3.6 High Priority Waterways and Wetlands

Waterways and wetlands of highest community value usually exhibit one or more of the following characteristics;

- recognised heritage value;
- have reaches that are associated with significant wetlands;
- classified as environmental sites of significance;
- have reaches that are considered to represent major river classes or types that occur in Victoria; and
- have reaches that are classified as having an overall environmental significance, social value and economic value (GBRHS, 2005).

The *Regional River Health Strategy* (GBRHS, 2005) identifies a number of High Priority Reaches within the Goulburn Broken catchment. These include rivers that are "of greatest value to the community", and rivers that are currently "ecologically healthy". For the Strategy, reaches of the highest community value in the Goulburn Broken Catchment are identified as (GBRHS, 2005):

- Heritage Rivers;
- Reaches associated with International or Nationally significant wetlands;
- Reaches classified as Environmental Sites of Significance;
- Regional Representative Rivers;
- Reaches with records of water-dependant nationally listed endangered flora and fauna species located within 100m of the watercourse;
- Reaches classified as having very high overall environmental significance;
- Reaches classified as having very high overall social value; and
- Reaches classified as having very high overall economic value.

No high priority/ecologically significant wetlands have been identified and no RAMSAR wetlands are listed within the pipeline corridor. However, wetlands of local significance may exist within the corridor. An example of such a site is the Yea Wetlands, which are located north of Yea.

3.7 Existing Water Users

3.7.1 General

Water is currently extracted from streams and used for irrigation, filling of on and off-stream storages, urban, industrial, stock and domestic purposes. A summary of the total number of licences and total licence volume along the corridor is provided in Table 4 below. These licences need to be taken into account when determining the location and type of waterway crossings.

- **Table 4 – Summary of Number and Volumes of Current Licences in waterways along the corridor (SKM, 2007a)**

Type		Number	Volume (ML)
Total Number of Licences		296	5 070
Irrigation		54	1 588
Stock and Domestic		145	312
Commercial and Industrial		11	82
Irrigation (winterfill condition)	On-stream	3	176
	Off-stream	4	1 351
Registered Farm Dams		79	1 561
Total Number of Licences		**296**	**5 070**

3.7.2 Yea River Catchment

The majority of the water (by volume) is extracted in the lower and middle reaches/catchments. In the lower reaches of the Yea River (downstream of the confluence with the Murrindindi River), there are 86 licence holders with a total licence volume of 1,478ML (SKM, 2006). Of this total, there are 661ML in licences for off-stream winterfill storages. Goulburn Valley Water also diverts water in this reach to supply the township of Yea with an average historical demand of about 230ML/a.

In the middle reaches of the Yea River (between Mountain Creek and Devlins Bridge), there are 68 licence holders with a total licence volume of 1,068ML. This volume includes 615ML of registered farm dams and 176ML of on-stream winterfill licences.

3.7.3 Steels and Dixon Creek Catchment

Water used in the Steels Creek catchment is generally for the filling of on and off-stream storages. There are 4 licence holders in the catchment with a total licence volume of 320ML. An additional 260ML is allocated for un-licensed farm dams. There are no domestic and stock licences in this catchment. It is also worth noting that a stretch of the creek flows through a small urbanised area at the township of Yarra Glen.

There are 7 diversion licence holders in the Dixons Creek catchment with a total licence volume of 211ML comprising 209ML allocated for on and off stream dam filling and 2ML allocated for domestic and stock use.

The majority of water use in the Steels and Dixon Creek catchments is in the middle and lower reaches (i.e. downstream of the proposed pipeline works) with the most common use being for viticulture and small areas of orchard, market gardens, pasture and turf (SKM, 2003).

3.7.4 Sustainable Diversion Limits and Index of Stream Condition

Sustainable Diversion Limits (SDLs) have been developed across Victoria and represent the upper limit on winterfill water use diversions, beyond which there is an unacceptable risk that additional extractions may degrade the environment. The SDLs for the Yea, Steels and Dixons Creek catchments are summarised below in Table 5.

- **Table 5 – Summary of Sustainable Diversion Limits**

Catchment	SDL (ML)	Total Use (ML)
Yea River	17,022	2,476
Steels Creek	648	968
Dixons Creek	266	476

The SDL estimates show that the Yea River catchment is currently under allocated whilst total use in Steels and Dixons Creeks currently exceeds the SDL. This indicates that the in-stream ecology of Steels and Dixons Creek may be particularly susceptible to any reductions in flow.

The Index of Stream Condition (ISC) is an integrated tool for catchment management that assists in setting management objectives and measures the effectiveness of long term management programs for rivers (DSE, ISC). The ISC measures the key river health attributes of hydrology, water quality, streamside zone (vegetation), bed and bank condition and instream habitat, and aquatic life. The environmental condition of streams is assessed as Excellent, Good, Moderate, Poor, Very Poor and a value out of 50 assigned. The Yea River has an ISC of Moderate to Good, and Dixons Creek has an ISC of Poor. The poor result is due to a combination of factors including changed river flows, poor water quality, poor condition of river bank land, changes to the river channel and reduced habitat (DSE, River Health Website, 2007). For the Yea River ISC, any stress from works carried out would have a greater impact on the overall condition of the stream than Dixons Creek which has a poorer ISC. However, the ISC identifies river conditions and therefore all changes to river health attributes are only acceptable if managed properly.

3.7.5 Other Relevant Flow Studies

Environmental Flow Studies

Environmental flow assessments are used to estimate the quantity and timing of flows to sustain identified aquatic values. Environmental flow studies have been completed for the Yea River catchment (SKM, 2000) and the Steels and Dixons Creek catchments (Doeg, 2004). Both studies have recommended minimum flow regimes be maintained in the rivers systems to sustain overall river health.

Streamflow Management Plans

Streamflow Management Plans aim to provide balanced and sustainable sharing of streamflow between water users in un-regulated catchments (DPI, 2007). Streamflow Management Plans are currently being prepared by Melbourne Water for the Yea River, Steels Creek and Dixons Creek catchments.

3.7.6 Summary

Following confirmation of the pipeline alignment, further work will be required to confirm the total number of licences and total licence volumes of irrigators and domestic users in streams downstream of the pipeline alignment. This data will be sought from G-MW to locate these water users and improve the understanding of the potential impacts on these customers in order to develop appropriate mitigation and management strategies.

In hydrological terms, the Yea River is in relatively good condition with streamflows maintaining high levels of natural seasonal variability (ISC of Moderate to Good). While diversions in this catchment are relatively low, there are multiple licence holders along the route of the river (SKM, 2006).

The Steels and Dixons Creeks have experienced higher levels of development and are generally in poorer (hydrological) condition (with an ISC of Poor). Further impacts on flows regimes should therefore be avoided, particularly in relation to summer flows as the most common use for water is for viticulture and small areas of orchard, market gardens, pasture and turf (SKM, 2003). Also the Sustainable Diversion Limits (SDLs) values estimate the Yea River catchment is currently under allocated whilst total use in Steels and Dixons Creeks currently exceeds the SDL.

3.8 Hydrology management and mitigation measures

3.8.1 Floodplain Management

Design flood levels have been obtained for key sites in the lower Yea River and Goulburn River catchments. There are significant areas of land within the pipeline corridor that are not subject to flooding and therefore the pipeline project is unlikely to have any on-going long term impacts on regional flooding. Flood risks during construction will be an issue requiring specific planning, particularly at stream crossings. Further consultation is required with the GBCMA to address specific design issues associated with the siting of the pump station and associated details for the suction line that will be constructed on the Goulburn River.

3.8.2 Waterway Management

Following selection of the preferred pipeline alignment, further investigations are required to assess likely impacts and to select appropriate methods for crossing waterways which minimise overall impacts. These further investigative works will include:

- Summary of land use and topography of the catchment and study area;
- Catchment area and hydraulic characteristics of each crossing location;
- Assess rainfall records and identify preferred construction periods as there will be a need to assess local rainfall data to determine the appropriate timing of construction works i.e. to ensure that works occur when favourable weather conditions prevail;

- Requirements of any existing local catchment management plans;
- Identify and assess waterway crossing locations, preferred crossing method and heavy vehicle access requirements;
- Determine the potential for erosion at each waterway crossing site and erosion mitigation measures required; and
- Lodge applications for works on waterway approval with Goulburn Broken CMA and Melbourne Water once a final pipeline alignment has been determined.

3.8.3 Existing Users

Impacts on summer flows and impacts on water quality are the main areas requiring specific consideration during further investigations. Further information is required on:

- The impacts on streamflow associated with dewatering, which will be assessed in conjunction with the detailed hydrogeological assessments, that will provide estimates of the period of drawdown and drawdown depths enabling changes in baseflow volumes to be estimated;
- The location of existing water users downstream of the pipeline corridor, which will be confirmed from customer records provided by GMW; and
- The types/purposes of water use and the assessment of associated risks resulting from changes to flow regimes and water quality, involving a detailed assessment of water use on individual properties to confirm specific water use needs and characteristics, including timing, volume, and water quality requirements.

Table 6 – Mitigation and Management Measures

Potential Impacts	Mitigation and Management Measures	Relevant Project Phase		
		Pre-construction	Construction	Operation
Streamflow regime seasonal variability	Assess stream flow seasonal variability of waterway crossings. Rainfall data is required Pipe to be constructed during dry months	✓	✓	
Downstream Users	Further information required on potential disruption of water supply or water quality to downstream users	✓		
Impacts of Sugarloaf Pipeline on Melbourne Supply and its catchments	Manage supply from Eildon into Melbourne supply by implementing operational constraints to avoid spillage of storage			✓

Issues on diversion of flows within and outside the irrigation season	Assess flow regime when diverting flows during and outside irrigation season Create acceptable operational and environmental flow regimes to manage irrigation diversions	✓		✓

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4. Waterway Crossings

This chapter focuses specifically on the waterways within the identified study area and likely issues that will need to be considered where the Sugarloaf Pipeline Projects intersects these waterways. It should be noted that this assessment is only, as the alignment is yet to be confirmed. This report also draws upon the findings from the Geomorphology Report.

4.1 Objectives

The objective of these investigations is to determine the likely issues that will be encountered with crossing waterways, the process that will need to be followed in order to obtain the appropriate approvals and general requirements for inclusion in the forthcoming design phase. Specifically, it addresses the following:

- Identification of relevant legislation in relation to 'designated' waterways affected by the proposed works. Determination of stakeholder requirements including CMA's, DSE, relevant EPA guidelines;
- Works on Waterways Approvals;
- Waterway crossing techniques for utilities and services;
- Waterway crossing requirements; and
- Summarises the general features of waterways and floodplains in the study area.

Waterway investigations report on locations where one of the preferred alignments crosses a watercourse and these crossing points could be assessed from the adjacent road reserve.

4.2 Methodology

4.2.1 Desktop Review

A desktop review of waterway crossings and permit requirements was completed on the 20th September 2007. In assembling this document the following sources were reviewed:

- Guidelines for Approval to Carry Out Works on a Waterway, GBCMA;
- Service Crossing, Works on Waterways Notes No. 6, GBCMA;
- General Conditions for Waterway Crossings by Pipe/Cables by Utility and Public Authorities Where No Deviation of Waterways is Involved, GBCMA;
- Guidelines for the Protection of Water Quality, North East Planning Referrals Committee;
- Pipeline Crossing Requirements within a Melbourne Water Reserve;
- Utility Installation near Melbourne Water Assets;
- Planting Near Sewers, Drains and Water Mains, Melbourne Water;
- Medium Creek Crossing – Service Crossing – Open Trench, Melbourne Water;

4.2.2 Identification of Waterway Crossings

The location of waterway crossings was determined using a GIS to determine where the pipeline will intersect waterways. Water crossings were therefore distinguished as points where the drainage network is crossed by one of the proposed pipeline alignments. This was based on the corridor options put forward by the Design team (dated 3 October 2007). In total, this resulted in the identification of 187 waterway crossings. The location of these waterway crossings is indicated on a series of maps presented in Appendix A.

4.2.3 Waterway inspections

Site inspections were completed over a seven day period (15 - 18 October, 4 - 6 December 2007) to assess the condition of the waterways crossed by the different alignments. These site inspections were carried out by a team of engineers and geomorphologists. The majority of the waterway crossings could be inspected from road reserves. Field inspections were focused on determining the preferred waterway crossing technique and assessing the stability of the waterway. Factors considered in the watercourse assessment included overall dimensions of the channel and floodplain, stability of bed and banks, type and quality of riparian vegetation, in-stream condition, environmental/civil assets to be protected and foreseeable impact of construction works and accessibility. Photo and GPS locations of key features were recorded with the aid of a Trimble GeoExplorer handheld system. Hardcopies of these sheets were also filled out in the field.

4.2.4 GIS compilation

Data collected in the field is currently being uploaded into a GIS dataset. This is seen as an important tool for communicating the details of each watercourse to the EIS team, the design team and the respective CMA's. Photographs of each watercourse crossing will be linked to each inspection location within the GIS dataset.

4.2.5 Waterway Summaries

While detailed assessments will be made available for each of the waterway crossings in the GIS environment, in reporting on this work, it was recognised assessments need to be made about the different types of waterways that are intersected by the proposed pipeline alignments, their geomorphological stability and preferred crossing techniques. At the location of proposed pipeline crossing locations, each waterway has been classified by class/reach types. Classifications include unchannelled hillslopes; gullied hillslopes; confined headwater; confined upland; unchannelled valley fill; meandering; and anastomosing (with reference to Table 7). The condition of these waterways, by these grouping is described in Section 4.3. Where the waterway crossing falls on a 'designated waterway', the number of the designated waterway is also presented. Of these 144 waterway crossings assessed to date, 59 occur on designated waterways. Should the final alignment of the pipeline intersect with these designated waterways, approval will need to be sought from both Goulburn Broken CMA and Melbourne Water (on behalf of Port Phillip and Westernport CMA) for works on these waterways.

- **Table 7 – Reach types (adapted from MDBC 2004; SKM 2005).**

Functional zone	Reach type	Reach Character					
		Floodplain	Floodplain features	Channel Planform	Streampower	Bed slope	Sediment transport
Hillslopes	**Unchannelled hillslopes**	No floodplain	N/A	N/A	Low	Steep	Varied
	Gullied hillslopes	No floodplain	N/A	Sinuosity = 1	Very high	Steep	Highly mobile source area
Confined	**Headwater**	No floodplain	N/A	Sinuosity ≤ 1.2	Very high	Steep	Mobile transport zone
	Upland	No floodplain	N/A	Sinuosity ≤ 1.2	High	Steep	Mobile transport zone
	Gorge	No floodplain	N/A	Sinuosity ≤ 1.2	High	Steep	Mobile transport zone
Unconfined	**Unchannelled valley fill**	Relatively narrow floodplain, often swampy	No defined channel	N/A	Low	Low	Deposition
	Partially confined	Floodplain on one or alternate sides	Alluvial flats floodrunners	Sinuosity = 1.4 – 1.6	Moderate	Moderate	Mobile transport zone Deposition of larger particles
	Meandering	Extensive floodplain on both sides of the river	Terraces, former channels, flood-runners, avulsions	Sinuosity ≥ 1.5	Moderate/low	Low	Mobile transport zone Deposition of finer particles
	Anastomosing	Multiple channels with permanent islands	Terraces, former channels, flood-runners, avulsions	Highly variable	Moderate	Low	Deposition

4.3 Existing Conditions

4.3.1 Waterways in the study area

Assessment of available aerial imagery and VicMap 25k datasets confirms that a large number of waterways exist within the identified study area and vary from minor (first order) streams to major waterways such as the Goulburn River, Yea River, Dixons Creek etc.

The waterways in the study area have been categorised as either minor or major waterways. Minor waterways are those that are unnamed on the VicMap 25k dataset, and major waterways are those that are named on the VicMap 25k dataset. As a general rule, the major waterways in the study area are those that have a well defined top of bank, have a well vegetated riparian zone and flow regularly throughout the year.

For the alignment options being considered, it is estimated that there are approximately 187 waterway crossing points. Of these, there are 24 major or named waterways that have been identified within the current study area. These include:

▪ Goulburn River	▪ Yea River
▪ Ross Creek	▪ Ewing Creek
▪ Limestone Creek	▪ Triangle Creek (also Sawpit Gully Creek)
▪ Tea Tree Creek	▪ Rellimeiggam Creek
▪ Caraman Creek	▪ Break Oday Creek
▪ Kalatha Creek	▪ Woolshed Creek
▪ Katy Creek	▪ Eagle Nest Creek
▪ Wee Creek	▪ Captain Creek
▪ Mountain Creek	▪ Campbell Creek
▪ Dixons Creek	▪ Steels Creek
▪ Dry Creek	▪ Jehosaphat Creek
▪ Maroondah Aqueduct	▪ Sugarloaf Creek

4.3.2 Waterway summaries

The following descriptions are summaries of the different waterways that are intersected by the proposed pipeline alignments. Particular emphasis is given to their geomorphological stability and preferred crossing techniques. The tables accompanying each description provide summaries of each of these waterway classes, broken down by waterway name, land system, waterway crossing number and identified risks. The location of each of the waterway crossing points is shown on the maps provided in Appendix A.

Unchannelled hillslopes

In the highest parts of the catchment, flow is conveyed in unchannelled hillslope hollows. Here, erosion occurs by sheetwash, mass movement (soil creep and landslides) or rilling. Rills are