12. Potential Environmental Impacts and Management Measures

This chapter provides details of the potential impacts of the construction and operation of the landfill, quarry and water reservoir components of the project.

The landfill, quarry and water reservoir are proposed to be located east of the East Tamar Highway in the vicinity of the Tippogoree Hills Figure 11-1.

The potential impacts have been assessed using the impact assessment methodology described in Chapter 3. The potential environmental, economic and social and community impacts are discussed for each component in Chapters 4 to 12.16.

12.1 Land Use and Planning

12.1.1 Use, Zone and Use and Development Status (Landfill)

In accordance with Part 4 of the George Town Planning Scheme 1991, the Landfill is classified as a Utility Service (Major). The definition for Utility Service (Major) is:

> *means any land used for a utility service which is not a minor utility service defined elsewhere in this Scheme and includes a water supply/treatment plant, a sewerage treatment plant, a refuse disposal site, a waste transfer station, a power generating works and an electricity substation or switching station or more than 110kV.*

The proposed landfill will be located within both the Bell Bay Major Industrial Zone and the Agricultural Zone. Under the provisions of the Bell Bay Major Industrial Zone, 'Utility Service (Major)' is classified as a permitted use or development (permit required). Under the provisions of the Agricultural Zone, 'Utility Service (Major) is classified as a discretionary use or development.

12.1.2 Use, Zone and Use and Development Status (Quarry)

In accordance with Part 4 of the George Town Planning Scheme 1991, the Quarry is classified as an Extractive Industry. The definition for Extractive Industry is:

> *Means;*
>
> - *the extraction of from any land of sand, earth, soil, clay, turf, gravel, rock, stone, minerals, or similar substance; or*
> - *the treatment or processing or manufacture of articles or products from any of the foregoing on the land from which the same was extracted or on adjacent land.*

The proposed quarry will be located within the Bell Bay Major Industrial Zone and subject to the provisions of the Skyline Protection Special Area. Under the provisions of the Bell Bay Major Industrial Zone, 'Extractive Industry' is classified as a permitted use or development (permit required).

12.1.3 Use, Zone and Use and Development Status (Water Storage Pond)

In accordance with Part 4 of the George Town Planning Scheme 1991, the Water Reservoir is classified as a 'Utility Service (major)'. The definition for Utility Service (major) is:

> *'Means any land used for a utility service which is not a minor utility service defined elsewhere in this Scheme and includes a water supply/treatment plant, a sewerage treatment plant, a refuse disposal site, a waste transfer station, a power generating works and an electricity substation or switching station of more than 110kV.'*

The proposed Water Reservoir will be located within the Bell Bay Major Industrial Zone and is subject to the Skyline Protection Special Area. Under the provisions of the Bell Bay Major Industrial Zone, 'Utility Service (major)' is classified as a permitted use or development (permit required).

12.1.4 Use, Zone and Use and Development Status (Leachate Pipeline)

In accordance with Part 4 of the George Town Planning Scheme 1991, the Water Reservoir is classified as a 'Utility Service (major)'. The definition for Utility Service (Minor) is: -

> *means any land used for the reticulation to the local area of a water, sewerage, stormwater, electricity or telephone service and includes a sewerage pump station, an electrical substation of not more than 110kV capacity, a water supply reservoir or source and a telephone exchange;*

The proposed pipeline will be located within the Bell Bay Major Industrial Zone. Under the provisions of the Bell Bay Major Industrial Zone, 'Utility Service (Minor)' is classified as a permitted use or development (permit required).

12.1.5 Use, Zone and Use and Development Status (Subdivision)

In accordance with Clause 5.9.5 of the Planning Scheme, subdivision in the Bell Bay Major Industrial zone (IN3) shall be determined on the specific requirements of approved developments. No subdivision shall be approved without prior development approval.

Gunns intend to purchase a 624.11 hectare parcel of land to be subdivided from CT 143039/1, upon which the pulp mill and some of the associated infrastructure will be located. The 624.11 parcel of land that would be created by the subdivision will be sold by Comalco Aluminium (Bell Bay) Limited if approval for the Project is received and the Project proceeds. The subdivision is therefore a development required as part of the Project.

12.1.6 Purpose of the Bell Bay Major Industrial Zone

Clause 5.9.1 defines the purpose of the Bell Bay Major Industrial Zone. Table 183 below lists the main objectives and provides comment on how the Landfill, Quarry and Water Reservoir components of the proposal meet the objectives.

Table 183: Bell Bay Major Industrial Zone - Assessment

Purpose of Bell Bay Major Industrial Zone	Comment
◗ *The Bell Bay Major Industrial Zone represents a unique opportunity to identify and make available land suitable for the expansion of industrial use and development at Bell Bay and its consolidation as one of the principal industrial estates in the State.*	The land upon which the landfill, water reservoir and quarry associated with the pulp mill is proposed to be constructed is clearly identified as suitable for future industrial expansion in the Bell Bay region. The Bell Bay Major Industrial Zone was created to entice new industries to locate within the area. The proposal to construct what will be one of the State's major industries on this land is entirely consistent with the intent of the zone and will further strengthen Bell Bay as one of the principal industrial estates in the State.
◗ *The inherent qualities of this area for industrial use and development including its deep water anchorages, existing transport infrastructure, availability of services and the separation from incompatible uses, are recognised by this zoning.*	The inherent qualities mentioned in the objective are precisely part of the reason the site was selected for the pulp mill and its associated infrastructure. The site for the landfill, quarry and water reservoir has been chosen due to its proximity to the pulp mill itself and ease of accessibility to the East Tamar Highway. Section 10 Volume 1 of the Draft IIS demonstrates fully the attributes of the site and why it was chosen. It is submitted that the very qualities that the Bell Bay Industrial Zone is trying to support are integral to the reason the site was chosen for some of the infrastructure associated with the pulp mill.
◗ *The intent of this zone is to promote the use of the area as a strategic location and clear focus for the establishment of major industries for value added resource processing and requiring the locational advantages the site has to offer.*	The landfill, water reservoir and quarry are integral to the operation of the pulp mill and therefore further this objective.
◗ *The provisions of this zone also establishes a framework for the provision of major infrastructure services and the preparation of a Development Plan to provide the detailed controls to further guide developments.*	The Development Plan referred to was prepared but never formally incorporated into the George Town Planning Scheme 1991. Whilst the development controls outlined in the Development Plan have no formal statutory standing, the appropriateness of the project against the strategic intent of the Plan has been assessed in Section 1.3.2 of this report.
◗ *The establishment and ongoing monitoring of industries will be subject to the appropriate environmental approvals under the Environmental Protection Act 1973. Quantified risk assessment shall be performed on proposed industrial developments.*	This Draft IIS will examine all possible environmental impacts. As a POSS the Project is taken out of relevant legislation including the *Environmental Protection and Pollution Control Act 1994*, which replaced the *Environmental Protection Act 1973*.

12.1.7 Use and Development Principles (Bell Bay Major Industrial Zone)

Use and development in the Bell Bay Major Industrial Zone is guided by a set of 'principles for the assessment of development applications' as listed in Clause 5.9.6 of the Planning Scheme. Table 184 below provides an assessment of the project against the principals.

Table 184: Use and Development Principles (Bell Bay Major Industrial Zone)

Use and Development Principle	Comment
◗ To encourage major industrial use and development to consolidate in this strategically important location.	The Landfill, Quarry and Water Reservoir components of the project are integral to the pulp mill itself as a major industrial use.
◗ To discourage small scale industrial activities except where such uses service or support major industrial use and development	N/A
◗ To promote industries, which have as their primary market, the Region, the State, national or international markets and whose activities have a significant multiplier effect on the State's economy.	As ancillary infrastructure to the pulp mill the proposed Landfill, Quarry and Water Reservoir components of the project further this.
◗ To recognise the importance of the road, rail and water transport infrastructure and the need to protect the safety and efficiency while planning for its further development and integration with use and development in the zone.	N/A
◗ To maximise the utilisation of existing service infrastructure and to provide for and co-ordinate the provisions or expansion of major services, including electricity, natural gas and water supply.	N/A
◗ To ensure land abutting the Tamar River Crown Reserve is reserved for industries, which specifically require access to the water for wharf and associated installations.	The site for that landfill, water reservoir and quarry is located on the eastern side of the East Tamar Highway, well away from the Tamar Foreshore.
◗ A foreshore corridor shall be provided to maintain the environment and visual amenity of the river foreshore. Development shall be set back a minimum 60 metres from the Tamar River Crown Reserve or as provided in the development plan, except where specifically required for wharf and associated installations.	N/A

Use and Development Principle	Comment
◗ Highway corridors shall be provided for purposes of visual amenity and future road widening or augmentation requirements	The Quarry and Landfill sites are set back over 400 m from the East Tamar Highway and are screened by a ridgeline. These facilities will not be visible from the Highway. The closest section of the water supply reservoir will be located approximately 150 m from the Highway and may be partially visible through screening vegetation for a short length of the highway. None of the sites interfere with future widening of the highway.
◗ Separate access points onto the East Tamar Highway and Bridport Main Road are to be limited, and use and development should be served by internal roads.	An existing access point to the Comalco buffer land will be used to access these facilities. This access will need to be upgraded from the current dirt access road to cater for waste truck and maintenance vehicles. These requirements are detailed in Section 4 Volume 2 of the Draft IIS.
◗ To provide appropriate separation between incompatible industries within the zone.	There are no incompatible uses within the Bell Bay Major Industrial Zone. The existing site essentially comprises an industrial buffer in support of the Comalco smelting plant.
◗ Emissions at the boundary of the zone shall meet the necessary environmental quality requirements of the adjoining zoning.	Emissions are discussed in Volume 2, Section 14.
◗ To ensure activities within the zone are established at an adequate safety distance from the boundary of the zone and other activities within the zone;	The adjoining land is State Forest. Appropriate buffer zones have been included within the design layout (and area proposed to be rezoned) to ensure that there is no impact on surrounding land uses.
◗ To encourage retention of vegetation cover by the application of the Tree Preservation Provisions under Clause 6.4.	The proposal will involve the removal or disturbance of vegetation. The potential impacts and mitigation measures proposed is outlined in Appendix 29, Volume 12. This includes commitment on behalf of Gunns to provide offsets to compensate for proposed loss of vegetation. These offset areas will be protected by virtue of reserve and covenant of title.
◗ The development plan shall incorporate landscape assessment analysis and developments shall comply with the landscape assessment. Extensive landscaping for all developments will be required and such landscaping to be in accordance with the planning authority approved plans.	Specific landscaping will include: ◗ Rehabilitation of areas disturbed during construction which lie outside the facility footprints; ◗ Rehabilitation of closed landfill cells; ◗ Rehabilitation of the quarry site should in accordance with the Quarry Code of Practice.

Use and Development Principle	Comment
◗ Subdivision of land shall be only approved on the basis of approved development.	See Section 2.2 of this Volume.
◗ To protect water storages and catchments.	Management measures will be implemented to protect water storages and catchments. Discussion is provided in Volume 2, Section 14.
◗ To protect use and developments within the zone and adjacent forest areas from wildfire including provision of buffer zones of cleared land.	A Fire Management Strategy will be implemented to protect surrounding areas and assets.
◗ Unless otherwise provided in the development plan, the height, form and appearance of buildings and structures shall be determined in accordance with Schedule 5.	N/A
◗ Corridors of native bushland are to be retained within the zone to provide for the protection of wildfire and native flora	Outside the facility construction footprints, native vegetation will not be disturbed
◗ The preferred staging of use and development and provision or extension of infrastructure.	A Detailed construction-staging plan is provided in Volume 1 of the Draft IIS. Provision exists to expand the landfill site if required. It is not expected the quarry or water supply reservoir will require expansion.

12.1.8 Skyline Protection Area

The George Town Planning Scheme (1991) identifies the Tippogoree Hills as a "Skyline Protection Area". Under the Scheme:

> *5.10.6.3 ii) A lot shall not be located such that the resulting residential use or development could significantly alter, or have an adverse impact on the environment, flora and fauna habitats, watercourses, skyline and tree and particularly areas where defined as "Skyline Protection Areas".*
>
> *6.4.1 (i) For the purpose of securing or of preserving the amenity in any Village, Low Density Residential, or Tourist Facility Zone, or Skyline Protection Area, no person hall ringbark, cut down, top, lop, remove, injure or wilfully destroy any tree or trees, except with the consent of the planning authority given with or without such conditions as the planning authority deems necessary.*

The proposed landfill is situated in a depression in the lower section of the Tippogoree Hills, below the ridgeline. This positioning reduces the visual impact from the clearing of trees required for construction of the landfill, thus protecting the integrity and scenic qualities of the Skyline Protection Area. Specific landscaping will include the rehabilitation of areas disturbed during construction that lie outside the facility footprints and rehabilitation of closed landfill cells. It is noted that consent of the planning authority pursuant to Section 6.4.1 (i) of the Planning Scheme does not apply to a declared project of state significance.

12.1.9 Exploration Licence

The landfill, quarry and water supply reservoir are located within an area covered by a Retention Licence under the *Mineral Resources Development Act 1995*. Licence RL3/1997 Category 3 – construction materials, is held by Tasmanian Hardrock Pty Ltd over an area of 7 km^2. The licence expires on 19 December 2007[30].

Under provision in the *Mineral Resources Development Act 1985*, landowners are permitted to use stone on the property on which it was mined without the need to obtain a mining lease. When Gunns purchase this property, they will be able to utilise the quarried dolerite on the site. Gunns will still need to seek permission from Tasmanian hardrock to mine the site.

12.1.10 Planning Scheme Amendment

While a planning scheme amendment is not required in order to facilitate the proposed landfill, a rezoning for that portion of the landfill located within the Agricultural Zone to Bell Bay Major Industrial Area is recommended. This would ensure that the whole of the facility is located within the one zone and that future works to the landfill will be considered permitted. The proposed rezoning provides an appropriate planning response for the following reasons:

- The development of this site for a landfill will aid in the establishment of the Gunns' pulp mill, a major resource value adding industry, also to be developed within the Bell Bay Major Industrial Zone.
- The use and development of the site as a landfill furthers the strategic importance of this area/zone for major industrial use and development.
- The location of the site maximises the existing road and rail infrastructure and ensures an integrated and efficient method for disposing of the waste material to be generated by the pulp mill.
- The location of the site is such that there is substantial separation from incompatible or other uses on which the development may have an impact.
- The proposed site maximises the use of the existing site features and topography.
- The adjoining land is State Forest. Appropriate buffer zones have been included within the design (and area proposed to be rezoned) to ensure that there is no impact on surrounding land uses.
- Best practice landfill design and operation in accordance with Department of Primary Industries, Water and Environment (2004) Sustainability Guide for the Siting, Design, Operation and Rehabilitation of Landfills will prevent any adverse impact on the surrounding natural environment during the construction and operation of the landfill.
- The proposed landfill is situated in a depression in the lower section of the Tippogoree Hills, below the ridgeline. This positioning reduces the visual impact from the clearing of trees required for construction of the landfill, thus protecting the integrity and scenic qualities of the Skyline Protection Area.

The landfill is not compatible with the Agricultural Zoning of the land on which part of the development is located. An amendment to the planning scheme is required to reflect approval of the project under the Project of State Significance assessment process.

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[30] The List http://www.thelist.tas.gov.au/listmap/ accessed 13/06/06.

The area bounded by the GDA 1994 MGA Zone 55 coordinates 493827E, 5445540N to 494465E, 5445954N to 495056E, 5444944N to 494983E, 5444902N to 494614E, 5445400N back to 493827E, 5445540N, as shown in Figure 3, needs to be rezoned from Agricultural to Bell Bay Major Industrial, ie:

Amend the George Town Planning Scheme Map by drawing a black line around the section of property PID 2535084 as shown in Figure 3. Rezone the area contained by this line to Bell Bay Major Industrial.

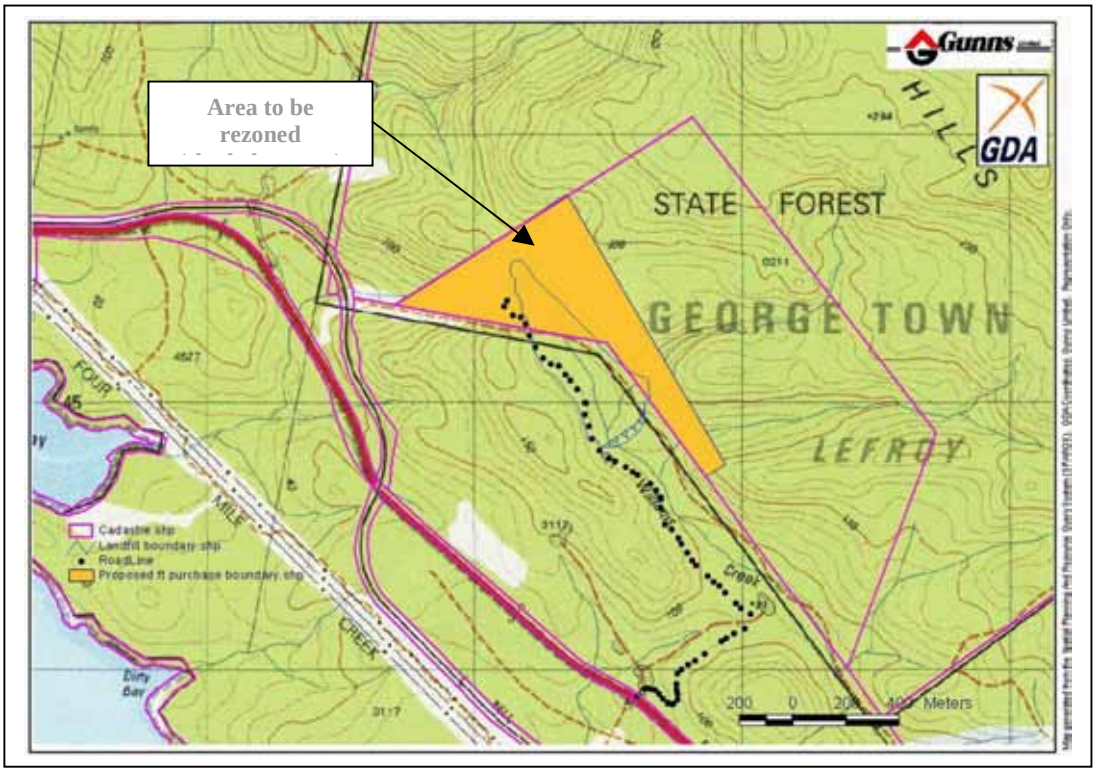

Figure 12-1 Area to which the amendment relates

The proposed planning scheme amendment is outlined in more detail in Appendix L of Appendix 55, Volume 16, Volume 8 - Pitt and Sherry 2006a, *Gunns' Pulp Mill Solid Waste Landfill Conceptual Design*.

12.1.11 Summary of Impacts and Management Measures

A summary of potential impacts, management measures to minimise the impact and a cost/benefit rating related to infrastructure and services is provided below.

Table 185: Summary of potential impact rating and management measures – land use and planning

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Land Use and Planning				
Landfill not all located within the Bell Bay Industrial Zone	Minor negative impact	Planning Scheme amendment	Minor positive impact	Insignificant impact
To meet the requirements of Use and Development Principles	Minor negative impact	Environmental Management Plans and specific sub-plans such as vegetation management, landscaping etc.	Minor positive impact	Insignificant impact
Impact on the Skyline Protection Area	Minor negative impact	No clearing or infrastructure located above ridge crests	Minor positive impact	Insignificant impact

Overall, impacts on land use and planning are considered insignificant.

12.2 Infrastructure and Services

12.2.1 Buildings

Landfill

A demountable site office and an ablutions block are proposed as part of the landfill component (Pitt and Sherry, 2006a). The demountable office and ablutions block will be located uphill of the landfill, above Cell 1, at the end of a permanent access road.

Quarry

No buildings are proposed as part of the quarry development.

Water Reservoir

No buildings are proposed for the water reservoir component.

12.2.2 Services

Water Supply

Landfill

Water for the landfill operations will be supplied from a 25,000 L storage tank fed from office building roof run off; and a small pond to be constructed on a small upstream tributary of Williams Creek, which will augment water roof run off from the office building.

The 25,000 L landfill operations water supply tank will also fulfil the requirements for a fire fighting water supply. This tank will be filled as necessary by water tanker during extended dry weather periods.

Potable water supply for the office and ablution buildings will have a separate dedicated 13,000 L tank filled solely by water tanker. The toilet and wash/shower facility will be a transportable system which can be easily relocated, with effluent entering an in-ground septic tank and absorption trench, to be installed in accordance with George Town Council requirements.

After the initial construction period, a maximum of only two operators will work at the landfill at any given time. Approximately 200 L per operator per day of wastewater will be produced. The maximum 400 L of wastewater produced each day and treated through a septic system and associated trench should not present a significant risk to ground water or surface waters (Pitt and Sherry, 2006a).

Quarry

During construction and operation of the quarry, water supply will be required as a management measure for dust control and to assist in rehabilitation of exposed surfaces.

During construction, the proposed water source will be the water reservoir and existing water services available at the woodchip mill.

However, during operation, a settling pond (approximately 25 m x 10 m x 2 m deep) is proposed in which water may be drawn from where necessary.

Water Reservoir

The water reservoir is designed to meet the water supply needs of the pulp mill. A detailed description of the water reservoir is provided in Section 11.4. Water will be sourced from Trevallyn Dam at Launceston.

Additional water supply will not be required for the construction and operation of the water reservoir.

Sewerage

During construction of the landfill, quarry and water reservoir, a toilet and wash/shower facility will be available and will be a transportable and relocatable system, with effluent reporting to an in-ground septic tank and absorption trench. The toilet and wash facility will be installed in accordance with George Town Council requirements.

Following the initial construction period, a maximum of two operators will work at the landfill. An estimated 200 L per operator per day of wastewater will be produced, which equals a maximum 400 L of wastewater and treatment through a septic system per day.

Electricity

There is no existing infrastructure that can be used to provide electricity to the proposed landfill, quarry and storage dam.

Electricity supply is required for:

- Power and lighting;
- Hot water, ovens and fridge;
- Pumping of water to the landfill spray monitor;
- Potable water supply to amenity building;
- Fire fighting pump;
- Flood lighting for night time operations; and
- Leachate collection buffer storage pond pumps.

New transmission and distribution plant will be required to provide power to the landfill and storage dam areas.

Power will be transmitted to the landfill and storage dam areas at 22 kV from a proposed substation at the pulp mill site.

The transmission route will traverse three major services: an overhead electricity (high voltage) transmission line, a railway line (the East Tamar Rail Link), and the main traffic route into George Town (East Tamar Highway).

The type of construction proposed for the transmission line to the landfill is a mixture of underground cable and overhead open line construction. The total distance from the edge of the pulp mill site to the far side of the highway reserve (a distance that could potentially require underground cable) exceeds 500 m. Cable for underground transmission at 22 kV is available and is the method of choice for crossing existing services. However, the cost is relatively high when compared with overhead construction, and its use will necessarily be limited to essential areas only. The installed cost will be especially sensitive to ground conditions if, for example, significant rock is present.

The proposed transmission line has been broken up into segments illustrated in Appendix H of Appendix 55, Volume 16.

For the purposes of conceptual design, underground cable is proposed under the HV transmission line and the railway. However, underground cable may also be used under the East Tamar Highway, subject to investigation during detailed design. The remainder of the line will use overhead open wire construction.

At the landfill site, a 50kVA pole-mounted transformer will be installed. This will supply three-phase power to a main switchboard, from where power will be distributed to the leachate pump and amenities

building. No detailed load demand has been calculated since 50 kVA is the smallest practicable three-phase load to be provided from a pole-mounted substation. The same applies to the water reservoir electrical supply.

At the water reservoir, a second 50kVA pole-mounted transformer will be installed. This will feed three phase power to a main switchboard, from where power will be fed to the storage dam pump station and other loads, as required.

In the event that quarry operations are implemented, the electrical demand will increase substantially. In this case, the 50kVA pole-mounted transformer will be replaced with a 500 kVA unit, suitable for operating a crusher and other loads. The 500 kVA transformer will supply the landfill and the quarry loads through separate main switchboards. To provide flexibility for the location of the quarry main switchboard, a substation low voltage circuit breaker cubicle is proposed at the landfill transformer. This will have an isolator on the incomer from the transformer, a single circuit breaker for the landfill main switch board, plus space for a future circuit breaker to feed the quarry main switchboard. This arrangement will protect a longer mains cable to the quarry main switchboard and has the advantage of simplifying the future installation works.

A generator could well be cheaper to install than a transmission line. However, when comparing a generator versus a transmission line, running costs will be quite different. More details on the option of a generator vs transmission line are provided in Appendix 55, Volume 16.

Natural Gas

Natural Gas is not currently available at the site and will not be required to operate the landfill, quarry or water reservoir.

Telecommunications

No telecommunications, optic fibres or lines will be required for construction and operation of the landfill, quarry or water reservoir. Mobile phone and/or radio services will be provided for telecommunication purposes.

Road

The construction and operation of the proposed landfill, water reservoir and quarry will result in a cumulation of traffic utilising the new access to these components of the pulp mill. Refer to Section 12.10.

Rail

The landfill, quarry and water reservoir will not impact on rail services.

12.2.3 Management Measures

The need for buildings, water supply, sewerage infrastructure and electricity supply will not result in an increase in current service demands. Management measures to meet the service requirements of the

project are included as part of the project concept design and therefore, no management measures as such are recommended.

To minimise the impact of traversing the high voltage transmission line, East Tamar Rail Link and East Tamar Highway, options for overhead and underground transmission lines will be considered more closely in the detailed design phase. To minimise disruption Gunns will liase with the service providers and notify service users about potential temporary disruptions.

12.2.4 Summary of Impacts and Management Measures

A summary of potential impacts, management measures to minimise the impact and a cost/benefit rating related to infrastructure and services is provided below.

Table 186: Summary of potential impact rating and management measures – infrastructure and services

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Infrastructure and Services				
Construction of a new transmission line will traverse a high voltage transmission line, East Tamar Rail link and East Tamar Highway. Temporary disruption to service supply.	Moderate negative impact	Consider overhead and underground options. Method to be determined in the detailed design phase. Liase with relevant services providers. Advise service users of any temporary disruptions.	Minor positive impact	Minor negative impact

Overall, impacts on infrastructure and services are considered minor.

12.3 Topography, Climate and Meteorology

12.3.1 Topography

Landfill

Landfill construction and operation activities will result in local disturbance to the topography. Excavation activities associated with the establishment of the landfill cells and permanent and temporary access roads will occur.

The design of the landfill has considered topographic constraints including the saddle to the north west and two drainage lines running from the east above and below the site and potential visibility from roads, tourist lookouts and residential areas. To achieve the required landfill volume within these constraints, a two layer design is proposed (Pitt and Sherry, 2006a).

Both layers will be constructed in a sequence from up-slope to down-slope. Progressive clearing works are proposed.

The 20-year design life landfill will consist of up to 10 cells, each with an average 100,000 m^3 capacity and a surface area of up to 23,500m^3. Additional cells could be added to extend the life if necessary depending on waste disposal rates.

When a cell reaches its fill capacity, the intermediate cover will be overlaid with a 1 mm HDPE membrane, which will be the primary rain barrier. A 150 mm drainage layer of sand will be placed over this membrane, followed by a 300 mm layer of compacted native clay and then 450 mm of topsoil.

Shallow rooted native vegetation will be planted to bind the topsoil and assist with waterproofing.

The capping will slope at approximately 5% to direct surface water into the landfill's cutoff drains.

Quarry

Due to the nature of quarrying, the local topography will be physically impacted. The operational activities will involve the removal of vegetation, rock blasting, excavation, ground disturbance and the development of stockpiles and trenches.

The quarry is proposed to be approximately 300 metres wide, 200 metres long with two working interfaces, each ten metres high. Figure 12-2 shows the concept design of the quarry and topography stages.

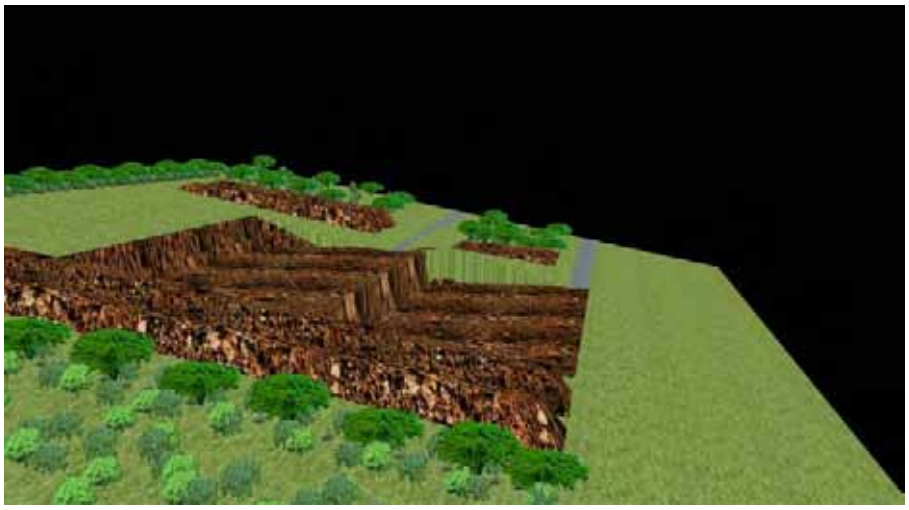

Figure 12-2 Quarry Concept Design – Operational Phase

Following the removal of 180,000m^3 of dolerite and soil, rehabilitation of the site will occur. The planned crest length along the face will be a maximum of 200 metres at completion. In order to reduce the unnatural contours, the uppermost benches will be reduced in height, to approximately 5 metres high and 200 metres wide, near completion. The benches will be spread with stockpiled topsoil and overburden and subsequently ripped.

The quarry faces will be rounded at the top edge to the extent possible in dolerite by using an excavator with a view to converting near vertical faces to more rounded features with minimal near vertical sections. Following rehabilitation of the quarry, the topography will be dominantly benches with recontoured faces (refer to Figure 12-3).

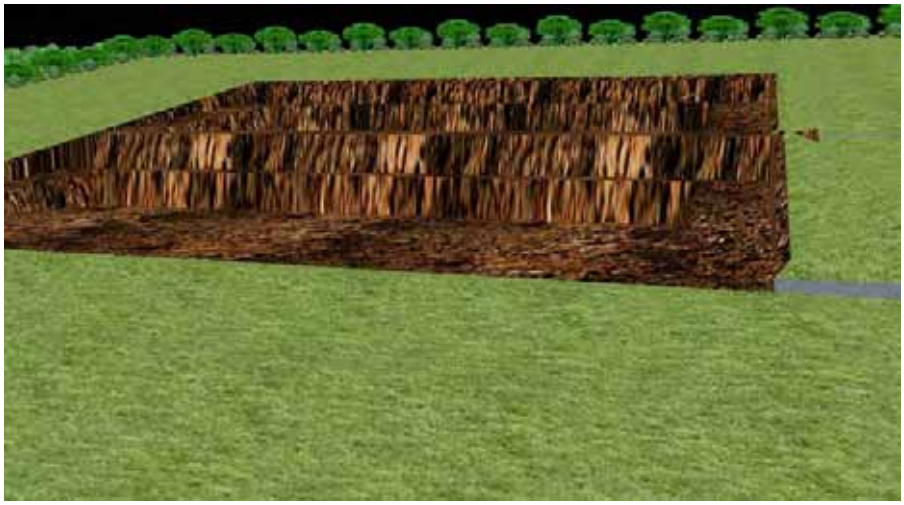

Figure 12-3 Quarry Concept Design – Following Rehabilitation

Water Reservoir

The water reservoir will comprise two earth embankments constructed across a valley in the Tippogoree Hills, immediately to the east of the mill site (GHD, 2006e). The water reservoir will change the topography of the local area.

12.3.2 Climate

The landfill, quarry and water reservoir will not have any impact on the climate in the region.

12.3.3 Meteorology

The landfill, quarry and water reservoir will not have any impact on the meteorology in the region.

12.3.4 Management Measures

Management measures to minimise the potential impacts on the topography are listed below:

- Use progressive works for clearing and construction of the landfill cells;
- Develop an ongoing landfill rehabilitation plan prior to operation of the landfill;
- To prevent accidental disturbance to any area, all quarry boundaries are to be clearly marked;
- Rehabilitation of the quarry will be in accordance with the Quarry Code of Practice, including – levelling of bunds and stockpiles, rippable benches recontoured, overburden backfilled, bench heights

reduced to 5 m (10m bench heights will be split into 2 x 5m benches by spreading overburden near the face), slope disturbance less than 30 m, fill to increase the height of the interfaces;

- Revegetation of the quarry face will occur as detailed in Section 12.7; and
- Minimise the construction footprint and disturbance to topography during construction of the water reservoir.

12.3.5 Summary of Impacts and Management Measures

A summary of potential impacts and management measures on topography, climate and meteorology, resulting from associated activities with the landfill, quarry and water reservoir, is provided in Table 187.

Table 187: Summary of potential impacts and management measures – topography, climate and meteorology

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Topography, Climate and Meteorology				
Localised physical impacts on the topography resulting from excavation	Minor negative impact	Clearly mark areas to be excavated to minimise accidental disturbance.	Minor positive impact	Insignificant impact
Exposure of surfaces	Minor negative impact	Rehabilitation	Minor positive impact	Insignificant impact
Changes to site topography	Minor negative impact	Rehabilitate the landfill and quarry areas.	Minor positive impact	Insignificant impact
	Minor negative impact	Prepare a rehabilitation plan in accordance with the Quarry Code of Practice	Minor positive impact	Insignificant impact
	Minor negative impact	Prepare and landfill rehabilitation plan.	Minor positive impact	Insignificant impact

Overall, impacts on topography, climate and meteorology are considered insignificant.

12.4 Air Quality

Landfill

The majority of the solid waste transported from the pulp mill will be relatively coarse and contain a substantial amount of water. The moisture content is estimated to be up to 50%.

Fly ash and lime kiln precipitator dust has the potential to be dusty. The waste will be transported to the landfill in trucks with tarpaulin covering of the loads. Loads could be up to 25 m^3 but 20 m^3 loads have

been assumed for truck movement calculations. If necessary, the waste will be wetted prior to transport. Unloading and spreading at the landfill will be managed to minimise dusting. A water monitor spray will be strategically located to wet the unloaded waste as required.

Waste has the potential to create dust and odour emissions. A number of management measures are discussed in 12.4.1 to minimise potential impacts.

Prevailing winds are from the northwest, which means that the principal dust movement direction will be into the forested hillside. This will restrict dust propagation.

Domestic waste will be wetted as required and will be compacted and soil or process waste covered as required to minimise dust nuisance as well as to minimise the risk of odours, wildlife scavenging and fire.

Spraying waste in the landfill for dust suppression will be required if and when moisture in the waste surface layer has evaporated sufficiently to dry the surface. Spraying will only be to rewet the surface, and should not involve large volumes. Over use of spraying to the point where significant amounts of water might percolate below the waste surface layers to potentially generate leachate will be a waste of water, and serve no ongoing purpose for dust suppression.

Provided dust suppression spraying controls avoid the over use of water, there should therefore be little additional leachate generated.

The main solid wastes to be disposed of to the landfill are inorganic and inert (eg. green liquor dregs, lime slaker and lime kiln electrostatic precipitator solids and boiler ash etc.).

No green wastes will be disposed of to the landfill. All wastes with a calorific value will be reused as fuel for power production. The waste type with the potential to produce gas is the domestic waste. The domestic waste will be placed in each of the ten individual main cells in a separate dedicated cell for each main cell.

There will therefore be ten separate domestic waste cells, one each in the ten main cells. The annual production of domestic type waste will be approximately 760 t/a or 5,000 m^3/a. This amounts to approximately 10% of the maximum amount of wastes for disposal. The domestic cell for each main cell will have dimensions of approximately 75 m x 25 m x 5m, for the disposal of approximately 10,000 m^3 during the nominal two year minimum life expectancy of the main cells.

Each domestic type cell will be closed out along with each main cell and a new one constructed as part of the new main cell. Each domestic waste cell will have a gas discharge pipe. Given the volume of domestic waste stored in each individual domestic cell, the amount of gas generated will be small and will have negligible commercial value.

Quarry

Due to the nearest residence being approximately 3 km from the quarry, and prevailing winds from the north west dust is not perceived to be a hazard to neighbours or traffic on the East Tamar Hwy.

Truckloads will not be covered as the loads will primarily be dolerite rock (coarse particles unlikely to generate dust problems).

Water Reservoir

Site preparation works will result in some dust generation. As per above, prevailing winds are from the northwest, which means that the principal dust movement direction will be into the forested hillside. This will restrict dust propagation.

12.4.1 Management Measures

Management measures to minimise the potential environmental impacts on air quality are recommended below:

- Trucks carrying fine particle loads will be covered;
- Wastes will be wetted at the pulp mill prior to transporting to the landfill facility if necessary;
- A water monitor spray will be strategically located to wet the unloaded waste as required;
- Domestic waste will be wetted as required and will be compacted and soil or process waste covered as required to minimise dust nuisance as well as to minimise the risk of odours, wildlife scavenging and fire;
- Spraying waste in the landfill for dust suppression will be required if and when moisture in the waste surface layer has evaporated sufficiently to dry the surface. Spraying will only be to rewet the surface, and should not involve large volumes. Over use of spraying to the point where significant amounts of water might percolate below the waste surface layers to potentially generate leachate will be a waste of water, and serve no ongoing purpose for dust suppression;
- Unsealed access roads and the quarry will be kept damp by water trucks to suppress dust;
- Make provisions for windy conditions;
- Use equipment that is regularly serviced and operate efficiently to minimise air emissions; and
- Turn equipment off when not in use.

12.4.2 Summary of Impacts and Management Measures

A summary of potential impacts and management measures on air quality resulting from associated activities with the landfill, quarry and water reservoir, is provided in Table 188.

Table 188: Summary of potential impacts and management measures – air quality

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Air Quality				
Generation of dust and odour	Minor negative impact	Cover loaded trucks carrying fine particulate matter	Minor positive impact	Insignificant impact
	Minor negative impact	Hydrate wastes	Minor positive impact	Insignificant impact
	Minor negative impact	Wet and cover domestic waste when required	Minor positive impact	Insignificant impact
	Minor negative impact	Spray waste in the landfill	Minor positive impact	Insignificant impact
	Minor negative impact	Spray unsealed haul roads	Minor positive impact	Insignificant impact
Generation of fuel emissions	Minor negative impact	Use equipment that is regularly serviced	Minor positive impact	Insignificant impact
	Minor negative impact	Turn equipment off when not in use.	Minor positive impact	Insignificant impact

Overall, impacts on air quality are considered insignificant.

12.5 Geology and Soils

12.5.1 Landfill

The geology and soils of the landfill area will be disturbed. Site preparation works will involve clearing vegetation, exposing soils to elements making it susceptible to erosion. Topsoil will be removed and stockpiled for later use and excavation will occur at various stages throughout the operation of the landfill. The 20 year concept design life landfill will be approximately 1 km long and 200 m wide. The landfill will be approximately 10 metres deep. A cross-section of the landfill is provided in Appendix 55, Volume 16.

The Bell Bay area is dominated by a northwest trending graben structure formed by large-scale normal faulting in the Tertiary. A major normal fault along the eastern edge of the Tamar River defines the eastern edge of the Tamar Graben and separates Jurassic dolerite on the eastern side from Tertiary sediments and basalt on the western side.

The Tippogoree Hills are marked by a large number of lineations, some of which parallel the major normal fault along the Tamar River, and the landfill site is situated above a fault. Any reactivation of these structures at the site is considered to be unlikely, however, as there are no known active faults in Tasmania, although there are some that are suspected of having been active within the last thousand years or so, such as the Lake Edgar fault in southwest Tasmania.

Fault movement is very unlikely to occur, and if it did, the movement is likely to be in the order of centimetres rather than metres. Nevertheless, it is possible that movement of the fault where it underlies the landfill could cause differential settlement of the landfill, including its liner.

Differential settlement can be characterised by the distortion of the liner, defined as vertical settlement over horizontal distance. Small vertical movement over a large horizontal distance is low distortion, whereas large vertical movement over a small horizontal distance is high distortion. If distortion is high enough the resultant tensile strains may cause the landfill barrier layer to crack and lose its ability to retain leachate.

Tests (LaGatta et al, 1997 cited by Qian in Pitt and Sherry 2006a) have shown that a geotextile encased, needle punched GCL can maintain a hydraulic conductivity of 1 x 10-9 m/sec even with a distortion as large as between 0.18 and 0.30 vertical movement to horizontal span, corresponding to a tensile strain of 5 to 16%. In addition, the swelling and self-healing ability of bentonite enables panel overlaps to maintain their hydraulic integrity despite slippages over several centimetres. GCL panels are typically installed with overlaps of 300 mm, which should be adequately for any reasonable credible fault slippage scenario. If added security was required, even greater overlaps could be used.

There is therefore negligible risk of the proposed composite GCL barrier being breached due to fault movements.

12.5.2 Quarry

The maximum disturbed area for the next five years is approximately seven hectares including access roads.

The resource will be worked in a systematic manner, generally across or down the slope so that worked-out sections can be rehabilitated as mining progresses.

Site preparation works will involve removal of vegetation as described in Section 12.7, and subsequent exposure of soils.

Topsoil depth ranges from 300 mm to 1,500 mm of clay over dolerite. The subsoil depth varies 300 mm to 1,200mm.

Blasting will be required to break up the dolerite. Blasting is proposed to occur twice per week for the first six months of operation. Precautions to prevent fly-rock, noise and vibration include the following and are as per the Quarry Code of Practice (June 1999).

The quarry is proposed to have two working interfaces, ten metres high. The planned crest length along the face will be 200 m at completion. The uppermost benches will be reduced in height, to approximately 5m high and 200 m wide, near completion. The final landform will be benches. Potential small

hydrocarbon spills from machinery during operation will be relocated to a bunded area for oil and subsequently disposed of as hazardous waste.

The Standard Attenuation Distances in the Draft Quarry Code of Practice (2006) of 1,000 m for blasting, 750 m for crushing 500 m for screening and 300 m for extraction will all be met.

Rehabilitation of the site will be undertaken as per the Quarry Code of Practice (June 1999).

12.5.3 Water Reservoir

A preliminary site investigation of the proposed storage was undertaken as part of this study (GHD, 2006e).

The site is a small, extremely weathered dolerite valley between two dolerite hills, with a saddle to the northeast end. The hills and saddle exhibit varying degrees of weathering. The northern side supports more vegetation, typically eucalypt bush. The southern side exhibits more extensive outcrops of hard rock with scattered she oak scrub. The valley is densely vegetated with ti-tree and paper bark with an access track skirting the southern side of this vegetation.

A level traverse was undertaken to establish the top water level limits of the site and a number of test holes were excavated around the perimeter. These test holes could only be excavated to an average depth of 0.7 m deep with some reaching refusal at 0.5 m depth. The test holes confirmed varying degrees of weathering of the dolerite predominantly consisting of cobbles and boulders in a clay matrix. No samples were taken for laboratory testing from these test holes.

A number of test holes were excavated across the site where existing access permitted, thus minimising site disturbance. All the test holes on the slopes were consistent, with the only variable being the depth of refusal. The test holes in the valley revealed a good depth of clay, being over 3 m deep in some areas. Four samples were taken at different depths from two of the test holes that were excavated in the valley. Table 189 shows the test pit and sample locations and depths. BFP Consultants tested the samples for Sieve Analysis, Atterberg Limits, Linear Shrinkage and Emerson Class Number.

Table 189: Details of Test Holes

Test Hole	Easting (m)	Northing (m)	Depth of Excavation (m)	Depth of Topsoil (m)
TP1	494888	5444286	3.5	0.3
TP2	494997	5444355	2.0	0.3
S1	-	-	0.6	-
S2	-	-	3.5	-
S3	-	-	1.0	-
S4	-	-	2.0	-

The preliminary work undertaken as part of this study indicates that this site should be suitable for water storage with a substantial clay deposit for the embankment core sourced within the impounded area.

Further clay deposits should be found in the adjoining valley immediately east of the saddle. Rock for the embankment will most likely be sourced from the pulp mill site works.

No geoconservation areas are listed on or surrounding the proposed development site (Parks and Wildlife Service 2004).

12.5.4 Management Measures

Management measures to minimise the potential environmental impacts on geology and soils include:

- The landfill cell liner will be capable of retaining its integrity should minor seismic activity or land instability occur;
- Removal of vegetation to occur at stages;
- Rehabilitated exposed surfaces as soon as possible to prevent erosion;
- Reuse of overburden and stockpiled soil;
- An Erosion and Sediment Control Plan will be prepared prior to construction and implemented for the project;
- Traffic access will be restricted to designated traffic access paths and roads;

A rehabilitation Management Plan will be developed prior to construction in accordance with legislation and the Quarry Code of Practice;

- A sediment pond will be built to capture stormwater and minimise potential erosion from water; and
- Erosion and surface water control measures such as sediment traps, silt fences will be implemented in accordance with the Erosion and Sediment Control Plan prior to commencement of construction activities.

12.5.5 Summary of Impacts and Management Measures

A summary of potential impacts and management measures on geology and soils, resulting from associated activities with the landfill, quarry and water reservoir, is provided in Table 190.

Table 190: Summary of potential impacts and management measures – geology and soils

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Geology and Soils				
Erosion and sediment transport to Williams Creek	Moderate negative Impact	Erosion and Sediment Control Plan	Minor positive Impact	Minor negative Impact

Overall, impacts on geology and soils are considered minor.

12.6 Groundwater and Hydrology

12.6.1 Groundwater

Landfill

Based on preliminary geotechnical information, the siting of the landfill will not interfere with current groundwater movement.

The watertable level is approximately 16 m below the surface level at the landfill area at its top end but may be less than 5 m below the surface at its lower end. The landfill leachate quality has the potential to affect the quality of the groundwater, especially the pH and conductivity, in the event of a significant breach in the landfill liner's integrity. However, the weathered soil between the landfill and the groundwater will attenuate the impact of any leachate lost from the landfill, and the effectiveness of this attenuation will depend on where the breach occurs. Attenuation will be much greater for a breach at the upper end of the landfill than for a breach at the lower end. The concept design does not rely on this attenuation, however.

Based on the conceptual landfill design, the proposed liner and capping system, the underlying geology and the leachate collection system, the risk and therefore the requirements for groundwater management are minimal.

The adoption of the proposed landfill liner design will minimise the potential risk of ground water contamination and the extent of potential contamination in accordance with Section 24.1 of the *State Policy on Water Quality Management 1997*.

Permanent groundwater monitoring bores have been installed in strategic locations, above and below the landfill footprint, to monitor the groundwater levels and quality (Appendix 55, Volume 16).

It is envisaged that risk to groundwater is mitigated by the following measures:

1. The geology of the area is dolerite, with drainage lines following fracture lineaments. It is expected that major groundwater movement will essentially follow these fractures. The groundwater level is deep (c. 15 m) at the head of the landfill and shallow at the foot (c. 3 m). The design has the first cell at the head, where there is no significant risk of the water table approaching the DPIWE *Landfill Sustainability Guide* limit of 5 m. By the time cell number 4 at the foot needs to be constructed, there will be some 8 years of detailed groundwater monitoring data available, which will enable any risk from a shallow water table in that area to be addressed through detailed engineering design (eg. the installation of a drainage layer under the liner).

2. Groundwater levels will rise and fall in response to infiltration from rainwater running down natural drainage lines during wet conditions. The drainage lines are just that – drainage lines – and not permanent creeks. The cutoff drains that will be constructed either side of the landfill will intercept surface runoff that will otherwise have run into the landfill area's natural drainage line to recharge the groundwater. The cutoff drains are very conservative in design (factors of 31, 132 and 38 more so than the DPIWE guidelines). The diversion will mean that the recharge from that water will then occur down-slope of the landfill's foot, and groundwater levels under the landfill area should drop accordingly. The important groundwater monitoring will therefore come once

those cutoff drains have been installed – it will then be possible to monitor the actual groundwater behaviour that will occur in the presence of the landfill. Attempting to model that future behaviour at this stage will be very expensive and largely academic.

3. The design uses both a geosynthetic clay liner and an HDPE membrane liner. Calculated leachate seepage rates are low an order of magnitude lower than the Victorian EPA guideline 38 of 10 L ha/day, for example. Potential contamination rates of underlying groundwater are correspondingly low, even ignoring further attenuation that could occur in the intervening soil.

4. The process waste itself is inorganic and relatively benign. It is primarily the high pH that warrants the landfill's classification as Category C. No hazardous waste will go to the landfill. The leachate should therefore contain no intractable toxic chemicals, and if any leachate seepage does encounter groundwater it will be quickly attenuated.

5. The groundwater is not a potable water supply nor are there surface potable water sources in the area. Further, there are no known wetlands or other surface water bodies in the vicinity of the landfill that will be fed by groundwater seepage, meaning that there is no identifiable risk of contamination of aquatic ecosystems should leachate seepage enter groundwater (Pitt and Sherry, 2006a).

12.6.2 Drainage and Catchments

Landfill

The proposed landfill project will affect one ephemeral tributary in the upper Williams Creek catchment and approximately 800 m of Williams Creek itself. The location of the landfill and its design has endeavoured to minimise interference to the natural waterways in the area.

A section of Williams Creek will be impacted by the proposed landfill. The landfill will be constructed at the head of Williams Creek, making use of the natural gully formed by the creek. Cutoff drains will divert natural overland flow around the landfill, and back into the creekline below the landfill. The drains will also capture runoff from the surface of the landfill's capped cells. The net impact on the flow in Williams Creek down-slope of the landfill will therefore be insignificant but within the landfill footprint the natural drainage line of the creek will be lost.

The area of natural drainage that reports to Williams Creek and requires diversion around the western side of the landfill site is approximately 20 ha. The area of natural drainage that reports to Williams Creek and requires diversion around the upper eastern side of the landfill is approximately 64 ha. The area of natural drainage that reports to Williams Creek and requires diversion at the lower eastern end of the landfill is approximately 198 ha. These catchment areas were determined from 1:25,000 site topographic maps.

Surface water diversions are a key component of the landfill layout. A permanent surface water cut off drain will be installed along the western side of the ultimate landfill footprint adjacent to the access road.

A permanent surface water cut off drain will be installed along the eastern side of the landfill adjacent to the ultimate landfill footprint. This drain will also collect diverted surface water from above and to the east

of the landfill. A permanent surface water diversion drain will be installed to divert surface water from a relatively large (but still ephemeral) drainage line flowing from the east at the lower end of the landfill.

The above surface water infrastructure will remain for the life of the landfill and be integral to the final close out plan for this area of the landfill. The surface water diversion drains will be directed at an appropriate velocity and slope back into the natural Williams Creek watercourse below the landfill footprint.

The drains will be designed to handle a 1:50 year rainfall event at the nominal time of concentration for the individual catchments. The drains will be designed and constructed to appropriate design standards and for ease of ongoing maintenance.

During the operation of the lower layer of cells, temporary drains closer to the boundary of those cells will be installed, extra to the ultimate outside permanent drains. The DPIWE *Landfill Sustainability Guide* specifies design criteria for surface water management for a 1:50 year storm event of 24 hours duration. The intensity of rainfall and associated surface water flow rates from a 24 hour duration storm may not be indicative of good engineering design for different locations.

For the catchments mentioned above, the overland flow time for surface waters around the landfill area is approximately 30 minutes.

Using the more appropriate 30-minute rainfall event for design purposes (which gives much higher rainfall intensities and hence flow rates), the surface water cut off drain on the western side of the landfill must be able to handle 100 L/s. The surface water diversion and cut off drain on the upper eastern side of the landfill must be able to handle 3,500 L/s. The surface water diversion drain on the bottom eastern side of the landfill must be able to handle 9,000 L/s.

The conceptual design is for the permanent earth drains to be cut into the natural ground around the landfill with nominal dimensions of 2 m wide by 1 m deep and 45° sides with nominal downhill slopes of 1 %. The flow that such a drain could handle has been calculated at approximately 7,500 L/s.

This design is more than enough for the western and upper eastern drains. The lower eastern drain has a slope of approximately 10% and at this slope the flow capacity of the 2 m x 1 m drain is approximately 24,000 L/s, which is also more than adequate. An important point to be addressed at the detailed design phase is the velocity of the surface water in the drains, which is estimated to be approximately 2.5 m/s for the 1% slope and 8.0 m/s for the 10% slope. Armouring of the drains may be required to prevent erosion and to mitigate the kinetic energy of the water, particularly those on the eastern side of the landfill. This armouring will be considered at the detailed design phase.

The DPIWE *Landfill Sustainability Guide* specifies a design that deals with a 50 year 24 hour storm event, ie. a one in 50 year rain spread over 24 hours. The use of a 30 minute storm event is even more conservative, ie. a one in 50 year rain spread over only half an hour. The 24 hour spread is equivalent to 2 mm of rain each half hour, compared with 28 mm for the half hour spread.

The conservative assumption betters the DPIWE rainfall guidelines by a factor of 14. For the cutoff drains themselves, a minimum practical size of 2 m wide by 1 m deep has been assumed. On the slopes on the eastern and western sides of the landfill a drain this size will take 7.5 cumecs of runoff. On the steeper slope below the landfill the drain will take 23.8 cumecs.

For the assumed conservative 30 minute storm event, the eastern drain will need to take 3.4 cumecs, the western drain 0.8 cumecs and the lower drain 8.8 cumecs, giving safety factors of 2.2, 9.4 and 2.7 respectively. Combined with the conservative rainfall assumption, the safety margins for the three drains are therefore 31, 132 and 38 respectively.

If even these conservative design constraints are exceeded, stormwater will overflow the cutoff drains and potentially erode the sides of the landfill cells. During the operational life of the cells, this erosion could readily be repaired. If the erosion occurred post-closure, repair work could be more problematic. Even though the conservative design means that this risk is already very low, rock armouring of the edges of the closed cells will be considered during detailed design. Overflow water could also enter any open operating cell. Its flow will be buffered by the waste in the cell, and eventually it will emerge as leachate and be piped to the WWTP (Pitt and Sherry, 2006a).

Quarry

Williams Creek is located approximately 50 m north west of the proposed quarry site. The watercourse will not be physically impacted by the quarry. Management measures such as erosion and sediment control will be implemented to prevent any sediment entering the water body.

A sediment pond 25 m by 10 m and 2 m deep has been designed to store runoff for a two year, one hour duration rainfall events.

Run-off from the quarry will flow in the direction of the natural topography towards Williams Creek towards the settling pond. Run-off from working areas and roads, which contain sediment, will be collected in settling ponds, sediment in the water will be settled out, outflow from the pond will be filtered through rip-rap before flowing into native vegetation.

Water Reservoir

The water supply reservoir has been located so as to not directly impact on Williams Creek. The eastern embankment is located approximately 40 m away from the creek enabling construction to take place without disturbing the banks of the creek. Sufficient room exists to locate access roads and sediment and erosion controls within this area.

The upper reaches of an ephemeral drainage line which flows to Williams Creek will be directly affected and a small area of catchment lost. As the reservoir is located at the upper extent of this drainage line, and as the total reservoir footprint is small (approximately 16 ha), any impact on flows will be insignificant.

Appropriate sediment and erosion controls will be implemented to address protential sedimentation impacts during construction.

12.6.3 Management Measures

Implement an Erosion and Sediment Control Plan prior to commencement of construction works.

12.6.4 Summary of Impacts and Management Measures

A summary of potential impacts and management measures on groundwater and hydrology and infrastructure, resulting from associated activities with the landfill, quarry and water reservoir, is provided in Table 191.

Table 191: Summary of potential impacts and management measures – groundwater and hydrology

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Groundwater and Hydrology				
Contamination of groundwater from the landfill	Major negative Impact	Geosynthetic clay liner and an HDPE membrane liner	Moderate positive impact	Minor negative impact
	Major negative Impact	Exclusion of hazardous materials from the landfill	Moderate positive impact	Minor negative impact
Interception and diversions of flows to Williams Creek	Moderate negative Impact	Diversion of flows around landfill	Minor positive Impact	Minor negative Impact
Contaminated stormwater entering Williams Creek	Moderate negative Impact	Diversion of potentially contaminated flows and storage on site	Minor positive Impact	Minor negative Impact
Erosion and sedimentation of Williams Creek from landfill	Moderate negative Impact	Erosion and Sediment Control Plan	Minor positive Impact	Minor negative Impact

Overall, with the implementation of the above drainage and leachate controls, the landfill, quarry and water reservoir is unlikely to impact on water quality.

12.7 Terrestrial Flora

A total of 14 potential ecological impacts have been identified in relation to the proposed landfill/quarry/water reservoir. These impacts are briefly described below.

Loss or damage to native vegetation (State threatened Ecological Vegetation Community)

The development of the landfill/quarry/water reservoir will result in the loss of approximately 9.1 hectares of threatened native vegetation, including a portion of one State significant Ecological Vegetation Community, '*Eucalyptus ovata* forest and woodland' (DOV). The actual area of DOV proposed to be cleared is 9.1 ha. It should be noted that the current landfill proposal has a 20 year design life, which is the footprint used to calculate native vegetation losses in this area. However, there is potential for the landfill design life to be extended to 50 years, to bring it in line with the design life of the pulp mill. If the landfill was expanded to accommodate the increased design life, the southern boundary of the landfill would be extended approximately 400 m further down the valley, which would involve the loss of an

additional 6.0 ha of DOV. As no firm plans are currently available for such an extension, this calculation is an approximation that is based on the landfill following its current contour lines for 400 m downslope from the existing southern edge.

Loss or damage to native vegetation (general)

The development of the landfill/quarry/water reservoir would result in the direct loss of 14.3 hectares of non-threatened native vegetation communities in relatively good condition. It may also result in a localised reduction in species richness, via localised extinction (within the study area) of a small number of species. It is difficult to quantify impacts in a local context without surveying the local (5 km radius) area. However, it should be noted that similar habitat and vegetation communities are common within the local area.

Fragmentation of native vegetation

The landfill/quarry/water reservoir has undergone a minor level of fragmentation in the past, via clearing or slashing of native vegetation for the establishment of firebreaks and tracks. Development of the landfill/quarry/water reservoir would increase the level of fragmentation within the local landscape.

Loss or damage to a population of a nationally significant flora species

No nationally threatened flora species have been identified from within the landfill/quarry/water reservoir. However, there is potential habitat within the site for one species of National significance, *Glycine latrobeana*. It is highly unlikely that this species is present within the study area, owing to the intensity of the field surveys. Therefore, any potential impact is deemed unlikely.

Loss or damage to a population of a State significant flora species

A total of two State significant flora species are present within the landfill/quarry/water reservoir. There is likely to be a direct impact upon one of these species (*Pimelea flava* subsp. *flava*), based on the proposed development footprint. In addition, one State significant species (*Ranunculus sessiliflorus* var. *sessiliflorus*) may be impacted by the proposed development, as it occurs very close to the north-western edge of the proposed landfill. There is also potential habitat within the site for six species of State significance previously recorded within 5 km of the pulp mill, but not within the site itself.

Introduction of environmental weeds

There is potential for the introduction of environmental weeds during the construction and development phase of the landfill/quarry/water reservoir, particularly via heavy machinery that may be carrying viable weed seeds on their bodies or wheels.

Spread of existing environmental weeds

In addition to the impact identified above, existing environmental weeds at the landfill/quarry/water reservoir may be spread on- and off-site by the various trucks and construction vehicles moving elsewhere after visiting the site. Although the site currently has a very low weed cover, there are weed species already present (e.g. *Acacia longifolia* subsp. *longifolia*, *Cortaderia selloana*) that may take advantage of recently cleared ground.

Introduction and spread of *Phytophthora cinnamomi*

At the landfill/quarry/water reservoir, one EVC, '*Eucalyptus ovata* forest and woodland' (DOV), has been identified as being highly susceptible to *Phytophthora cinnamomi* (Forest Practices Authority 2005). with

heathy shrub species occurring within this EVC particularly susceptible. Plants within the Epacridaceae, Fabaceae, Proteaceae and Mimosaceae families are especially susceptible to the pathogen (Barker and Wardlaw 1995) (see Appendix 30, Volume 13 for a complete list of species occurring within these genera within the greater pulp mill site). None of the threatened species present within the site are known to be particularly susceptible to *Phytophthora cinnamomi*, although it should be noted that little information exists for most of these species. There was no evidence of *Phytophthora cinnamomi* at the landfill/quarry/water reservoir. Soil testing is the only way to ascertain with certainty whether the pathogen is present within the study area.

Altered fire regimes

The most likely fire-related impact relating to construction of the landfill/quarry/water reservoir involves a potentially higher frequency/low intensity fuel reduction burning program associated with protection of infrastructure. However, this is unlikely to have a major impact on community structure, species richness and species composition, owing to the relatively high fire frequency already encountered at the site. A change in the fire regime to a higher or lower frequency may adversely impact some threatened flora species.

Altered grazing regimes

Exclusion of native herbivores within the landfill/quarry/water reservoir may have an impact on the ecology of native grassland communities by allowing the grass sward to increase in density, consequently shading out light-sensitive herbaceous species that occur in the inter-tussock spaces (Barker 1999). This is likely to lead to a decrease in species richness.

Erosion and/or sedimentation

There is evidence of soil erosion along tracks and cleared areas in the south of the site. The development of the landfill/quarry/water reservoir may result in an increase in on-site erosion, with a corresponding increase in levels of sedimentation within waterways flowing through the site and into the Tamar River. In the absence of mitigation measures, increased erosion may damage or destroy localised areas of retained native vegetation (on- and off-site), while sedimentation may have a deleterious effect on aquatic, semi-aquatic and riparian flora. Erosion and sedimentation control issues are discussed in Volume 4 of the IIS.

Altered surface water runoff into waterways

Following rainfall events, surface water runoff may be altered into waterways flowing through the site. In the absence of any mitigation measures, any such runoff may collect chemicals/pollutants spilled at the site during the construction phase and eventually deposit these materials in the Tamar River. Runoff and pollution control issues are discussed in Volume 4 of the IIS.

Inhibition of plant photosynthesis and reproductive capability due to airborne dust

During the development and operational phase of the landfill/quarry/water reservoir there would be extensive soil disturbance, which is likely to lead to the generation of large amounts of dust. This may result in a potentially negative impact on plant species growth and seed viability in the vicinity (i.e. <100 m) of the works footprint.

Altered hydrology

Earthworks associated with development and operation of the landfill/quarry/water reservoir may facilitate localised changes to the groundwater table, which may subsequently influence vegetation community structure and composition.

12.7.1 Management Measures

A number of management measures can be undertaken to minimise the impact of the proposed development. Management measures are listed below.

A. Minimising or altering the footprint of disturbance

The clearance of native vegetation is listed as a threatening process under the Tasmanian *Threatened Species Strategy 2000*. Therefore, every effort should be made to avoid and/or minimise the clearance of native vegetation, particularly threatened communities and species, in order to comply with the strategy. In addition, owing to the degradation of the Tamar estuary foreshore, the *Planning Guidelines for Tamar Estuary and Foreshore* state that areas in marginal condition should be protected from further degradation (Watchorn 2000).

The significance of the footprint of disturbance could be modified and/or minimised by locating roads and other infrastructure to avoid or minimise damage to threatened EVCs and threatened species.

B. Avoiding accidental loss or damage to native vegetation

Clearance of native vegetation will require a certified Forest Practices Plan, which will identify the area proposed to be cleared. These areas would be flagged clearly prior to operations commencing and maintained accordingly, in order to avoid any inadvertent damage to vegetation that is planned to be retained.

C. Development of a Vegetation Management Plan

A Vegetation Management Plan (VMP) would be developed prior to the construction phase. An example of an item that should be included in the VMP is the development of measures to protect and manage threatened species and EVCs. Mitigation measures for dealing with the direct loss of any threatened EVCs would be considered, with the principles of such mitigation to be outlined in the Plan. The Plan would also incorporate aspects of weed and fire management. Development of a VMP would help to ensure that retained vegetation is appropriately managed for conservation purposes.

D. Retaining a seed bank for threatened species

Recolonisation of disturbed areas by threatened species is likely to occur for disturbance-tolerant species such as *Pimelea flava* subsp. *flava*. However, for species intolerant of soil disturbance, or for species whose tolerance to disturbance is unknown, alternative mitigation measures should be employed.

In areas proposed to be disturbed where there are known populations of threatened species, and the area is proposed to be rehabilitated following disturbance, topsoil should be carefully scraped from the surface (5-10 cm depth) and stockpiled, in order to retain as much of the soil seed bank as possible, particularly seed of threatened species. Retained topsoil should then be used for rehabilitation works. Soil should be stockpiled for the shortest possible time to prevent ‘premature’ germination prior to use in

site rehabilitation works. Where threatened species are known to not typically recruit from soil-stored seed, seed should be collected prior to vegetation clearing, in order to be used in rehabilitation works.

E. Minimising the introduction and spread of environmental weeds

To prevent the establishment of new environmental weeds or the spread of existing environmental weeds, a Weed Management strategy should be developed and incorporated in the Vegetation Management Plan. The strategy should be developed prior to construction and should include a specific program to monitor and control any weed invasions arising from the proposed works. Any environmental weeds that establish following the works should be eradicated as a matter of high priority. Vehicle wash-down points should be established (at the same location as the *Phytophthora* wash down point) to remove weed seeds from material attached to earth-moving equipment.

F. Minimising the spread and reducing the impact of *Phytophthora cinnamomi*

A series of measures should be undertaken to prevent the introduction and/or minimise the spread of *Phytophthora cinnamomi* within the site. These include the following:

- Undertaking a formal assessment of the presence and extent of *Phytophthora cinnamomi* within the study area;
- Establishing wash-down points for vehicles and earthmoving equipment entering and departing the site, in order to prevent/minimise the spread *Phytophthora cinnamomi*;
- Avoiding the use of *Phytophthora*-infected gravel in track construction works;
- Minimising the area of soil disturbance and new road/track development where possible;
- Coordinating construction activities over summer (where practicable) when soils are dry and least likely to facilitate the spread of the pathogen; and
- Minimising vehicular movement between any infected and uninfected areas, and/or closely monitoring access to infected areas.

Management of *Phytophthora cinnamomi* will be in accordance with DPIW Interim *Phytophthora cinnamomi* Management Guidelines (Rudman 2005).

G. Development of a Fire Management Strategy

Establish a Fire Management Strategy and incorporate into the Vegetation Management Plan. The strategy would need to take into consideration the regenerative requirements of species and set achievable targets for fire regimes within the study area. Fire regimes should be designed to maintain biodiversity, while serving the dual purpose of asset protection. Fire regimes should also be designed to minimise the encroachment of shrubs and trees onto remnant grasslands. The Fire Management Strategy should accommodate the needs of all species, including threatened flora species.

H. Minimising the width of firebreaks

Negative impacts on retained native vegetation will be minimised if firebreaks are kept to the minimum required width and the break consists of slashed native vegetation, rather than an earthen firebreak. The location and extent of firebreaks should also take into consideration the location of threatened species and EVCs. The minimisation of firebreak width is a measure that is likely to reduce the effect of habitat fragmentation, albeit in a small manner compared to the overall impact of the project.

I. Maintenance of native herbivore grazing regimes

Native herbivores should be allowed to continue grazing in retained vegetation, rather than be totally excluded from the site by fences. This will help to maintain an open grass sward and high species diversity within the highly significant native grassland remnants that are scattered throughout the study area.

J. Rehabilitation of disturbed areas

Any revegetation/landscaping of temporarily disturbed areas should be undertaken using locally indigenous species appropriate to the position in the landscape. Detailed rehabilitation measures would be outlined in the Environmental Management Plan once the project gains planning approval.

Rehabilitation of the site will be undertaken as per the Quarry Code of Practice (June 1999).

K. Timing of construction activities

The likelihood of impacts upon ecological values can be reduced through appropriate timing of construction activities. For example, potential disturbance to ephemeral wetland communities is likely to be minimised if construction activities occur during the dormant phase of most species (i.e. summer-autumn) and topsoil is retained for rehabilitation purposes.

L. Development of an Environmental Management Plan

An Environmental Management Plan (EMP) should be developed prior to the construction phase. The EMP should incorporate the recommendations made within this report. The EMP should also include dust suppression measures to minimise the impact of dust upon plant growth and reproduction.

12.7.2 Summary of Impacts and Management Measures

A summary of the likelihood and consequence of occurrence for each potential impact, together with the significance of the impact, is outlined in Table 192. A range of potential management measures to minimise the impact are also provided in this table, and an overall cost-benefit rating has been determined, assuming that all management measures will be implemented.

Table 192: Summary of potential flora-related impacts and management measures, including the overall cost/benefit rating if management measures are fully implemented, Landfill/Quarry/Water Reservoir -

Impact	Description of nature and extent of impact	Likelihood of impact	Consequence of impact	Significance of impact	Proposed mitigation	Overall significance of impact
1. Native vegetation loss (threatened EVCs)	Potential loss of <0.1 ha (potentially up to 0.5 ha) of NAL (this represents <0.2% of NAL in the bioregion and <0.1% of NAL in Tasmania[1])	Possible	Substantial	Very high *	A, B, C (as detailed in Section 7.2.2)	Major negative impact
	Loss of *c*. 9.1 ha of DOV (this represents 0.7% of DOV in the bioregion and 0.1% of DOV in Tasmania[1])	Almost certain	Substantial	Very high	A, B, C (as detailed in Section 7.2.2)	Major negative impact
2. Native vegetation loss (general)	Loss of 14.3 ha of non-threatened EVCs	Almost certain	Substantial	Very high	A, B, C, J	Major negative impact
	Potential loss of species richness in local area	Unlikely	Minor	Low	A, B, C, J	0
	Establishment of firebreaks – loss of at least 2 ha of native vegetation	Likely	Minor	Moderate	A, G, H	Moderate negative impact
3. Fragmentation of native vegetation	Potential increased barrier to seed dispersal and subsequent loss of long-term genetic fitness in certain species	Almost certain	Minimal	Moderate	A, B, J	-
	Increased edge effect – greater likelihood of weed invasion	Likely	Moderate	High	A, E	Moderate negative impact
4. Loss or damage to a population of a nationally significant flora species	Potential loss of unrecorded species due to vegetation clearing	Highly unlikely	Major	Moderate #	A, B, C, D	0

Impact	Description of nature and extent of impact	Likelihood of impact	Consequence of impact	Significance of impact	Proposed mitigation	Overall significance of impact
5. Loss or damage to a population of a State significant flora species	Loss of *c.* 280 individuals of *Pimelea flava* subsp. *flava* (2% of total population within broader pulp mill)	Almost certain	Major	Very high	A, B, C, D	Moderate negative impact
	Potential loss of *c.* 10 individuals of *Ranunculus sessiliflorus* var. *sessiliflorus* (100% of total population within broader pulp mill)	Possible	Minor	Moderate	A, B, C, D	0
6. Introduction of environmental weeds	Potential for introduction of environmental weeds via machinery and colonisation of bare surfaces	Likely	Minor	Moderate	E	Moderate negative impact
7. Spread of existing environmental weeds	Potential for spread of environmental weeds via machinery	Possible	Minor	Moderate	E	Moderate negative impact
8. Introduction and spread of *Phytophthora cinnamomi*	Potential for introduction of *Phytophthora* via infected machinery	Possible	Substantial	Very high	F	0
	Potential for spread of existing infestation of *Phytophthora* via infected machinery and alteration to site hydrology	Unlikely	Substantial	High	F	0
9. Altered fire regimes	Potential localised species extinctions if fire frequencies are too low (or high)	Possible	Major	High	G	0
	Potential invasion of woody species into native grasslands, resulting in reduction of grassland area and localised species extinctions	Likely	Major	Very high	G	0
10. Altered grazing regimes	Potential exclusion of sensitive herbaceous species (including threatened species) if native herbivore grazing is removed	Possible	Major	High	I	0

Impact	Description of nature and extent of impact	Likelihood of impact	Consequence of impact	Significance of impact	Proposed mitigation	Overall significance of impact
11. Erosion and/or sedimentation	Potential damage to retained vegetation through removal of habitat by soil erosion	Possible	Minor	Moderate	K, L	0
	Potential damage to retained vegetation by sedimentation of waterways	Possible	Minor	Moderate	K, L	0
12. Altered surface runoff into waterways	Potential damage to retained vegetation by chemical spills, pollution, etc	Possible	Minor	Moderate	L	0
13. Inhibition of plant photosynthesis and reproductive capability due to dust	Potential short-term impact resulting in reduced growth and seed output in certain species	Possible	Minor	Moderate	L	-
15. Altered hydrology	Potential long-term impact on community structure and composition	Possible	Minimal	Low	None available	-

* Impact will not occur given current works footprint, but may occur if development strays outside this footprint

\# Impact dependent upon presence of threatened species, which has not been found during intensive surveys

[1] Based on TASVEG 1.0 data provided by Sib Corbett (DPIW). It should be noted that bioregional and statewide extent of non-forest EVCs given here is usually a significant underestimate of the actual extent, owing to the scale at which TASVEG mapping has been undertaken (1:25,000). This mapping scale effectively excludes many highly localised non-forest EVCs (particularly ephemeral wetlands) from being mapped at a scale of 1:25,000, consequently resulting in an underestimate of total extent.

NAL *Allocasuarina littoralis* forest

DOV *Eucalyptus ovata* forest and woodland

The quarry site will be rehabilitated in accordance with the Quarry Code of Practice (1999).

Rehabilitation will include:

- The stabilisation of all worked-out areas to minimise ongoing erosion;
- Revegetation of worked-out areas with suitable plant species. Revegetation will include direct seeding, soil spreading; fertiliser application; browsing controls; soil tillage/ripping; spreading of seed slash. Follow up fertiliser; weed control and re-sowing for crop failure.
- Minimisation of visual impacts by retaining the vegetation buffer near the East Tamar Highway and revegetating the benches;
- All worked-out areas will be safe for any future uses;
- Removal of plant and rubbish;
- Levelling of bunds and stockpiles;
- Compacted areas and roads deep ripped;
- Rippable benches recontoured;
- Signage/security around remnant benches;
- Overburden back filled;
- Slope distance less than 30m
- Bench heights reduced to 5 m
- Settling ponds to remain
- Weed identification and control.

12.7.3 Offsets

Offsets are planned to compensate for the proposed loss of 9.1 ha of '*Eucalyptus ovata* forest and woodland' (DOV), which is a state threatened forest community. Gunns has indicated a commitment to reserve and covenant (on title) DOV from within the Gunns' estate in the north-east region of Tasmania, as close as practical to the pulp mill site. A total of three times the area proposed to be cleared (that is 27.3 ha) is proposed to be set aside as an offset. This will then potentially be incorporated into the statewide reserve system. At this stage, offsets have not been finalised, but will be subject to negotiation and approval by DPIW.

12.7.4 Summary of Impacts and Management Measures

A summary of potential impacts, management measures to minimise the impact and a cost/benefit rating related to reserves and protected areas is provided below.

Table 193: Summary of potential impact rating and management measures – terrestrial flora

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Terrestrial Flora				
Loss and fragmentation of native vegetation	Major negative impact	Minimise disturbance and preparation of Vegetation Management Plan	Minor positive impact	Moderate negative impact
	Major negative impact	Rehabilitation of disturbed areas including retention of seed bank	Minor positive impact	Moderate negative impact
Loss or damage to significant flora species	Major negative impact	Minimise disturbance and preparation of Vegetation Management Plan	Minor positive impact	Moderate negative impact
	Major negative impact	Rehabilitation of disturbed areas including retention of seed bank	Minor positive impact	Moderate negative impact
Spread and/or introduction of weeds and pests	Moderate negative impact	Weed Management Strategy and DPIW Interim *Phytophthora cinnamomi* Management Guidelines	Minor positive impact	Minor negative impact
Alteration to fire and grazing regimes	Minor negative impact	Fire management strategy and minimise disruption of native herbivore grazing	Minor positive impact	Insignificant impact
Erosion and sediment	Minor negative impact	Construction EMP	Minor positive impact	Insignificant impact
Impacts from dust and pulp mill emissions	Minor negative impact	Construction EMP	Insignificant impact	Minor negative impact
Altered hydrology	Minor negative impact	Construction EMP	Insignificant impact	Minor negative impact

Overall, based on the management strategies identified and the conservative nature of impact assessment applied, the impact of construction and operation of the pulp mill is considered to be moderate.

12.8 Terrestrial Fauna

Potential impacts and management measures for the landfill, quarry and water reservoir site are included in the fauna assessment of the Bell Bay site, grouped with the pulp mill and wharf sites. Refer to Section 4.10 for details of the fauna assessment for this component.

12.9 Reserves and Protected Areas

No protected areas or reserves will be directly or indirectly impacted by the proposed construction or operation of the landfill, quarry or water reservoir facilities.

12.10 Transport, Traffic and Access

12.10.1 Site access

A gravel access road will be constructed from a junction with the East Tamar Highway to the landfill, quarry and water reservoir site. The proposed alignment of this road is shown in Figure 12-4.

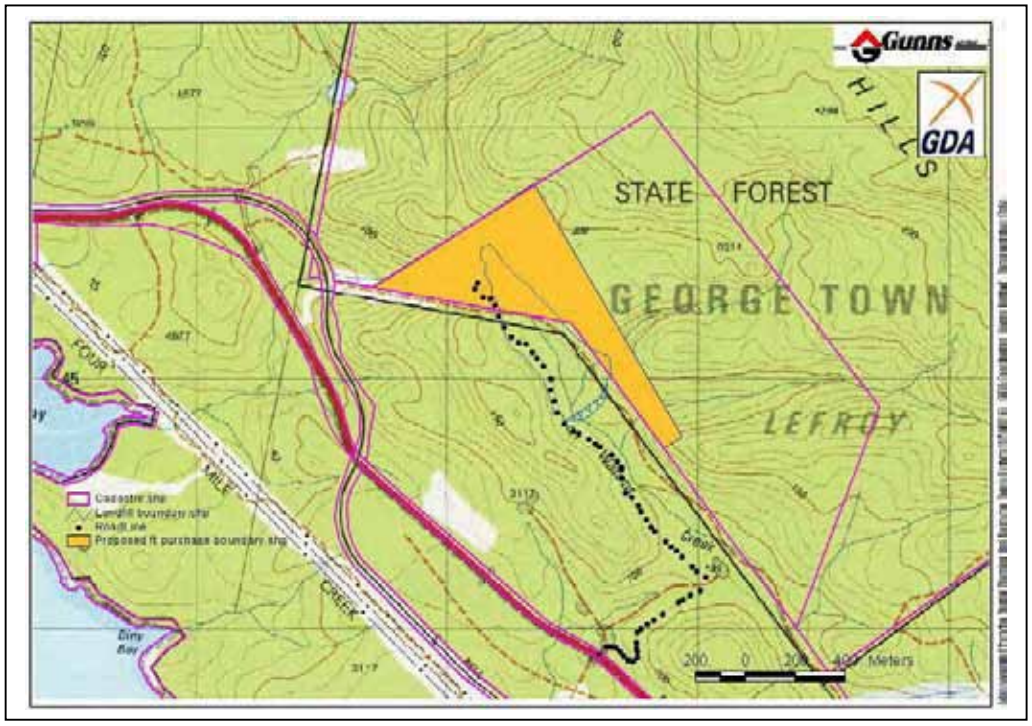

Figure 12-4 Proposed alignment of landfill, quarry and water reservoir access road

An analysis of the junction between the site access road and the East Tamar Highway is provided in Appendix J of Appendix 55, Volume 16.

Access to the proposed landfill/quarry/water reservoir site is located approximately 1.4 km north of the existing woodchip plant access, on the eastern side of the highway. It is also 5.6 km north of the Batman Highway intersection and 7.3 km south of the Bridport Main Road intersection.

The access location has been assessed on the basis of available sight distance for the posted speed limit.

Sight distance was measured in accordance with the criteria contained in the Austroads Guide to Intersections at Grade. For the posted speed limit and design speed of 100 km/h, the Safe Intersection Sight Distance is 250 m.

Available sight distances measured in both directions from the anticipated access location are >300 m north and 265 m south.

Sight distance to the north for southbound traffic could be extended to 340 m with some clearing of overhanging tree foliage. A southbound overtaking lane merges back to a single lane between 340 m and 272 m from the access location.

The DIER Guidelines for Traffic Impact Assessment require that the assessment consider the traffic conditions 10 years after commencement of the development. In this case it is assumed that the projected level of operations will remain static over a 20 year period from commencement. (Landfill traffic levels may be less than this assumption, depending on the extent of beneficial reuse of mill process waste that is achieved).

For the purpose of this assessment, it was assumed that the pulp mill will generate up to 200 tonnes of material to be disposed to landfill per day. The waste material may be transported to the site in a range of trucks with varying capacities. For example, for a single 8 hour shift per day:

- 10 t truck means 20 round trips/day, ie. 2.5 trips/hr, ie. 24 min cycle time
- 15 t truck means 13 round trips/day, ie. 1.6 trips/hr, ie. 38 min cycle time
- 20 t truck means 10 round trips/day, ie. 1.3 trips/hr, ie. 48 min cycle time.

A 24 minute cycle time could be achieved on the route. If the cycle time was slightly longer then either the truck capacity could be increased or a longer shift worked.

Associated activities may add 4 round trips per day for light utility vehicles. If 50% of the associated movements occurred within one hour, the peak hourly movements will be 5 trips per hour in and out of the site.

The critical turning movement at the site is the right turn entry against southbound traffic. Department of Infrastructure, Energy and Resources traffic statistics record the 2004 evening southbound as having a peak of 310 vph (vehicles per hour). The 2025 extrapolated southbound volume is 460 vph.

Because the turning volumes are very small, being approximately 50% of the quantity required for the installation of a type B intersection, no intersection widening works are required by strict interpretation of the guidelines.

However, the primary turning traffic will be relatively slow moving trucks. It will be a lowering of the overall traffic standard of the highway to install a new intersection where northbound traffic were required to pass a right turning truck on the gravel shoulder. Therefore, it is considered that the intersection should be upgraded to the Type B standard due to the nature of the turning and entering traffic.

The location of the new intersection may be varied marginally from the existing access location provided that sight distances are maintained. The critical sight distance is to the north both for trucks turning into the landfill access and for trucks exiting via a left turn.

The traffic to be generated by the transport of waste to the landfill and associated activities has been assessed as less than 5 trips per hour. This provides a 100 % margin to the Type B turning volume threshold and 400 % to the Type C turning volume threshold of 20 turns per hour. Therefore, the resulting access construction will result in an access with a large degree of flexibility should pulp mill operations be altered significantly.

The road will be constructed to meet Class 2 ("Significant feeder road") standards under the Forest Practices Code 2000.

It will be surfaced with an all-weather gravel pavement, having a pavement width of 5.5 m, a 0.6 m shoulder and a maximum gradient of between +8 and –10%. Design, construction, drainage and surfacing will meet the Code's requirements. The target speed limit for the road is 50 kmh.

At the landfill itself, the road will continue along the western side of the landfill, immediately adjacent to the ultimate landfill footprint, and will be a permanent road at least for the life of the landfill. The road will be designed and constructed to allow heavy vehicles to pass.

The road will extend up to a large turning circle at the top of the landfill where the office, amenity block and water storage tanks will be located.

12.10.2 Cell Access Roads

The individual cells will be accessed from the main permanent road by temporary gravel roads into each individual cell as the landfill develops.

The temporary access roads into the individual cells will be constructed to meet Class 4 ("Minor (spur) road") standards under the Forest Practices Code 2000. These roads will be designed for single vehicle access only with no double passing.

The locations of the roads around and into the landfill are indicated schematically in Figure 11-2 and Figure 11-3 and on the conceptual engineering drawings Appendix F of Appendix 55, Volume 16.

The temporary roads into individual cells will be removed and the material reused for the construction of the next cell access road if it has remained fit for that purpose.

The progressive construction of the six upper layer cells will ultimately cover the remnants of all the temporary lower cell layer access roads.

The construction of the proposed landfill, water reservoir and quarry will result in a cumulation of traffic utilising the new access to these components of the pulp mill.

The cumulative traffic generation of these three components will impact on the intersection of the new road with East Tamar Highway, and to a lesser extent, the junction of the existing access road to the Tamar woodchip mill. Both junctions have been assessed as being adequate for this purpose from road capacity and road safety perspectives.

Traffic volume increases will also impact on the East Tamar Highway, however the relatively low traffic volume arising from these construction activities will not have an impact on the level of service of the road.

12.10.3 Quarry

Access to the proposed quarry is via the East Tamar Highway along a gravel roadway situated at the same location as the landfill and water reservoir road. An access road is proposed at the lower end and sides of the two quarry benches.

During periods of peak activity, an estimated 50 truck loads per day will be required to haul the estimated 6,000 cubic metres of rock. The trucks will travel between the quarry and the pulp mill site during the construction phase.

12.10.4 Water Reservoir

Access to the water reservoir site will be required for construction purposes and for occasional maintenance during the operation of the pulp mill. Access to the water reservoir will be via the access roads outlined for both the landfill and quarry.

The construction of the water reservoir will generate a small amount of heavy vehicle and associated traffic.

12.10.5 Management Measures

Management measures for transport, traffic and access include:

- Consultation with DIER
- Comply with Forest Practices Code 2000; and
- Monitoring traffic operations during the early stages of the development to evaluate and amend trucking operations if required.

12.10.6 Summary of Impacts and Management Measures

A summary of potential impacts and management measures on transport, traffic and access, resulting from associated activities with the landfill, quarry and water reservoir, is provided in Table 194.

Table 194: Summary of potential impacts and management measures – transport

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Transport, traffic and access				
New permanent intersection on East Tamar Highway for quarry, landfill and water storage reservoir	Minor negative impact	Consult with DIER. Comply with Forest Practices Code 2000. Monitor traffic operations during the early stages of the development to evaluate and amend trucking operations if required.	Insignificant impact	Minor negative impact

12.11 Noise and Vibration

The three sites (landfill, quarry and water supply reservoir) are located over 3 km from the nearest residence, being those on the western banks of the Tamar River at Rowella. The pulp mill site will be located between the residences and the three sites.

Landfill

Appendix 55, Volume 16 states the location of the site is well away from any residential or other sensitive land use areas, and is largely within the well-established Bell Bay Major Industrial Area. Prevailing winds are from the northwest, which means that the principal noise direction will be into the forested hillside. This will restrict noise propagation.

There will be some temporary construction noise, mainly from earth moving machinery but possibly also from rock breakers. Operational noise will be limited to that from waste delivery trucks and waste spreading machinery. Given the low level of noise likely to be generated from the landfill, and the lack of nearby sensitive land uses, it is not considered likely that there will be any significant noise impacts.

During operation it is proposed initially to operate the landfill on weekdays during normal operating hours. This may change to 12 hours per day, seven days per week when more operating details are available.

Quarry

Blasting for the site will be carried out in accordance with Australian Standard *AS 2187.2 -1993*.

The blasting risk assessment undertaken for the pulp mill site by Orica (Appendix 49, Volume 15) identified three blasting effects (airblast, flyrock, and ground dislocation), which were assessed and considered to be manageable during construction works based on the following:

- Airblast – Orica considered that due to the blasting methods employed and the nature of the structures surrounding the site, airblast would be below levels that may potentially cause damage;

- Flyrock – flyrock resulting from blasting is expected to be contained with the nominated stemming heights. Orica suggest that additional ground cover material may be required in critical areas. A blasting management safety plan will need to be in place for blasting activities; and
- Ground dislocation – Due to the distance between the proposed blasting areas and nearest receivers, ground dislocation was not identified as a significant issue. There are no existing structures close to the quarry site.

The Standard Attenuation Distances in the Draft Quarry Code of Practice (2006) of 1,000 m for blasting, 750 m for crushing 500 m for screening and 300 m for extraction will all be met.

As such, the effects of blasting during quarrying works of the site are not expected to be a significant issue.

Water Reservoir

Noise generated from construction activities will be similar to the landfill component.

The noise source for the water reservoir is a water pump. Due to the nearest sensitive noise receptor being located approximately 4 kilometres from the water reservoir, noise emissions from the operation of the water pump will be insignificant.

12.11.1 Summary of Impacts and Management Measures

A summary of potential impacts, management measures to minimise the impact and a cost/benefit rating related to reserves and protected areas is provided below.

Table 195: Summary of potential impact rating and management measures – noise

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Noise				
Construction Noise	Major negative impact	Environmental Management Plan	Moderate positive impact	Minor negative impact
Operational Noise – Quarry	Moderate negative impact	Noise Management Strategy	Minor positive impact	Minor negative impact

Based on the implementation of the above management strategies, the impact on the noise environment is considered to be minor.

12.12 Visual

12.12.1 Landfill, Quarry and Water Supply Reservoir

All facilities for the landfill, quarry and water supply reservoir are to be located in a narrow valley which runs north-east to south-west parallel to the highway. The centre of the valley is approximately 700 m north-east of the highway. The valley is separated from the highway by a small ridge which rises nearly 50 m above the highway elevation.

The landfill is proposed to be located in the upper end of the valley, the quarry in the middle and the water reservoir further down, with the dam wall to be located in a small saddle.

The development area, particularly the landfill, falls within the Skyline Protection Area as detailed in the George Town Planning Scheme.

The landfill and quarry will be virtually completely shielded from views from the highway as all works will be undertaken below the ridgeline and as such there will be no obvious evidence the facility is located close to the Highway other than the entrance road. Avoiding significant visibility from vantage points was a design prerequisite for the landfill, and a determinant of the final concept design.

The water supply reservoir wall will be constructed within a small saddle approximately 250 m from the highway. One wall will face the highway with a length of 460 m and maximum height of 17 m. That wall will be an earthen wall (Appendix 44, Volume 15) which will span the saddle. The dam wall will consist of an earthen batter at 1:2.5 slope.

The dam wall will be screened by topography and vegetation on the approaches from north and south along the highway. The wall will be visible from the highway immediately adjacent to the dam regardless of the retention of screening vegetation, although all vegetation between the road and wall will minimise exposure and the extent of view modification. Revegetation of the dam wall with grasses will be undertaken (trees and shrubs will not be permitted to grow as they can weaken the structure) to minimise the visual impacts and stabilise the wall from erosion impacts. Given the narrow view to the site, 100 kmh speed limit and proposed construction (earthen dam), it is considered that there will only be very short duration views to the site and that visual impacts will be low.

Based on the above, the works proposed in this area will not significantly alter, or have an adverse impact on the environment, flora and fauna habitats, watercourses, skyline and tree in contravention to the Skyline Protection Area provisions of the George Town Planning Scheme.

12.12.2 Management Measures

- There will be no clearing of vegetation above the ridgeline within the Williams Creek catchment to ensure no visual impacts from the landfill or quarry;
- Retention of all screening vegetation between the Highway and water supply reservoir;
- Stockpiling topsoil from the water supply reservoir for use on the rock embankment for the dam wall so as to allow rehabilitation with grasses and small shrubs where possible.

12.12.3 Summary of Impacts and Management Measures

A summary of potential impacts, management measures to minimise the impact and a cost/benefit rating related to noise and vibration is provided below.

Table 196: Summary of potential impact rating and management measures – visual

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Visual				
Landfill and quarry visible from highway and west of the site	Moderate negative impact	No clearing of vegetation above the ridgeline within the Williams Creek catchment	Minor positive impact	Minor negative impact
Reservoir visible from highway	Moderate negative impact	Retention of screening vegetation	Minor positive impact	Minor negative impact
	Moderate negative impact	Vegetation of reservoir embankment	Minor positive impact	Minor negative impact

Overall, visual impacts of the landfill, quarry and water supply reservoir are considered minor.

12.13 Waste Management

As discussed throughout this Draft IIS, the landfill is required to accommodate process waste generated from the pulp mill.

Waste generated as a result of construction and operation of the landfill, quarry and water reservoir will include:

- Soil;
- vegetation following clearing of the site; and
- Domestic waste from personnel on site.

Overburden resulting from quarry activities will be a temporary “waste” product.

12.13.1 Management Measures

Overburden will be stockpiled for reuse in the rehabilitation phase of the quarry.

Domestic waste during the construction phase will be disposed at Remount or George Town.

12.13.2 Summary of Impacts and Management Measures

A summary of potential impacts and management measures on waste management, resulting from associated activities with the landfill, quarry and water reservoir, is provided in Table 197.

Table 197: Summary of potential impacts and management measures – waste management

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Waste Management				
Disposal of construction waste	Minor negative impact	Overburden to be stockpiled	Minor positive impact	Insignificant impact
	Minor negative impact	Domestic wastes to existing landfill	Minor positive impact	Insignificant impact

Overall, waste management impacts of the landfill, quarry and water supply reservoir are considered minor.

12.14 Aboriginal and Historic Heritage

12.14.1 Aboriginal Heritage

Three site are located within the area proposed for a solid waste disposal site and quarry (TASI 7485, 7486 and 7487). The three sites will be directly impacted.

TASI 7485, 7486, 7487

These sites are recorded as artefact scatters, located within the area to be developed for the solid waste disposal site. Only one isolated artefact has been located by a representative of the Aboriginal Heritage Office (DTAE) at the recorded locality of these sites, previous searching of the area failed to locate any evidence of the sites (Stone and Stanton 2006).

TASI 10003, 10009

These sites are located in the vicinity, but outside the area to be developed. No impacts on these sites are anticipated.

12.14.2 Historic Heritage

One site of Historic Heritage Significance has been identified within the area to be developed for the local water reservoir: the Williams Creek Fence Posts.

12.14.3 Management Measures

The following management measures were developed in consultation with the Aboriginal Heritage Office (DTAE), the Tasmanian Aboriginal Land and Sea Council and Office of Aboriginal Affairs.

A Cultural Heritage Management Plan will be prepared prior to the construction phase for the management of Aboriginal and historic heritage sites.

Aboriginal Heritage

The area containing sites TASI 7485, 7486 and 7487 will be searched thoroughly in a final attempt to locate the sites. A permit to relocate will be required. Relocated artefacts will be moved to the adjacent permanent reserve area to the north of the current locality. Ministerial permission will be sought under the *Aboriginal Relics Act 1975* for a suitably skilled and experienced Aboriginal Heritage Officer to relocate these artefacts to a culturally appropriate, alternative site.

If the artefacts are unable to be located, a permit to destroy the sites will be required.

The areas containing the sites TASI 10003 and 10009 will be maintained as restricted areas, ensuring no accidental damage to sites.

Historic Heritage

As the Williams Creek Fence Posts were identified as having minimal significance, no recommendations were made for management. All three components of this site are located within the area to be cleared and inundated for the local water reservoir. Further work is currently being undertaken to determine if any additional management requirements, including potential salvage, are required.

Cultural Heritage Management Plan

A Cultural Heritage Management Plan will be prepared prior to the construction phase for the management of both Aboriginal and historic heritage sites.

The following procedure will be incorporated into the Cultural Heritage Management Plan, for the event that further Aboriginal or historic heritage sites are located during clearing and construction activities.

- cease works immediately;
- contact Heritage Tasmania immediately;
- assess the significance of the site utilising an appropriately qualified specialist;
- arranging a site visit for a staff member of Heritage Tasmania, if necessary, to determine the significance of the site; and
- depending on the significance, determining appropriate actions with regard the continuation of works, including, as appropriate, approval from the Tasmanian Heritage Council.

All site specific management prescriptions and clear indication of the location of sites will be incorporated into the Cultural Heritage Management Plan.

12.14.4 Summary of Impacts and Management Measures

A summary of potential impacts and management measures on heritage, resulting from associated activities with the landfill, quarry and water reservoir, is provided in Table 198.

Table 198: Summary of potential impacts and management measures – Aboriginal and historic heritage

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Aboriginal and Historic Heritage				
TASI 7485, 7486 and 7487 will be directly impacted	Minor negative impact	Seek permits to relocate these artefacts	Minor positive impact	Insignificant impact
Impacts on TASI 10003 and 10009	Minor negative impact	These sites will be maintained as restricted areas	Minor positive impact	Insignificant impact

Overall, impacts on Aboriginal and historic heritage are considered to be minor.

12.15 Risk Assessment

Landfill

A hazard analysis of the conceptual design has been undertaken in accordance with AS/NZS 4360 Risk Management (Australian/New Zealand Standard *4360:2004 Risk Management)* methodology.

The hazard analysis matrix for the landfill is provided in Appendix 55, Volume 16. In that matrix, the aspects considered are consistent with those identified in the acceptable standards of the *DPIWE Landfill Sustainability Guide*.

For each aspect, an inherent risk was initially determined and then management measures were applied to reduce that to a net risk.

The assessed net risk of the conceptual landfill design is low for most aspects and assessed as moderate in a few.

This overall level of risk is therefore concluded to be readily acceptable by all reasonable standards, including those specified in the *DPIWE Landfill Sustainability Guide*.

Quarry

Blasting for the site will be carried out in accordance with Australian Standard *AS 2187.2 -1993*.

The blasting risk assessment undertaken for the pulp mill site by Orica (Appendix 49, Volume 15) identified three blasting effects (airblast, flyrock, and ground dislocation), which were assessed and considered to be manageable during construction works based on the following:

- Airblast – Orica considered that due to the blasting methods employed and the nature of the structures surrounding the site, airblast would be below levels that may potentially cause damage;
- Flyrock – flyrock resulting from blasting is expected to be contained with the nominated stemming heights. Orica suggest that additional ground cover material may be required in critical areas. A blasting management safety plan will need to be in place for blasting activities; and
- Ground dislocation – Due to the distance between the proposed blasting areas and nearest receivers, ground dislocation was not identified as a significant issue. There are no existing structures close to the quarry site.

The Standard Attenuation Distances in the Draft Quarry Code of Practice (2006) of 1,000 m for blasting, 750 m for crushing 500 m for screening and 300 m for extraction will all be met.

Expolosives will be stored on site during site preparation. The storage of explosives on the site will be in licensed magazines which will comply with AS 2187.1-1998 and AS 2187.2-2006. Any Transport of explosives on public roads will comply with the *Dangerous Substances (Safe Handling) Act 2005, Dangerous Substances (Safe Transport) Act 1998,* the Dangerous Goods (Road and Rail Transport) Regulations 1998 and the Australian Code for the Transport of Explosives by Road and Rail.

Given the extensive buffer distances, management of blasting activities, explosives and transport, the overall level of risk is considered to be acceptable.

Water Reservoir

A secure and reliable water supply is fundamental to the operation of the pulp mill. It is proposed to provide onsite storage near the mill.

A preliminary assessment of the consequences of failure of the local site storage was undertaken as part of the water supply study (GHD, 2006e). This preliminary assessment identified that the following key issues will relate to the likely hazard category of this proposed dam:

1. potential flooding of the East Tamar Highway, which is runs parallel to the proposed dam embankment, some 200 m downstream of the toe;
2. potential flooding of the pulp mill site;
3. potential flooding of the Bell Bay Rail Line; and
4. potential flooding of the major overhead power transmission lines.

The preliminary assessment of the consequences of dam failure suggested that there is a population at risk of between 11 and 100 persons and, in accordance with Appendix D of ANCOLD Guidelines on Assessment of Consequences of Dam Failure, the likely damage and loss will be Major. This indicates that the dam is likely to be assigned a hazard category of High B. Accordingly, this dam will be designed to meet appropriate standards to ensure any such risks are minimised.

Site Storage Spillway Design

A desktop assessment of the likely spillway design flow was undertaken using Sections 4 and 6 and Bulletin 53 of Australian Rainfall and Runoff. This process uses statistical data from throughout Australia to develop predicted rainfall events for various critical durations and recurrence intervals.

The key assumptions for this assessment included:

1. calculation of the critical storm duration using the Bransby Williams formula (Australian Rainfall and Runoff, Volume 1, Section 1.3.2);
2. use of the approximate formulas in Table 9, Section 6 of Australian Rainfall and Runoff to determine the storm intensity; and
3. adoption of a blanket coefficient of runoff of 0.9 for the entire catchment (assuming the catchment was supersaturated during the storm event).

The recurrent interval storm was set at the Probable Maximum Precipitation (PMP) in accordance with an estimated population at risk of 10 to 100 and a severity of damage of Major.

The spillway will consist of a 5 m wide concrete lined channel. This means that the maximum water level over the spillway for the PMP storm event will be 0.8 m.

Determination of Reservoir Wave Height

The reservoir wave height was determined in accordance with ANCOLD guidelines. The wave run-up freeboard requirement is 0.6 m using an 85 kmh design wind speed (or 1 in 1,000 year return period). Wave set-up was also computed for a 1 in 1,000 year event, however it is below 10 mm and consequently was disregarded in calculations.

12.16 Summary of Triple Bottom Line Approach

A summary of the potential impacts and management measures is during construction and operation of the landfill, quarry and water reservoir is provided below.

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Planning and Land Use				
Landfill not all located within the Bell Bay Industrial Zone	Minor negative impact	Planning Scheme amendment	Minor positive impact	Insignificant impact
To meet the requirements of Use and Development Principles	Minor negative impact	Environmental Management Plans and specific sub-plans such as vegetation management, landscaping etc.	Minor positive impact	Insignificant impact
Impact on the Skyline Protection Area	Minor negative impact	No clearing or infrastructure located above ridge crests	Minor positive impact	Insignificant impact
Infrastructure and Services				
Construction of a new transmission line will traverse a high voltage transmission line, East Tamar Rail link and East Tamar Highway. Temporary disruption to service supply.	Moderate negative impact	Consider overhead and underground options. Method to be determined in the detailed design phase. Liase with relevant services providers. Advise service users of any temporary disruptions.	Minor positive impact	Minor negative impact
Topography, Climate and Meteorology				
Localised physical impacts on the topography resulting from excavation	Minor negative impact	Clearly mark areas to be excavated to minimise accidental disturbance.	Minor positive impact	Insignificant impact
Exposure of surfaces	Minor negative impact	Rehabilitation	Minor positive impact	Insignificant impact
Changes to site topography	Minor negative impact	Rehabilitate the landfill and quarry areas.	Minor positive impact	Insignificant impact
	Minor negative impact	Prepare a rehabilitation plan in accordance with the Quarry Code of Practice	Minor positive impact	Insignificant impact
	Minor negative impact	Prepare and landfill rehabilitation plan.	Minor positive impact	Insignificant impact

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Air Quality				
Generation of dust and odour	Minor negative impact	Cover loaded trucks carrying fine particulate matter	Minor positive impact	Insignificant impact
	Minor negative impact	Hydrate wastes	Minor positive impact	Insignificant impact
	Minor negative impact	Wet and cover domestic waste when required	Minor positive impact	Insignificant impact
	Minor negative impact	Spray waste in the landfill	Minor positive impact	Insignificant impact
	Minor negative impact	Spray unsealed haul roads	Minor positive impact	Insignificant impact
Generation of fuel emissions	Minor negative impact	Use equipment that is regularly serviced	Minor positive impact	Insignificant impact
Geology and Soils				
Erosion and sediment transport to Williams Creek	Moderate negative Impact	Erosion and Sediment Control Plan	Minor positive Impact	Minor negative Impact
Groundwater and Hydrology				
Contamination of groundwater from the landfill	Major negative Impact	Geosynthetic clay liner and an HDPE membrane liner	Moderate positive impact	Minor negative impact
	Major negative Impact	Exclusion of hazardous materials from the landfill	Moderate positive impact	Minor negative impact
Interception and diversions of flows to Williams Creek	Moderate negative Impact	Diversion of flows around landfill	Minor positive Impact	Minor negative Impact
Contaminated stormwater entering Williams Creek	Moderate negative Impact	Diversion of potentially contaminated flows and storage on site	Minor positive Impact	Minor negative Impact
Erosion and sedimentation of Williams Creek from landfill	Moderate negative Impact	Erosion and Sediment Control Plan	Minor positive Impact	Minor negative Impact

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Terrestrial Flora				
Loss and fragmentation of native vegetation	Major negative impact	Minimise disturbance and preparation of Vegetation Management Plan	Minor positive impact	Moderate negative impact
	Major negative impact	Rehabilitation of disturbed areas including retention of seed bank	Minor positive impact	Moderate negative impact
Loss or damage to significant flora species	Major negative impact	Minimise disturbance and preparation of Vegetation Management Plan	Minor positive impact	Moderate negative impact
	Major negative impact	Rehabilitation of disturbed areas including retention of seed bank	Minor positive impact	Moderate negative impact
Spread and/or introduction of weeds and pests	Moderate negative impact	Weed Management Strategy and DPIW Interim *Phytophthora cinnamomi* Management Guidelines	Minor positive impact	Minor negative impact
Alteration to fire and grazing regimes	Minor negative impact	Fire management strategy and minimise disruption of native herbivore grazing	Minor positive impact	Insignificant impact
Erosion and sediment	Minor negative impact	Construction EMP	Minor positive impact	Insignificant impact
Impacts from dust and pulp mill emissions	Minor negative impact	Construction EMP	Insignificant impact	Minor negative impact
Altered hydrology	Minor negative impact	Construction EMP	Insignificant impact	Minor negative impact
Transport, traffic and access				
New permanent intersection on East Tamar Highway for quarry, landfill and water storage reservoir	Minor negative impact	Consult with DIER. Comply with Forest Practices Code 2000. Monitor traffic operations during the early stages of the development to evaluate and amend trucking operations if required.	Insignificant impact	Minor negative impact
Noise				
Construction Noise	Major negative impact	Environmental Management Plan	Moderate positive impact	Minor negative impact

Potential Impact	Potential Impact Rating	Proposed Management	Management Impact	Overall Rating
Operational Noise – Quarry	Moderate negative impact	Noise Management Strategy	Minor positive impact	Minor negative impact
Visual				
Landfill and quarry visible from highway and west of the site	Moderate negative impact	No clearing of vegetation above the ridgeline within the Williams Creek catchment	Minor positive impact	Minor negative impact
Reservoir visible from highway	Moderate negative impact	Retention of screening vegetation	Minor positive impact	Minor negative impact
	Moderate negative impact	Vegetation of reservoir embankment	Minor positive impact	Minor negative impact
Waste Management				
Disposal of construction waste	Minor negative impact	Overburden to be stockpiled	Minor positive impact	Insignificant impact
	Minor negative impact	Domestic wastes to existing landfill	Minor positive impact	Insignificant impact
Aboriginal and Historic Heritage				
TASI 7485, 7486 and 7487 will be directly impacted	Minor negative impact	Seek permits to relocate these artefacts	Minor positive impact	Insignificant impact
Impacts on TASI 10003 and 10009	Minor negative impact	These sites will be maintained as restricted areas	Minor positive impact	Insignificant impact