complex in the study area for conservation purposes,
- restoration of the Harvey Main Drain, Wellesley and Wokalup Creeks on the coastal plain,
- compliance with requirements of the proposed Harvey River Restoration Trust, as outlined in a catchment management plan developed by WRC,
- full supply level not to exceed 80m,
- compliance with Aboriginal Affairs Department with regard to Aboriginal heritage, and
- existing irrigation allocation from the Harvey River is maintained.

In addition, the EPA believes that the further studies outlined below should be carried out to enable formal environmental impact assessment of any proposal for a new dam on the Harvey River, or for ongoing management of such a development:

Impacts from modified streamflow downstream on riparian vegetation and aquatic fauna

1. A program should be established to monitor the efficacy of EWPs of riparian vegetation and aquatic fauna that may be affected by the diversion of surface water from the Harvey River.

Impacts from inundation and pipeline construction on terrestrial flora and fauna

2. Additional Declared Rare Flora survey work should be carried out in spring in areas likely to be inundated to maximise the likelihood of detection of all significant flora;

3. Vegetation survey results should be analysed at plant community level, and analysis/comment provided to enable comparison of the vegetation at this level to areas outside of the study area;

4. The floristic relationship of the Forrestfield vegetation complex in the proposed inundation area should be compared to areas of the same complex below the Darling Scarp. There is a possibility that while structurally similar to vegetation of the same complex below the Darling Scarp, that the vegetation of the Forrestfield complex in the inundation area is floristically different;

5. Measures should be identified to offset the loss of conservation values of vegetation that would be impacted by any development proposal. Ideally, this would involve the securing of equivalent areas of the same vegetation types for protection in appropriate reserves. Alternatively, vegetation of similar scarcity should be protected or a larger area of vegetation of lower conservation value;

6. A developer of a new Harvey Dam should be required to locate pipelines outside sensitive riverine areas;

7. The population size should be confirmed and recommendations outlined for management of any remnant populations of Western Ringtail Possum present in the study area;

8. In the event of inundation of declared rare fauna habitat, a relocation strategy for individual animals affected by the inundation will be required, to comply with Conservation and Land Management Policy Statement No 29 *Translocation of Threatened Flora and Fauna.*

Impacts on social surroundings

9. A policy for protection of water quality should be developed in consultation with affected landowners;

10. A reservoir recreation plan should be developed that considers existing and potential recreation values of the resource;

11. A review of policies for the recreational use and development of reservoirs in the Harvey and Waroona Shires should be undertaken; and

12. Options for a Harvey-Quindanning Road re-alignment should be arranged in consultation with affected landowners.

Impacts on cultural and heritage values

13. Further archaeological and ethnographic surveys of the Harvey Basin should be undertaken prior to development of a new dam; and

14. Heritage values should be salvaged to the best of the ability of a developer of a new Harvey Dam, on advice from the Heritage Council.

Individuals

JDH Bell
S Boocock
CJ & SM Boyle
BL Brindle
Mr & Mrs Brindley
S Bunce
N Clarke
J Collins
K Collister
M Coffey
L Greed
M Grounds
R Hagen
R Khorshid
LG Knight
E Lefroy
S Maley
B Morgan
R Nicholson
MJ Pederson
H Roberts
C Thorpe
S Trend
W Tucker
DG & JL Watts

Organisations:

Shire of Harvey
Western Australian Sports Federation
Ministry of Sport and Recreation
Southwest Development Commission
Conservation Council of WA Inc
Skea Nelson & Hager

Appendix 2

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