Unfortunately, because of the scale of the mapping in the Study report and the thickness of the lines, there is a lack of consistency between these suggested widths and those obtained from scaling from the maps.

5.4.2 Drainage Line 1

The Study lists Drainage Line 1 as "steep headwater" secondary tributary branching from the Middle Creek Tributary. Based on the fact that the section of the channel of Middle Creek Tributary through the Australian Tennis Academy site is classified as "urban modified", it would appear that this classification would be more appropriate to the section of Drainage Line 1 for the reach along side the tennis courts extending a least 150 m upstream of the junction with Middle Creek Tributary.

The drainage line is classified as Group C for which no additional constraints are recommended on future development intensity.

For the whole of Drainage Line 1, the Study maps show a CRZ of is 25 m with a VB of 15 m. As the majority of Drainage Line 1 is bounded by cleared open space, the mapped VB width of 15 m is inconsistent with the 5 m recommended in Appendix D of the Study. The mapped width of CRZ and VB contrasts with the drainage line within the Ardel site (the subject of the Land & Environment Case quoted in Section 5.1 above) which has similarly received an increase in surface runoff but was not deemed to be a "river'. For that site the Study maps show a CRZ of 12.5 m and a VB of 12.5 m. In that case the final approved development permitted clearing of bushland to leave a CRZ of 12.5 m with no VB.

5.4.3 Drainage Line 2

The Study lists Drainage Line 2 as "steep headwater" secondary tributaries branching from the Middle Creek Tributary. Based on the fact that the section of the channel of Middle Creek Tributary through the Australian Tennis Academy site is classified as "urban modified", it would appear that this classification would be more appropriate to the section of Drainage Line 2 downstream of the dam.

The drainage line is classified as Group C for which no additional constraints are recommended on future development intensity.

For the whole of Drainage Line 2, the Study maps show a CRZ is 20 m with a VB of 10 m. As the Drainage Line 2 within the site is bounded by cleared open space, the mapped VB width of 10 m is inconsistent with the 5 m recommended in Appendix D of the Study.

5.4.4 Middle Creek Tributary

Apart from a short section of channel through the Australian Tennis Academy site, Middle Creek Tributary is shown as a "low sinuosity sand bed" channel which eventually drains into the north western section of Narrabeen Lagoon. Only the section through the Australian Tennis Academy site is classified as "urban modified". The classification of the section of channel downstream of the Australian Tennis Academy and in the vicinity of Dreadnought Road "low sinuosity sand bed" appears to be in conflict with "urban modified" appearance of other sections of the "creek" near Dreadnought Road (see Photos 6 and 7). Similarly, whilst not modified as significantly as the channel within the Australian Tennis Academy, the Middle Creek Tributary upstream of Barnes Road has been significantly modified as a result of development (see Photo 4).

The drainage line is classified as Group C for which no additional constraints are recommended on future development intensity.

Downstream of Barnes Road, including the "urban modified' section of creek, the Study maps show a CRZ of 20 m and a VB of 10 m. Upstream of Barnes Road the maps show a CRZ of 25 m and a VB of 15 m.

5.5 DIRECTOR GENERAL'S REQUIREMENTS

The Director General's Requirements (16 August 2006) include four specific aspects that relate to the drainage lines within the site:

- Demonstrate consistency with the *RFI Act*;
- Assess the proposal relative to the *Warringah Creek Management Study*;
- Impacts of the proposed development on existing natural drainage lines;
- Provision of a minimum riparian setback of 30 m on either side of the "the watercourse".

5.5.1 Objectives of the RFI Act

Since the preparation of the Director General's Requirements in 2006, the RFI Act has been repealed and the requirements of the RFI Act have been incorporated under the *Water Management Act 2000* by the gazettal of the *Water Management Amendment (Controlled Activities) Regulation 2008* in January 2008. Section 5.2 above addresses the relevant aspects of the Regulation as they relate to each of the drainage lines on the site while Chapter 6 below sets out how the proposed development will be consistent with the objectives of the relevant guidelines issued under the Regulation by the Department of Water and Energy.

5.5.2 Warringah Creek Management Study

Section 5.4 above provides an analysis of the relevance of aspects of the *Warringah Creek Management Study* to the drainage lines within the site, while Chapter 7 provides and assessment of the proposed drainage systems and riparian buffers in relation to the findings ogf the *Management Study*.

5.5.3 Natural Drainage Lines

The Director General's Requirement in relation to natural drainage lines pre-supposes that the drainage lines within the site remain in a "natural" state. However, as outlined in Chapters 2 – 4 any "natural" characteristics of the drainage lines have largely been eliminated by construction of channels in different locations from the original location and, in the process, creation of channels with negligible "natural" features. In particular, the following sections of drainage lines within the site have been constructed at some stage:

- Drainage Line 1 from the confluence with Middle Creek Tributary to the culvert near the water quality control pond;
- Drainage Line 2 from the confluence with Middle Creek Tributary to the existing dam;
- Middle Creek Tributary within the Australian Tennis Academy site.

The following drainage lines retain some natural characteristics, but these have been heavily compromised by the absence or degradation of riparian vegetation:

- Middle Creek Tributary upstream of Barnes Road – absence of any riparian vegetation;.
- Middle Creek Tributary between Barnes Road and the Australian Tennis Academy – severely degraded riparian vegetation.

The only section of drainage line within the site that retains substantial natural characteristics is the steep rocky section of Drainage Line 1 between the culvert near the water quality pond and the extension of Barnes Road. However, the increase in flows (as a result of the substantial increase in catchment area and proportion of impervious surfaces) severely compromises any aquatic habitat value of this section of drainage line.

It can be seen that the features and condition of the existing drainage lines indicate that there is little remaining of any "natural" drainage lines. Notwithstanding, the proposed development will (as outlined in Chapter 6), involve substantial works to restore "natural" features to most of the drainage lines and provide appropriate riparian buffers.

5.5.4 Riparian Setback from "the Watercourse"

Under the heading "**Impacts on Water Quality, Natural Watercourses and Riparian Areas; Soil and Water Management**", the Director General's Requirements make reference to "*. . . in the context of the subject site containing a watercourse (an unnamed tributary of Middle Creek) . . . .* ". Accordingly it is understood that the stated requirements for setback from "the watercourse" refer to the drainage line that is referred to as "Middle Creek Tributary" for purposes of this report.

Unfortunately the Director General's Requirements do not provide any rationale for the stipulated minimum of 30 m either side of the watercourse. In addition, the requirement for a minimum 30 m buffer

6 PROPOSED DRAINAGE SYSTEMS

6.1 OVERVIEW

The proposed drainage systems within the site have been developed with the intent of being sympathetic to, and enhancing, the natural environment whilst also taking account of the fact that all of the drainage systems have been significantly modified over the years and/or impacted by changes in the contributing catchments:

- Drainage Line 1 from the confluence with Middle Creek Tributary to the culvert near the water quality control pond is a constructed channel that has been relocated from the original alignment of the drainage line;
- Even the steep rocky section of Drainage Line 1 between the culvert near the water quality pond and the extension of Barnes Road has been severely affected by a significant increase in flows (as a result of the substantial increase in catchment area and proportion of impervious surfaces);
- Drainage Line 2 from the confluence with Middle Creek Tributary to the existing dam is a constructed channel that has been relocated from the original alignment of the drainage line;
- Middle Creek Tributary upstream of Barnes Road has been severely degraded by stock access and the absence of any riparian vegetation;
- Middle Creek Tributary between Barnes Road and the Australian Tennis Academy is heavily silted and is heavily weed infested;
- Middle Creek Tributary within the Australian Tennis Academy site is a constructed channel through an area that was, apparently, a swamp in the early 1900s. The works to drain the swampy area are likely to be the reason why the creek channel in this area is straight and has a fairly uniform channel section.

The Retirement Resort development proposes to make the following modifications to the existing drainage lines in locations where they have been modified in the past:

- Middle Creek Tributary will be re-aligned to provide a more sinuous alignment for the section commencing about 100 m downstream of Barnes Road where the existing channel does not have any significant riparian vegetation.
- Drainage Line 2 will be relocated to run along the southern boundary of the site.

In addition to these works, stormwater drainage pipe outlets will be provided at various locations.

The realignment works and drainage outlets along the Middle Creek Tributary will be undertaken in accordance with the following guidelines:

- "*Guidelines for Controlled Activities: In-stream Works*".
- "*Guidelines for Controlled Activities: Outlet Structures*".

A controlled activity approval will be required for all works within 40 m of the Middle Creek Tributary.

Although Drainage Lines 1 and 2 do not meet the requirements for classification as a "river", and are therefore exempt from the requirements of the WMA and the Regulation, the principles in the two guidelines identified above will be followed.

6.2 STORMWATER DRAINAGE OUTLETS

Stormwater drainage from the site will drain into the existing drainage systems at four locations. In order from north to south, these are:

1. The catchment area to the north of Drainage Line 1 will drain into Drainage Line 1 just upstream of the junction with Middle Creek Tributary;

2. The catchment area in the central portion of the site immediately south of Drainage Line 1 will also drain into Drainage line 1 just upstream of the junction with Middle Creek Tributary;

3. The catchment area in the central portion of the site immediately north of Barnes Road will drain into Middle Creek Tributary approximately mid-way between Barnes Road and Drainage Line 1;

4. The catchment area to the south of Barnes Road will drain into Drainage Line 2 (relocated to the southern boundary of the site) just upstream of the junction with Middle Creek Tributary.

Of these four locations, only Outlet 3 will drain into a first order creek. All other outlets will be into drainage lines which will be subject to some modification. The drainage outlets will be incorporated into the modified channel form at these locations.

6.3 DRAINAGE LINE 1

As set out in Chapter 2, the catchment draining to Drainage Line 1 has increased from about 1.5 to 17.5 ha as a result of urban development on the plateaux above the Site. Also, the drainage line within the Site has been significantly modified in its location and channel form. The main features of the proposals for Drainage Line 1 include:

- Relocation of the existing water quality control pond (constructed at the time that residential lots were developed on the eastern side of Barnes Road);
- Preservation of the existing general alignment of Drainage Line 1 within the site;
- Construction of a pond to serve both water quality and aesthetic purposes immediately upstream of the junction with Middle Creek Tributary;
- Stormwater discharge from sections of the site to the north and south of the drainage line into the pond immediately upstream of the junction with Middle Creek Tributary.

6.4 DRAINAGE LINE 2

The catchment draining to Drainage Line 2 has decreased from about 50 ha to 40 ha as a result of urban development on the plateaux above the Site. In addition, over the years Drainage Line 2 has been significantly modified in its location and channel form. In particular, the construction of the dam at the base of the cliff appears to have been accompanied by redirection of Drainage Line 2 towards Barnes Road. The main features of the proposals for Drainage Line 2 include:

- Relocation of the constructed outlet channel from the dam to a new location running along the southern boundary of the site;
- Stormwater discharge from the southern precinct of the Site will be directed into Drainage Line 2 just upstream of the junction with Middle Creek Tributary.

6.5 MIDDLE CREEK TRIBUTARY

Over the years Middle Creek Tributary has been significantly modified, particularly in the section that runs through the Australian Tennis Academy site. Based on early Parish maps, it appears that the location of the existing channel through the Australian Tennis Academy was a swampy area. The "V" shaped linear channel along this section of the creek could be attributable to works designed to drain the swamp.

The main features of the proposals for the Middle Creek Tributary include:

- Reconstruction of the linear channel section within the Australian Tennis Academy to form a more natural sinuous channel. This relocation will not involve any change in the channel location at the point where the creek exits from the site;
- As part of the relocation, an area of the floodplain on the western side of the channel downstream of Drainage Line 1 will be reconstructed as an off-line wetland area, that is intended to mimic some of the ecological features of the swampy area that once existed in that vicinity;
- No change in the location where Drainage Line 1 enters the creek;
- A stormwater outlet from the Site will drain into the creek about 85 m downstream of Barnes Road (approximately mid way between Barnes Road and Drainage Line 1);
- A bridge structure will be used to carry the main site entrance over Middle Creek Tributary immediately upstream of the Drainage Line 1 junction;
- A culvert will be constructed on Barnes Road to provide access to the southern precinct of the Site.

7 RIPARIAN BUFFERS

The characteristics of the drainage lines within the site (Chapters 2 -4) and the analysis of various published guidelines (Chapter 5) provide the basis for the summary and assessment of appropriate buffer zones set out below.

Key considerations in setting the proposed buffer widths are:

- Significant improvements to the health of the drainage lines will achieved through restoration to provide a functioning aquatic ecosystem (where none exists at present); and
- The land adjoining the riparian buffers will be a fully managed landscape under the control of the site management. Accordingly, the areas of designated CRZ will be under significantly less pressure from weed invasion than riparian zones adjacent to creeks within "normal" residential development.
- Similarly, because all stormwater will be treated and directed to four specific discharge points (see Section 6.2), there will be significantly less need for stormwater treatment within the VB zone that is considered desirable in normal residential development.

7.1 FUNCTIONAL REQUIREMENTS OF A VEGETATED BUFFER

There is considerable ambiguity about the functions that a vegetated buffer is required to perform.

The *Guidelines for Controlled Activities: Riparian Corridors* recommends the provision of a vegetated buffer (VB) to protect the integrity of the CRZ. The specific functions of the VB are to protect the CRZ from:

- Weed invasion,
- Micro-climate changes,
- Litter,
- Trampling, and
- Pollution.

The guidelines recommend a VB of 10 m but acknowledge that the width depends on the merits of a particular situation.

For Category 1 and 2 watercourses, *Managing Urban Stormwater: Soils & Construction* suggests that a 10 m buffer width be provided to "counter edge effects on the urban interface". Whilst no justification is provided for the arbitrary selection of 10 m, it assumes that the adjoining landscape would be subject to the normal urban management influences. In the case of the proposed Oxford Falls Retirement Resort, the landscape will be fully managed and many of the "normal" urban influences such as fertiliser runoff, dumping of garden wastes, and the escape of weeds will be absent.

Appendix D of the *Warringah Creek Management Study* lists the following functions of a vegetated buffer:

- Prevent water from affecting riparian vegetation (eg additional moisture, local erosion, nutrients, toxicants);
- Prevent weeds from invading the riparian zone; and
- Protect fauna from external l threats (such as domestic animals).

In the case of the proposed Oxford Falls Retirement Resort, the requirements for a VB need to be considered in the light of the intended high level of land management within the Site (which will be managed by a single entity) as well as the fact that all runoff from roofs and the land located up-slope of the roads will be directed into internal drainage systems for storage (roof runoff) and treatment (road and up-slope runoff) before being discharged into the creek system at specified

locations (see Section 6.2 above). Many of the functions of a VB will, therefore, be performed within the Site itself and thereby reduce the requirement for a functioning VB. Accordingly, in this instance, the functions of the VB are not necessarily incompatible with a dual function as part of an asset protection zone.

7.2 DRAINAGE LINE 1

Over the years Drainage Line 1 has been significantly modified in its location and channel form. The classification of Drainage Line 1 according to the various regulations and guidelines reviewed for this report are summarised in Table 3 together with the proposed buffer widths based on consideration of the merits of the various regulations/guidelines and the specific site conditions.

Table 3: Riparian Zone Recommendations for Drainage Line 1

Source	Classification	CRZ (m)	VB (m)
Guidelines for Controlled Activities: Riparian Corridors	Not classified according to Strahler System	0	0
Managing Urban Stormwater: Soils & Construction	Category 3	0	0
Warringah Creek Management Study	Steep headwater. Group C	25	5[1]
Proposed		***5***	***0***

Note 1: VB based on recommendations in Appendix D of *Warringah Creek Management Study*

Apart from the short steep rocky section of Drainage Line 1 located immediately east of the western boundary of the site, all of Drainage Line 1 is a relocated, constructed channel that has negligible aquatic habitat value. The proposed treatment for Drainage Line 1 involves reconstruction approximately along the same alignment to provide increased hydraulic capacity to convey the flood flows from the urban catchment area on the plateaux above the site. Whilst the drainage line would continue to fulfil its primary function as an urban drain, it is intended to incorporate aquatic habitat features where possible. In line with the intent to introduce aquatic habitat, it is also proposed to provide a riparian buffer which averages 5 m either side of the channel. This width exceeds the requirements of the *Guidelines for Controlled Activities: Riparian Corridors* and *Managing Urban Stormwater: Soils & Construction*, both of which specify no requirement for a riparian buffer. The proposal for a 30 m buffer (25 m CRZ and 5 m VB) as set out in the *Warringah Creek Management Study* are not considered relevant in this instance because the classification of "Steep headwater" is only consistent with the steep rocky section of the drainage line immediately east of Barnes Road, which will not be touched in the development process. The section of drainage line downstream of the culvert (approximately adjacent to the existing water quality control pond) is not a "steep headwater".

In keeping with its function as an urban drain system the key considerations for establishing an appropriate buffer zone are to achieve water quality protection and bank stability. In this instance, the water quality objectives will be achieved by the proposed treatment ponds at the upstream and downstream ends of the drainage line within the site. Accordingly, the main requirement for the riparian zone is to support bank stability which will largely provided by the engineered channel. A riparian zone of 5 m is considered appropriate for this section of drainage line.

7.3 DRAINAGE LINE 2

The classification of Drainage Line 2 according to the various regulations and guidelines reviewed for this report are summarised in Table 4 together with the proposed widths based on consideration of the merits of the various regulations/guidelines and the specific site conditions.

Table 4: Riparian Zone Recommendations for Drainage Line 2

Source	Classification	CRZ (m)	VB (m)
Guidelines for Controlled Activities: Riparian Corridors	Not classified according to Strahler System	0	0
Managing Urban Stormwater: Soils & Construction	Category 3	0	0
Warringah Creek Management Study	Steep headwater. Group C	20	5[1]
Proposed		***10***	***5***

Note 1: VB based on recommendations in Appendix D of *Warringah Creek Management Study*

The existing drainage line downstream of the dam is a constructed channel with negligible aquatic habitat value and no riparian vegetation. At present this channel functions as an urban drain. As part of the project it is proposed to reconstruct a new channel downstream of the existing dam. The new channel would be constructed with sufficient meanders and pools to provide aquatic habitat. In addition, it is proposed to provide riparian buffer zones averaging 15 m each side of the bank of the channel (10 m CRZ plus 5 m VB).

As shown in Table 3, according to the requirements of the *Guidelines for Controlled Activities: Riparian Corridors* and *Managing Urban Stormwater: Soils & Construction*, no riparian buffer is required for this drainage line. Notwithstanding, in line with the intent to introduce aquatic habitat, it is also proposed to provide riparian buffers to protect both water quality and channel stability. In this instance, a 10 m CRZ and a 5 m VB are intended to support the water quality treatment provided by the existing dam as well as providing some terrestrial and riparian habitat linked with the aquatic habitat in the reconstructed drainage line.

The proposed CRZ (10 m) and VB (5 m) widths are considered to be consistent with the objectives of the *Guidelines for Controlled Activities: Riparian Corridors* that were issued under the *Water Management Amendment (Controlled Activities) Regulation 2008*. The riparian zone requirements set out in the *Warringah Creek Management Study* have not been given the same weight in that they presume that an existing functioning stream system already exists.

7.4 MIDDLE CREEK TRIBUTARY

For purposes of this assessment, Middle Creek Tributary has been considered as three separate reaches:

1. Upstream of Barnes Road;
2. Barnes Road to the Australian Tennis Academy;
3. The Australian Tennis Academy.

7.4.1 Upstream of Barnes Road

Table 5 summarises the classification and recommended buffer widths for the section of Middle Creek Tributary upstream of Barnes Road according to the various regulations and guidelines

reviewed for this report. The last line of Table 5 sets out the proposed widths for this reach of the creek.

Table 5: Riparian Zone Recommendations for Middle Creek Tributary Upstream of Barnes Road

Source	Classification	CRZ (m)	VB (m)
Guidelines for Controlled Activities: Riparian Corridors	First order stream	10	10
Managing Urban Stormwater: Soils & Construction	Category 2	20	10
Warringah Creek Management Study	Low sinuosity sand bed. Group C	25	5[1]
Proposed Widths		***15***	***5***

Note 1: VB based on recommendations in Appendix D of *Warringah Creek Management Study*

This reach of Middle Creek Tributary represents the headwaters of the creek system. As described in Chapter 4, and shown in Photograph 4, this reach of the creek is highly degraded by trampling as a result of stock access and the absence of any riparian vegetation. It is proposed to rehabilitate this reach of creek to allow the recovery of aquatic habitat, and to provide a CRZ of 15 m and a VB of 5 m. These proposed buffer widths are based on considerations of the existing degraded state of the creek and the fact that the adjoining landscape will be fully managed as part of the site maintenance undertaken by the body responsible for management of the whole site. The proposed CRZ of 15 m represents a compromise between the recommendation for a first order stream as set out in the *Guidelines for Controlled Activities: Riparian Corridors* and the recommendation for a Category 2 stream set out in *Managing Urban Stormwater: Soils & Construction*. The VB width of 5 m is considered appropriate in view of the adjoining managed landscape.

7.4.2 Barnes Road to the Australian Tennis Academy

For simplicity, this reach of Middle creek Tributary will be referred to as the middle reach. Table 6 summarises the classification of the middle reach of Middle Creek Tributary according to the various regulations and guidelines reviewed for this report. The last line of Table 6 sets out the proposed CRZ and VB widths based on consideration of the merits of the various regulations/guidelines and the specific conditions in this reach of the creek.

Table 6: Riparian Zone Recommendations for the Middle Section of Middle Creek Tributary

Source	Classification	CRZ (m)	VB (m)
Guidelines for Controlled Activities: Riparian Corridors	First order stream	10	10
Managing Urban Stormwater: Soils & Construction	Category 2	20	10
Warringah Creek Management Study	Low sinuosity sand bed. Group C	20	R - 20[1] L -5[1]
Proposed Widths – East Bank		***20***	***20***
Proposed Widths – West Bank		***15***	***5***

Note 1: VB based on recommendations in Appendix D of *Warringah Creek Management Study*

This reach of the creek is different from all other reaches of the drainage lines on the site in that it has a band of bush on the eastern side extending as far as Oxford Falls Road, a distance that

varies from about 55 m to 65 m. This band of bushland will be retained and will provide a significant width to fulfil CRZ (nominal 20 m) and VB (nominal 20 m) functions on the eastern side of the creek.

On the western bank, there is currently a narrow band of weed (particularly lantana and privet) infested vegetation which gives way to open grazed paddocks. On this side of the creek it is proposed to provide a CRZ of 15 m and a VB of 5 m. These widths are proposed as compromises between the various recommendations in Table 6 for similar reasons to the proposed buffer widths for the reach of the creek upstream of Barnes Road.

7.4.3 The Australian Tennis Academy

For simplicity, this reach of Middle Creek Tributary will be referred to as the lower reach. Table 7 sets out the classification of the lower reach of Middle Creek Tributary according to the various regulations and guidelines reviewed for this report. Table 7 also lists the recommended CRZ and VB widths derived from these sources together with the proposed widths based on considerations of the merits of the various regulations/guidelines and the specific site conditions in this reach.

Table 7: Riparian Zone Recommendations for the Lower Section of Middle Creek Tributary

Source	Classification	CRZ (m)	VB (m)
Guidelines for Controlled Activities: Riparian Corridors	First order stream	10	10
Managing Urban Stormwater: Soils & Construction	Category 2	20	10
Warringah Creek Management Study	Low sinuosity sand bed. Group C	20	5[1]
Proposed Widths		***15***	***5***

Note 1: VB based on recommendations in Appendix D of *Warringah Creek Management Study*

In this reach the channel form is highly modified for a distance of about 150 m, possibly as a result of works to drain a swamp area in this vicinity that is shown on early parish maps. In this reach it is proposed to reconstruct a channel to include some sinuosity and an off-stream wetland on the western bank. Given that this section of creek has no existing riparian habitat, a CRZ of 15 m and a VB of 5 m is considered an appropriate compromise that would achieve the objectives of the *Guidelines for Controlled Activities: Riparian Corridors* and provide terrestrial and aquatic habitat in line with the objectives of a Category 2 stream as set out in *Managing Urban Stormwater: Soils & Construction.*

8 SUMMARY

8.1 CRZ AND VB WIDTHS

Based on the analysis of various guidelines set out in Chapter 7 above the proposed widths for CRZ and VB are set out in Table 6.

Table 6: Proposed Buffer Zone Widths

Drainage Line	**Core Riparian Zone** (each side)	**Vegetated Buffer** (each side)
Middle Creek Tributary: Upstream of Barnes Road	15 m	5
Middle Creek Tributary: Barnes Road – Aust Tennis Academy	East – 20 m West – 15 m	East - 20 m West - 5 m
Middle Creek Tributary: Aust Tennis Academy	15 m	5 m
Drainage Line 1	5 m	0
Drainage Line 2	10 m	5 m

8.2 WORKS WITHIN DRAINAGE LINES

All channel modification and realignment works and stormwater outlets works associated with the Middle Creek Tributary will be designed and documented in accordance with the relevant Guideline. An application will be made for a "controlled activity approval" covering these works.

All channel modification and realignment works and stormwater outlets works associated with the Drainage Lines 1 and 2 will be designed and documented in accordance with the relevant Guideline. Because these drainage lines are not "rivers" as defined in the WMA, a "controlled activity approval" is not required.

8.3 CROSSINGS

Two crossings are proposed on Middle Creek Tributary:

- A bridge structure will be used to carry the main site entrance over Middle Creek Tributary immediately upstream of the Drainage Line 1 junction;
- A culvert will be constructed on Barnes Road to provide access to the southern precinct of the Site.

Both these structures will be designed and constructed in a manner that is sympathetic to the movement of terrestrial, amphibious and aquatic fauna.

9 PHOTOGRAPHS

Photo 1
Drainage Line 1 - Constructed Channel on the Southern Side of the Tennis Courts (Looking West)

Photo 2
Drainage Line 2 - Constructed Channel Downstream of the Dam

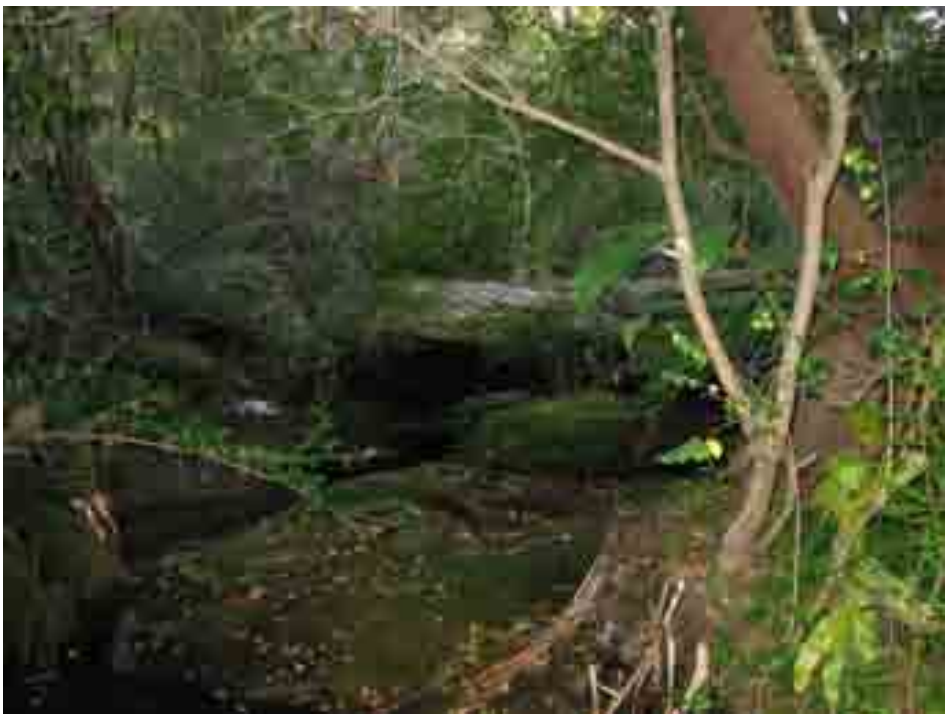

Photo 3
Drainage Line 2 - Upstream of the Dam

Photo 4
Middle Creek Tributary Upstream of Barnes Road
(Looking Upstream)

Photo 5
Middle Creek Tributary Within the Australian Tennis Academy
(Looking Downstream)

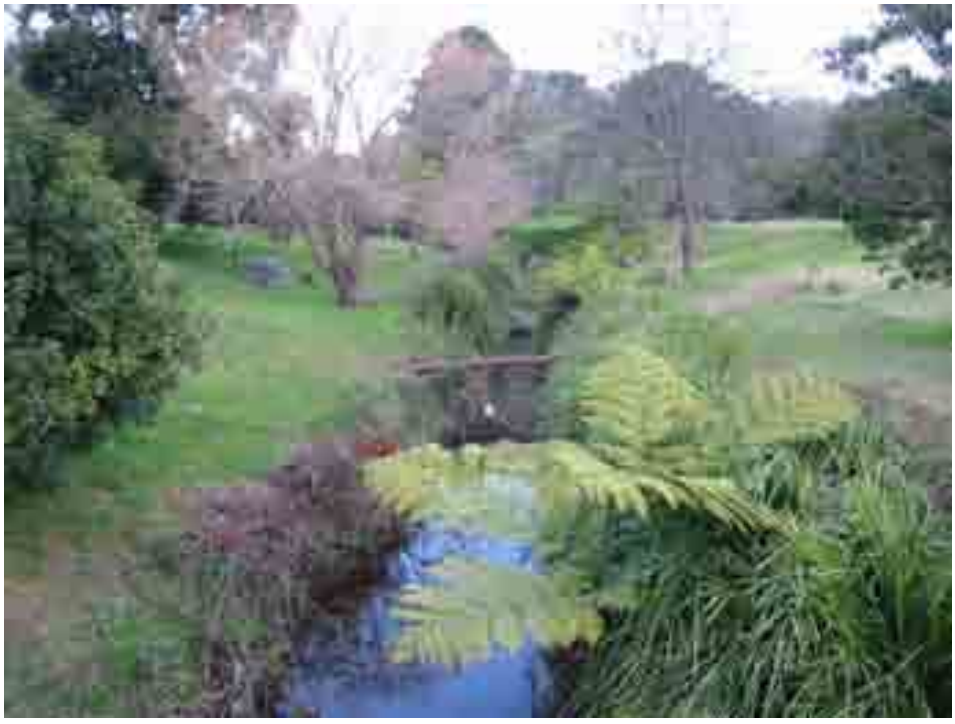

Photo 6
Middle Creek Tributary Upstream of Dreadnought Road
(Looking Upstream)

Photo 7
Middle Creek Tributary Downstream of Dreadnought Road
(Looking Downstream)