Ripley Valley Urban Core

Engineering Report

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Prepared for

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Executive Summary

The Queensland Government have identified the Ripley Valley as one of the key areas for population growth in South East Queensland over the next 20 years. Located 15 minutes drive from the Ipswich Central Business District and 40 minutes drive from Brisbane, Ripley Valley was identified in the South East Queensland Regional Plan 2009-2031 as a key Regional Development Area. Of strategic importance is the site's location in relation to major employment/ economic nodes. Swanbank/ New Chum Enterprise Park, Bremer Business Park, Amberley, Ebenezer/ Willowbank Industrial Park and Ipswich CBD will be the key focus of employment for the Ripley Valley community which is anticipated to provide in the vicinity of 55,000 new dwellings for a population of 120,000.

This report has been prepared on behalf of Sekisui House Australia Pty Ltd (SHA) to support the application for Material Change of Use (MCU) over the land within the Ripley Valley Urban Core. As part of this application a Context Plan for the Ripley Urban Core has been developed. Although SHA do not currently own all the land within the Urban Core, to facilitate a comprehensive approach to the preparation of a Context Plan, all properties within the Urban Core have been considered in this report.

The Context Plan for development has been prepared by Hames Sharley in association with a core consultant team. Extensive reporting has previously been carried out for most key aspects of the Ripley Valley development and in most cases the findings of these reports remain relevant to the current state of development. These reports have therefore been referenced where appropriate in this report. It has been noted where further investigation is required.

This report looks at the following environmental and engineering aspects of development

- Topography
- Geotechnical
- Mining
- Environmental
- Contaminated Land
- Cultural Heritage
- Flooding
- Earthworks
- Erosion and Sediment Control & Dispersive Soils
- Stormwater Drainage Quantity
- Stormwater Drainage Quality
- Water Supply
- Alternate Water Sources
- Sewage Infrastructure
- Power and Telecommunications
- Gas
- Street and Movement Networks
- Transport Corridor
- Pedestrian and Cycle Network

Key constraints to development have been identified in this report such as

- Mine related undermining of a small area in a north-east section of the site;
- Possible areas of contaminated land;
- Dispersive soils;
- Bundamba Creek environmental corridor;
- Water quality in downstream receiving waters; and

- Flood levels in downstream receiving waters.

Principles have been established and strategies proposed within the report so that all of the identified constraints can be suitably addressed to mitigate any impact on the environment and adjoining landowners.

Infrastructure is either available or can be provided such that development can proceed in a timely, orderly, integrated and coordinated manner.

This report concludes that

- the Context Plan is based on sound engineering and environmental principles;
- the development proposed complies with the requirements of the strategic plan for the Ripley Valley UDA area; and
- the proposal can be developed in such a way that it complies with the guidelines and policies of the ULDA and the ICC.

Development of the Urban Core as identified in the Context Plan should be endorsed by the ULDA and ICC as the appropriate development strategy for the area.

1.0 Introduction

Ripley has been identified by the Queensland Government as one of the key areas for population growth in South East Queensland over the next 20 years. It is located approximately 6 kilometres south east of the Ipswich CBD. Identified in the South East Queensland Regional Plan 2009-2031 as a Regional Development Area, Ripley is anticipated to provide in the vicinity of 55,000 new dwellings for a population of 120,000. Swanbank Industrial Park is located immediately to the east of the development site. The development area is close to major employment areas and offers opportunities for significant residential growth. A location plan for the development is included in Appendix A for reference.

Sekisui House Australia Pty Ltd (SHA) is a major land holder within Ripley, owning approximately 173 developable hectares including the primary town centre. The focus of this report is the area defined as the 'Urban Core' generally as shown in Appendix A for reference. SHA currently do not own all the land within the Urban Core, however all properties within the urban Core have been considered in this report to enable a Context Plan to be developed which ensures the timely, orderly, integrated, sustainable and coordinated development of the area,

1.1 Context Plan

The Context Plan for development of the Urban Core has been prepared by Hames Sharley in association with a core consultant team comprising:

- Town Planning – Hames Sharley;
- Engineering & Environmental – AECOM Australia Pty Ltd;
- Statutory Planning – Landpartners Pty Ltd;
- Landscape Planning – Hassell Pty Ltd; and
- Land Economics – Pracsys Pty Ltd.

As noted previously, the focus of the Context Plan was defined by the extent of the Urban Core. This area is influenced by existing and proposed major infrastructure elements such as Cunningham Highway to the north; Centenary Highway to the south; Ripley Road; and a proposed transport corridor with an interchange node at the heart of the Urban Core. Additionally, the site is bounded to the north east by Bundamba Creek providing an important interface boundary to the development. The 'Framework Plan' developed from the Context Plan prepared by Hames Sharley is attached in Appendix A for reference.

1.2 Urban Land Development Authority

The development site is located within the local government region of Ipswich City Council (ICC). The site is within a state government declared Urban Development Area (UDA) within which development is controlled by the Urban Land Development Authority (ULDA). In consultation with the Ipswich City Council, the ULDA have developed a number of guidelines which were consulted throughout the evolution of the development scheme. The key engineering guidelines are noted below:

- Ripley Valley Urban Development Area – Development Scheme;
- Design Guidelines – Ripley Road;
- Guideline No. 6 – Street and Movement Networks;
- Guideline No. 13 – Engineering Standards;
- Guideline No. 14 – Environment and Natural Resources Sustainability; and
- Guideline No. 15 – Protection from Flood and Storm Tide Inundation.

1.3 Previous Reporting

Master-planning, investigation and reporting for this site has been undertaken for various forms of the development since early 2005. There are therefore multiple reports available which identify and address the development considerations associated with the site. While the development plan has continued to evolve, the

considerations identified previously are still relevant to the scheme's current form. In most instances, this report references these previous works. A full list of the reports available is included in the references at the end of this document. For clarity, copies of these reports have not been included in the appendices of this report. These reports have been provided previously to both the ULDA and ICC. Should additional copies be required, these can be made available on request.

2.0 Background and Site Context

2.1 Topography

The proposed site of the Ripley Valley Urban Core is undulating with several prominent peaks and associated valleys. The topography provides the opportunity for views of the surrounding area while the existing natural stormwater catchments drain stormwater runoff to Bundamba Creek. Existing slopes vary between 1% and greater than 25%. A slope analysis plan for the site is included in Appendix B for reference. The site generally falls in an east, north east direction towards Bundamba Creek. Highest levels of the peaks vary between 80m and 95m as shown on the slope analysis plan. Lowest levels occur at Bundamba Creek from 43m at the upstream end of the Urban Core and 35m at the downstream end. Gullies generally grade between 1% and 15%. Bundamba Creek flows south-east to north-west along the site boundary.

2.2 Geotechnical

Geotechnical investigations of the site have been previously undertaken in 2009 by Butler Partners Pty Ltd and 2010 by Cardno Pty Ltd. Locations for the site works undertaken in these two investigations are shown in Appendix B for reference.

The results of the geotechnical investigations indicated that in general terms the site is comprised of topsoil and silty sand overlaying natural sandy clay in turn overlaying weathered low strength rock. The depth at which rock was encountered varied at the sites investigated from 0.6m to 7.45m. A limited number of surface outcrops of rock were identified in the Butler and Partners geotechnical investigation. Consideration of these areas should be undertaken at design phase to determine the most appropriate earthworks strategies.

From these investigations, it is anticipated that the majority of materials excavated from the site will be suitable for re-use as fill.

Further detailed geotechnical investigations would be required at detailed design phase to confirm the previous findings and acquire site specific geotechnical conditions.

Site levels vary between 95m and 35m. Acid Sulfate Soils are therefore not anticipated to be encountered in the development area.

2.3 Mining

The Ipswich region has been previously mined and as such a number of areas within the region are heavily constrained. Moreton Geotechnical Services have previously assessed the impact on the site from underground mining in the area. Although conclusions stated that the site was unaffected by mining activities, this study was completed in 2007 and is now past its validity. AECOM therefore commissioned Moreton Geotechnical to update this advice to reflect the current proposal. A copy of their report is attached in Appendix C for reference.

The conclusions and recommendations from this report are summarised as follows:

- A small part of the site under Lots 183 and 184 is within the mine influence zone;
- The majority of the site within the influence zone is proposed as open space, however there are two localised areas proposed for development which encroach on this zone;
- Potential impacts from the encroachment are anticipated to be low with conventional building methods anticipated to be sufficient for development in these areas; and
- Further assessment of these areas should be undertaken once details of the type and form of development is known.

2.4 Environmental

The majority of the site is undulating grazing land or moderately vegetated bushland. The site is divided into large property holdings with single houses and farm sheds on most of the properties consistent with the rural nature of the area. A number of well established trees are present across the whole site but particularly along the low lying areas of Bundamba Creek and existing floodplains. The SHA portion of the site is grazing land currently occupied by a site office, some sheds, driveway and hardstand areas. An aerial photo of the site overlaid with the proposed development is included in Appendix B for reference.

In December 2009, Cardno completed an 'Ecological Constraints Analysis' and 'Ecological Impact Assessment and Mitigation Report' for the site and designated three zones present on the site.

Zone 1 – Low ecological value with few development constraints;

Zone 2 – Moderate ecological value with some restrictions on the form and manner of site development; and

Zone 3 – High ecological value with significant restraints on development.

Cardno's assessment concluded that the majority of the site is contained within Zones 1 and 2 and is therefore suitable for the proposed development. Parts of the site are moderately to heavily vegetated. These areas were identified as potential fauna habitats and therefore have been identified for retention in the development where possible. Establishing these open space networks and linkages throughout the development facilitates fauna movement through the site.

Bundamba Creek which borders the eastern and northern sides of the site has been identified as the most valuable ecological feature on the site and was as such designated as a Zone 3 area. Field investigations indicated that the creek corridor is currently in poor to moderate condition. The following principles were recommended by Cardno for inclusion in the development scheme:

1. Bundamba Creek to be retained and preserved within the open space network;
2. Vegetated open space buffers to Bundamba Creek should be established to provide for retention and re-establishment of native vegetation within:
   - The banks of the watercourse;
   - The natural floodplain of the watercourse; and
   - A minimum of 50m from the top of bank.
3. The value of Bundamba Creek as a fauna movement network should be recognised and enhanced through the planting of suitable native vegetation; and
4. The management of the Bundamba Creek corridor in a manner that provides for the recognition of the importance of values such as open space, collection and treatment of stormwater and locating important community infrastructure.

The other area for consideration was a small area to the south of Centenary Highway which has been identified for conservation within the Ipswich City Council Planning Scheme and will be required to be preserved in the development.

A plan showing the three ecological zones together with the conservation zone is attached in Appendix B for reference.

The development of the site context plan has been undertaken in consideration of the above constraints and principles. A key feature of the development layout is the landscape and open space network and its linkage to Bundamba Creek. Within these open space networks, significant existing vegetation will be retained and enhanced by the establishment of new native vegetation. The open space networks have been located to coincide with the location of major drainage paths and as such will provide stormwater conveyance to the major receiving environment at Bundamba Creek. Water sensitive urban design principles will be adopted to treat stormwater within the development and open space areas prior to discharge to Bundamba Creek.

It is anticipated that an ecological restoration strategy addressing the condition of Bundamba Creek would be undertaken prior to undertaking works in the vicinity of the creek.

As noted in Cardno's 'Ecological Impact Assessment and Mitigation Report' the details of how the principles are achieved will be subject to further approvals and hence can be assessed on a precinct scale basis.

2.5 Contaminated Land

A desktop contaminated land investigation was undertaken by Butler Partners Pty Ltd in August 2011. Historical use of the site established in this report note that during the 1980's the site was used for agricultural grazing. In 1999 rural residential land use was established onsite which continues to the present. Previous contaminated land reporting completed for the site concluded that the site was exposed to a low risk of gross contamination. A review of the contaminated land and environmental registers included in the Butler Partners report notes that the sites covered by the context plan are not included on these registers.

Site investigations undertaken in association with Butler Partners reporting confirmed the land uses established from the desktop study. In addition, three sites within the development area were identified as having potential for containing contaminated lands. These areas comprised two former cattle dips and an oil, diesel and fuel storage area. The approximate location for these sites are shown attached in Appendix B.

Further site investigation and testing will be required to confirm the presence of contaminated land at these sites. These investigations will be completed at development approval stage. Recommended remedial works required following these investigations should be undertaken prior to commencement of other development site works.

2.6 Cultural Heritage

A cultural heritage assessment of the development area was undertaken by JM Pearce Architects in March 2009. Ripley is known to have been occupied by the Jagera indigenous people and early European settlers. The cultural heritage assessment concluded that the site does not retain significant European heritage significance. Likewise, Indigenous heritage is not known to have specific significance to the site. However there remains potential for the site to have residual significance particularly in the vicinity of Bundamba Creek. Due to the previous disturbance that has been undertaken on the site, JM Pearce Architects concluded that it is generally unlikely that the site will contain Aboriginal cultural heritage significance and that works would be subject to Category 4 Duty of Care Guidelines under the Aboriginal Cultural Heritage Act 2003.

JM Pearce Architects recommend a best practice approach of developing a Cultural Heritage Management Plan prior to site works commencing to ensure developer obligations are met.

2.7 Flooding

The proposed development site is affected by flooding from Bundamba Creek. There are a number of controls on Bundamba Creek that contribute to the flooding affecting the site including the Centenary Highway and a number of other bridge crossings of the creek. Numerous flood models for Bundamba Creek have been prepared previously by consultants working for both developers and Council. Previous modelling for this specific site was completed by Cardno Pty Ltd in December 2009 and updated in September 2010.

The ULDA advised developers in Ripley Valley of its intention to develop a master flood model for the catchment which was intended to be used as the basis of further modelling and assessment of proposals for development within the Ripley Valley. This model has been developed by KBR Pty Ltd and it is our understanding that while the model is complete, the terms of use are still being negotiated and therefore it has not yet been made available outside of the ULDA. Development of the Context Plan has therefore been undertaken to the most current information available being Cardno's flood modelling from September 2010.

A plan showing the Q100 extent of flooding resulting from Cardno's investigations is shown attached in Appendix B for reference.

Key conclusions from Cardno's modelling which relate directly and have been considered in the current development proposal include the following:

- Locating the majority of the urban core development outside of the Q100 flood lines;
- It is necessary to raise Ripley Road and culvert crossings at Barrams and Watsons (two locations) require upgrades in order to convey flows to Bundamba Creek; and
- A number of existing crossings of Bundamba Creek currently do not meet depth / velocity criteria and are therefore hazardous.

Conclusions from the previous reporting based on previous proposals for the Urban Core indicated minimal effect on the flood flows and levels along Bundamba Creek.

The impact of climate change was also investigated with results indicating increases in the peak water levels of between 140-390mm for increases in rainfall of between 10 – 30%.

Further modelling of Bundamba Creek will be required once the updated flood modelling information is available to confirm the extent of the site affected by flooding. The following will require reassessment as part of this modelling:

- Filling within the Q100 flood line;
- The locations and levels of the two proposed bridge crossings of Bundamba Creek;
- The need for and size of detention basins within the Urban Core area;
- The impact of development of the sports fields associated with the Swanbank development to the east; and,

- Revegetation proposals for the Bundamba Creek corridor.

3.0 Earthworks

3.1 Development Strategy

Generally, the development philosophy is to be sympathetic to the existing site characteristics where possible. Key considerations are as follows:

- Protection of significant natural features such as the visual amenity of views to the Limestone Ridges to the south;
- Protection and enhancement of the Bundamba Creek corridor;
- Retention of existing drainage corridors for use as open space, recreation and conveyance of stormwater runoff; and
- Retention of significant existing vegetation.

In accordance with these considerations, the earthworks strategy for the development has been to minimise the impact of earthworks over the Urban Core. Within residential areas, there is significant scope to work with the existing topography and natural features by incorporating grades across allotments and utilising stepped retaining walls. Other areas such as the commercial centre of the development provide more challenges in adhering to these principles. The detailed phases of the development will investigate these concepts further.

Although previous geotechnical investigations suggest that the majority of materials excavated from the site should be suitable for re-use, further geotechnical investigations would be undertaken as part of the detailed phases of the development. These investigations would confirm the suitability of material for topsoil, excavation and reuse, groundwater levels and batter stability during construction and for permanent works.

3.2 Erosion and Sediment Control/ Dispersive Soils

Previous investigations of the site have concluded that parts of the site are highly susceptible to erosion in both the short and long term. Of particular concern is the effect of sediment movement on the downstream receiving environment of Bundamba Creek, which has already been identified as being in poor condition in places. Careful investigation and consideration of these factors will be required during the detailed planning and design phases of the development.

Best Practice Erosion and Sediment Control guidelines as published by the International Erosion Control Association should be used to develop strategies that produce high quality outcomes for the control of erosion and sediment transportation. Typical methods for control of runoff during the development of the site are noted as follows:

- Minimising the generation of silt laden runoff and interception at the source (i.e. within the road reserves);
- Limiting the area disturbed during construction to the immediate construction area and associated access routes;
- Preventing overland flow from entering earthworks areas by utilising diversion channels and bunds;
- Erecting silt fences where required to prevent sediment from being transported to receiving waterways;
- Removing sediment trapped by silt fences and sediment traps on a regular basis and using it as top dressing for rehabilitated/landscaped areas;
- Establishing vegetated buffers along the road edge, which filter the runoff by trapping sediment, between the road verge construction activities and the road pavement and drainage;
- Stabilising soil stockpile areas to prevent erosion;
- Revegetating the site at the earliest opportunity during construction; and
- Constructing sediment traps and sediment basins at appropriate locations to collect silt contained in the runoff, prior to discharge to the receiving waterways.

Likewise, previous investigations have noted the high potential for the presence of dispersive soils. Dispersion in soil occurs when moisture seeps between individual soil particles, causing the aggregates within the soil to separate and collapse. The dispersion of the aggregates into clay, silt and sand causes the soil to become unstable. Collapse of the soil structure will cause the soil to lose porosity and slump, leading to an increase in soil density which restricts the root growth of vegetation.

Key recommendations from previous investigations also apply to the current proposals for the site and include:

- Confirmation of the risk of erosion and the presence of dispersive soils through detailed investigation of individual development areas;
- Preparation of a report by a suitably qualified geotechnical engineer recommending appropriate mitigation measures;
- Preparation of a site specific Earthworks Management Plan addressing construction sequencing and incorporation of mitigation measures where appropriate; and
- Continued monitoring of earthworks during and after construction to ensure compliance with above.

As an indication, the following are a variety of previously identified control measures that could be used to minimise the impact of dispersive soils from the development:

1. Minimise the disturbance to topsoil and surrounding vegetation;
2. Avoid water flow over areas that are vulnerable of becoming dispersed;
3. Fill any holes to prevent the collection of water above vulnerable subsoils;
4. Compact dispersive subsoils that have been disturbed or excavated;
5. Cover over exposed subsoils with topsoil and vegetation; and
6. Top dress the surface of vulnerable subsoils with topsoil containing gypsum or lime.

4.0 Infrastructure and Services

4.1 Stormwater Drainage

4.1.1 Existing Drainage Paths

The existing Ripley Valley Urban Core site is located on land fronting Bundamba Creek along its eastern and northern boundary, Fischer Road and Wensley Road to the west and extends about 400m south of the Centenary Highway. The site is affected by a number of external catchments to the west and south-west.

The legal point of discharge for the site is Bundamba Creek, which flows into the Bremer River to the east of Ipswich, approximately 3km upstream of the Warrego Highway crossing. Bundamba Creek has a total catchment area of 110km².

The Bundamba Creek catchment is used mainly for rural purposes with a few rural residences and is currently characterised by large grassed floodplains. Bundamba Creek is located within a densely vegetated meandering channel of about 50 m width and 5 m depth.

A number of existing water courses run through the Ripley Valley Urban Core to Bundamba Creek. These watercourses are fed by runoff from three major catchment areas. Site topography consists of undulating low hills with a cross slope to the watercourses of up to 10%. The slopes of the watercourses vary from approximately 8% in the upper reaches to 2% in the lower, flatter portions of the site, finally entering a flat plain with a slope of less than 1% prior to discharging into Bundamba Creek. Existing watercourse extents are shown on the plan attached in Appendix D.

The site is not heavily timbered and the soils are predominantly dispersive clays. Ground water springs occur in a few low lying areas.

4.1.2 Quantity Management Strategy

The key stormwater runoff considerations for developing the Context Plan were:

- Locating the urban core development outside of the Q100 flood lines;
- Providing detention basins throughout the Urban Core area to ensures that stormwater runoff at the site's boundaries does not exceed that which presently exists, and there is 'no net worsening' of flood conditions at the site's boundaries;
- Maintaining and enhancing the existing watercourses; and
- Providing connectivity across Bundamba Creek.

Further modelling of Bundamba Creek will be required once the updated flood modelling information is available from the ULDA to confirm that:

- The need and extent of detention basins required to ensure non-worsening of flows in Bundamba Creek;
- The proposed urban areas remain outside of the Q100 flood lines;
- The extent of works required to offset any effects of filling required within the Q100 flood line. The extent of proposed filling is limited to enhancement works within the park areas;
- The locations and levels of the two new bridge crossings of Bundamba Creek; and
- Revegetation proposals for the Bundamba Creek corridor.

Stormwater drainage will be provided by a network of underground piped drainage out-letting to existing water courses designed and constructed in accordance with the current ULDA Infrastructure policy. Outlets from the drainage will require careful detailing to ensure that the risks presented due to the presence of dispersive soils are properly dealt with.

A concept layout for the proposed stormwater quantity management strategy within the Urban Core is shown attached in Appendix D.

4.1.3 Quality Management Strategy

The proximity of the Ripley Valley to sensitive aquatic ecosystems, coupled with increased imperviousness and associated increases in flows and water borne contaminants, requires a carefully considered WSUD Strategy. The Ripley Valley Urban Core WSUD Objectives have been developed with the aim of delivering on the key principles of WSUD and are based on the WSUD Objectives established for SEQ. The WSUD Strategy aims to support the intended commercial, retail and residential land uses whilst also providing protection to the aquatic ecosystems.

A range of key issues were considered when deriving the WSUD Objectives and WSUD Strategy for the Ripley Valley Urban Core:

- Ecological Protection – Bundamba Creek, which forms the northern and western boundary of the site, is a waterway of local significance. Downstream of the Urban Core, Bundamba Creek flows into the Bremer River, which in turn links into the regionally significant aquatic ecosystems of Bramble Bay and Moreton Bay. Protection of these aquatic ecosystems is the primary objective of the WSUD Strategy. This requires appropriate treatment of stormwater to protect the key characteristics which sustain these ecosystems.
- WSUD strategy has been developed to be consistent with current best practice requirements as set out in the Implementation Guideline No. 7 and the State Planning Policy for Healthy Waters.
- Climate – It can be inferred from the regional climate that the natural aquatic ecosystems and landscapes within the region experience drying conditions during part of the year. The implementation of current best practice WSUD technologies that utilise vegetative systems to promote the interception, adsorption and biological processing of water borne pollutants need to account for this drying characteristic.
- Topography & Drainage – WSUD is a key element of the design process and designs are suitably informed by WSUD. Characteristics of the natural site topography and drainage paths and design that is sensitive to these features supports the integration of stormwater treatment infrastructure with both designed landscape features and existing natural flow paths.
- Water Conservation Targets – Mandatory water savings targets apply to new houses in Queensland. The targets are designed to make a significant contribution to reducing the demand for drinking water and have been implemented in response to the recent drought in SEQ. The targets are outlined in Mandatory Part 4.2 of the Queensland Development Code. It is anticipated that the targets will be achieved at Ripley Valley through the implementation of water efficient appliances and household rainwater tanks.
- Landscape Integration – The urban design and parkland layout proposed for the Urban Core has been informed by the principles of WSUD. The landscape design for these areas ensures that infrastructure associated with the treatment of stormwater is readily incorporated into the urban and parkland landscapes. The intention is to ensure functional management of stormwater through WSUD systems that enhance parkscapes while promoting stormwater and waterways as valuable resources.

In developing the Context Plan for the Urban Core, all elements of urban development were integrated into the design: aquatic and terrestrial ecosystems, roads, water infrastructure, earthworks, landscape and open space function. WSUD was a key element in the design process and collaboration with the design team has ensured the proposed Context Plan incorporates suitable WSUD measures. Selection of the most appropriate suite of measures for the Ripley Valley development required the matching of available technology to the climate, site conditions, management objectives and the desired urban form.

Each element of the WSUD Strategy has been categorised as either 'Private' or 'Public'. Private elements are located within private allotments, and their maintenance is the responsibility of the allotment owners. Public elements are located within public land, and will be owned and managed by Council. Developers will be responsible for the delivery (i.e. design, construction and establishment) of the WSUD Strategy with the relevant 'Public' elements of the strategy handed over to Council for operation and maintenance.

Stormwater quality management within the Urban Core will focus on accepting stormwater from the pit and pipe drainage network and treating this water. Stormwater quality treatment is to consist of bioretention basins and constructed wetlands integrated into local parks within the flatter areas adjacent to the Bundamba Creek riparian vegetation corridor. Gross pollutant traps may be incorporated into the more heavily developed areas such as the

commercial centre. A concept layout for the proposed stormwater quality strategy within the Urban Core is shown attached in Appendix D. A description of each of the treatment method applications is provided below.

4.1.3.1 Bioretention Basins

Bioretention basins will play a key role in the WSUD Strategy by providing treatment for the majority of the stormwater generated from the site. Bioretention basins operate by capturing and ponding runoff (0.2 - 0.4m extended detention depth) and percolating stormwater through a defined filter media (sandy loam topsoil). Filtered stormwater is then collected at the base of the filter media via a drainage layer containing perforated pipes. The surface of the bioretention basin is densely planted with ground level grasses and rushes and may also contain selected tree species. The agitation of the surface of the bioretention basin caused by movement of the vegetation and the growth and die off of root systems prevents accreted sediments clogging the filtration media.

Treatment of the stormwater occurs both on the surface of the bioretention basin and within the filter media. When large storm inflows cause temporary ponding on the surface of the basin, pollutants are removed from the stormwater through sedimentation and particulate adhesion onto the stems and leaves of the vegetation. As stormwater percolates through the filter media, fine particulates and some soluble pollutants are removed through processes such as adhesion on to the surface of the filter media particles, biological transformation of pollutants by biofilms growing on the surface of the filter media particles, and biomass uptake of nutrients and metals through the root systems of the vegetation growing in the garden. Figure 1 below provides a typical section through a bioretention basin. Stormwater runoff from the catchment will be delivered directly to the bioretention basins. In addition, the headwalls that accommodate the pipe outlets will be fitted with sediment forebays, which will provide energy dissipation and some coarse sediment/litter capture.

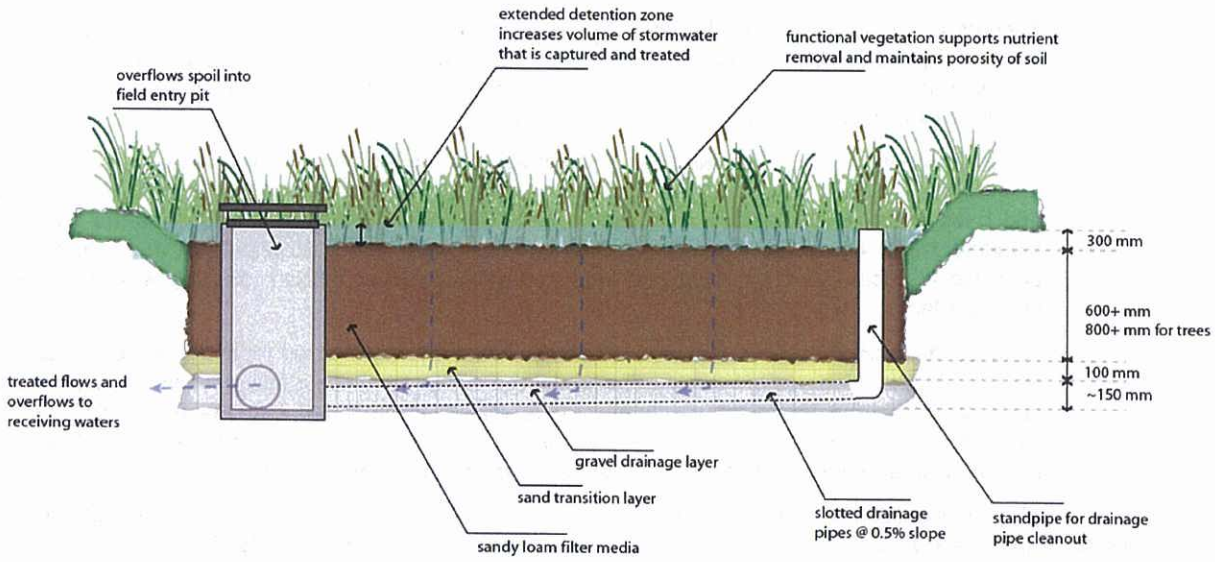


Figure 1 Typical Section through Bioretention Basin

The nature of the bioretention basins, being planted soil profiles, means there is a reasonable amount of flexibility regarding the size, shape and location of the systems. As such, there are opportunities to integrate the bioretention basins as landscape features within the overall development layout. AECOM has worked with the urban designers, and landscape architects to determine the preferred location, configuration and form of the bioretention basins to integrate and compliment the other landscape and open space features.

Examples of landscape form for Bioretention systems

4.1.3.2 Constructed Wetland

The development will also incorporate constructed stormwater treatment wetlands as part of its WSUD Strategy. The wetlands will be seamlessly integrated into public open space areas between the development proper and the existing riparian vegetation along Bundamba Creek. Constructed wetland systems are shallow, extensively vegetated water bodies that use enhanced sedimentation, fine filtration and biological uptake processes to remove pollutants from stormwater. Water levels rise during rainfall events and outlets are configured to slowly release flows, typically over two to three days, back to dry weather water levels. This slow release of stormwater helps recreate a natural hydrologic regime. The dense vegetation will also provide a physical buffer with the open space areas, keeping people away from riparian conservation areas. The constructed wetland would provide a physical and hydrologic buffer between the development and the riparian corridor. The constructed wetland will be planted using local provenance wetland species thereby extending the natural occurring wetland community, providing additional habitat for fauna.

Example of a constructed stormwater wetland providing both a hydrology and physical buffer from a residential development.

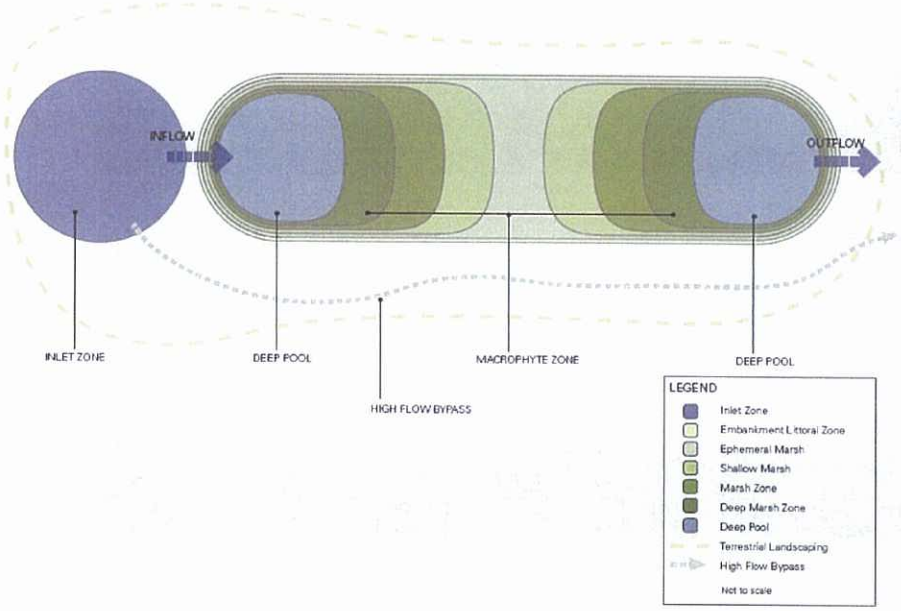
The construction and establishment of the wetland will be undertaken in a staged approach that suits the Sediment and Erosion Control Plan. Further details of the methodology to be used will be documented in a Functional Design Report as part of the detailed design of those stages and submitted to Council as part of the Operational Works Application.

The location and conceptual design of the constructed wetlands minimise their vulnerability to flood inundation and velocities. The constructed wetlands are located within drainage depressions set back from the Bundamba Creek channel. Therefore, under flood conditions, velocities in this area will be much lower than in the main channel and overbank area. The constructed wetland and the selection of plant species will be designed such that the flooding regime will not impact on the performance of the wetland as a stormwater treatment system.

The wetlands will capture and treat piped stormwater runoff from adjacent residential precincts before discharge to the receiving environment. Pre-treatment to remove coarse sediments will occur in the inlet zone for the constructed wetland. The wetland will also remove fine and suspended sediments, particulate nutrients/metals and some soluble nutrients within the macrophyte zone.

The wetland comprises three distinct functional elements (zones) that are critical to the successful functioning of the system. These are:

- Inlet Zone;
- Macrophyte Zone;
- High Flow Bypass System.

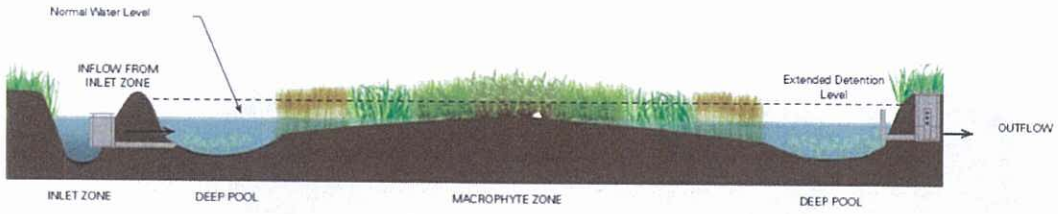


Plan view of a constructed stormwater wetland showing the functional elements

The wetland will capture and retain the stormwater runoff for a period of approximately 48 hours to provide substantial removal of particulate pollutants and some removal of soluble pollutants.

Wetland plants (macrophytes) play an important role in aiding the improvement of the water quality through:

- physical trapping;
- chemical adsorption;
- biological absorption;
- biological and chemical transformation.



NORMAL WATER LEVEL

EXTENDED DETENTION

Indicative long section of a wetland at normal water level (above) and while the extended detention is engaged and stormwater inflows are being treated (below).

The function of each element in the overall operation of the wetland is described below.

Inlet Zone – removes coarse sediment and controls the delivery of stormwater flows into macrophyte zone, prevents coarse sediments from smothering wetland vegetation in the macrophyte zone and provides the hydraulic control required to manage flows (up to 1 yr ARI) into the macrophyte zone and to ensure flood flows are diverted away from the macrophyte zone (via the bypass system). The inlet zone will be sized to settle out particles down to approximately 125 microns in size.

Macrophyte Zone – predominantly wet marsh zone with some ephemeral zones and open water. Uses a combination of physical, chemical and biological processes to intercept and retain/process fine sediment and associated particulate nutrients and heavy metals, soluble nutrients, and pathogens. Quiescent flow conditions (velocities generally kept below 0.05 m/s) are required and long detention times (48 hours) to achieve optimal water quality improvement.

Example of a macrophyte zone in a constructed stormwater wetland.

Water enters the macrophyte zone and passes through the wetland and fills the extended detention volume above the normal water level of the wetland. The macrophyte zone will be configured to optimise hydraulic efficiency and ensure healthy vegetation growth. This requires a varying bathymetry and extended detention depth (0.5m) to promote diversity in wetland vegetation, appropriate placement of inlet/outlet structures and adequate length to width ratio (5:1 min).

High Flow Bypass System – conveys flood flows away from the macrophyte zone providing protection to the wetland plants (macrophytes) and preventing scouring of the bed sediments in the macrophyte zone.

4.1.3.3 Gross Pollutant Traps

In general, it is not considered necessary to incorporate gross pollutant traps (GPTs) within residential catchments. The reasoning for this is twofold:

- Monitoring undertaken by Brisbane City Council (BCC) of GPTs receiving runoff from residential catchments has found that generally less than 5% by weight of gross pollutants captured within GPTs is anthropogenic (i.e. plastic, paper). The vast majority of the captured material is organics (i.e. leaf litter) or coarse sediment. This indicates the development density associated with residential allotments, coupled with the high level of general house and yard keeping by individual householders is resulting in only a low generation of anthropogenic litter.
- The BCC monitoring and observations noted in Hunter (undated) indicate that when this organic material is captured in wet vault type GPTs there is a tendency for this material to transform under anaerobic conditions to more bio-available forms of nutrients. This can result in a net export of nutrients in a form that is more deleterious to downstream ecosystems. Hunter concludes that stormwater management needs to target the various forms of gross litter using appropriate management responses. For example, targeting gross litter from residential catchments, which contain a high proportion of organics, should occur through aerobic systems.

In response, the WSUD Strategy for development of the Urban Core applies the following approaches for capturing gross litter and coarse sediment from the residential catchments:

- Gross litter, which is predominantly organic, is to be captured in aerobic conditions within the vegetated bioretention basins. The headwalls that accommodate the pipe outlets will be fitted with trash racks. This approach will effectively preclude the discharge of anthropogenic litter to downstream environs.
- Coarse sediment is to be captured within trash racks in the bioretention basins to avoid the smothering of vegetation.

4.2 Water Supply

4.2.1 Potable Water

Existing water mains are located in the vicinity of the site at Binnies Road (600mm and 100mm diameter), Wensley Road (150mm diameter) and Fischer Road (375mm diameter). All these existing mains are located to the west of the Urban Core. Sizes and alignments of these existing mains would require investigation during the detailed phases of the development. A plan showing the layout of the existing water supply infrastructure is included in Appendix F for reference.

4.2.1.1 Trunk Water

Water supply for the Urban Core has previously been investigated by Cardno Pty Ltd in their report dated December 2009.

Key conclusions from Cardno's investigation of the Trunk Infrastructure are summarised as follows:

- The area is currently primarily serviced by a 10ML reservoir beyond the southern end of Wensley Road with an additional 16ML reservoir available to service the ultimate development;
- Generally only areas below 75m AHD are able to be serviced by these reservoirs;
- Augmentation of a further high level reservoir currently servicing Deebing Heights will be required to service areas above 75m AHD;
- Trunk mains provide a link into the South Regional Water Pipeline;
- Existing trunk infrastructure is capable of servicing in the order of 6,000 Equivalent Persons (EP) before upgrades are required; and
- Ultimate trunk infrastructure will comprise water mains of the order of 750 – 900mm dia.

The timing for the upgrades and augmentations for the trunk infrastructure will depend on the development delivery rate and phasing. It is envisaged that in most instances, delivery of the ultimate infrastructure will be staged with a combination of pipe sizes utilized to provide the ultimate required capacities.

The above detailed arrangements are broadly consistent with the infrastructure plans prepared by both ICC and the ULDA. The ULDA are in the process of establishing an infrastructure funding framework for the delivery of these works.

Detailed assessment of the staging of the infrastructure will be undertaken once the phasing and uptake of the development has been established.

4.2.1.2 Internal Reticulation

Previous analysis for the reticulated mains within the urban core indicated main sizes range from 300mm diameter to 150mm diameter. Applying this previous work to the current layout, the reticulated water main system for the development is shown indicatively in Appendix F.

Part of the site will be restricted from development until the construction of the high level reservoir augmentation noted previously. This area has been shaded on the reticulated layout plan. The area affected by the high level service restriction is located within the southern region of the site. It is anticipated that the staging of the development would be such that these areas are developed within the later stages of development. Should a different phasing approach be proposed, temporary boosting systems may be necessary.

The configuration of the actual reticulated water layout will be subject to detailed analysis during the detailed phases of the project.

4.2.2 Alternate Water Sources

Capitalising on the use of alternative water sources has the potential to reduce the demand on the potable water system and is consistent with the Sekisui House philosophy of development. Generally the uses for alternate water sources would be restricted to non-potable reuse due the costs and risks associated with providing for potable quality drinking water. Reference to the 'Australian Guidelines for Water Recycling: Managing Health and Environmental Risk – Phase 2' notes the following potential uses:

- Irrigation for landscaping and open space areas;

- Toilet flushing;
- Washing machines;
- Car washing;
- Street cleaning; and
- Firefighting.

This list is not exhaustive and multiple other applications are available.

In general, use of alternate water sources will be subject to a risk assessment considering, among other things, the source of the water, reuse application, potential for contact with humans and the treatments applied to the water.

A number of options to supplement potable water use are readily available to the site with a brief description of the major ones below:

Recycled Water

Recycled water is currently available at the Swanbank Power Station. Water within this main is treated to Class A+ standard. Extension of this main to the Urban Core would provide a reliable and high quality alternative to potable water. Use of the recycled water would require the installation of a duplicate distribution main throughout the development. The use of recycled water could be of benefit in reducing the overall trunk distribution augmentations required to service the development.

Bore water

Bore water is available within the Urban Core. Onsite investigations have currently only extended to a shallow aquifer through which both quantity and quality of supply has proved inconsistent. A deeper aquifer exists but has not been investigated to date. Preliminary investigations undertaken by Cardno with the Department of Environment and Resource Management suggest that the quality and potential yield from this water source would not be adequate to make it a viable water alternative. Typically, bore water is contaminated with chemicals and micro-organisms. Testing would be required to determine the extent of treatment required to ensure the supply is suitable for various potential uses. Further detailed investigations would be necessary if bore water was determined to be a preferred water source alternative.

Stormwater harvesting

Stormwater harvesting is broadly represented by the collection of stormwater from drains and open channels as opposed to roofwater harvesting which is generally collected to rainwater tanks as discussed later. Health and environmental risks are key considerations in determining the appropriate reuse for harvested stormwater. The quality of the stormwater is affected by the land use of the contributing catchments and can vary significantly for each storm event. Treatment of the stormwater may be required in order to:

- Remove coarse material;
- Reduce loads from organic matter;
- Reduce nitrogen and phosphorous levels;
- Reduce iron concentrations; and
- Reduce water hardness.

The type of storage for the harvested stormwater e.g. lake or tank, will influence the treatment and uses.

Rainwater Tanks

Rainwater tanks have numerous benefits including conserving mains water, helping to protect urban streams by acting as detention to reduce stormwater runoff volumes, and reducing the concentration of stormwater pollutants reaching downstream waterways.

The greatest environmental benefit of rainwater tanks is the increased pollutant removal and groundwater recharge that occurs because a large fraction of the annual stormwater runoff volume is applied back to the watershed.

Rainwater tanks are mandatory to all residential areas in accordance with the Queensland Development Code – MP 4.2 Water Saving Targets.

Treated effluent

Treated effluent reuse would require the establishment of a centralised system onsite which could collect and treat sewage. The viability of this type of system would need to be evaluated particularly in the early phases of the development when inflows to the system are likely to be low. In this case, some supplementary flows from either the potable water system or another water source would be required.

The viability of alternate water sources will be subject to feasibility assessments during the detailed phases of the development.

4.3 Sewage Reticulation

The Ripley Valley development area is currently only serviced by limited sewerage infrastructure. Ultimately the Ripley catchment will form an extension of the existing Bundamba catchment. Numerous previous investigations for servicing Ripley Valley have been conducted under commission from both ICC and private developers. The most recent investigation prepared by MWH in October 2010 for Queensland Urban Utilities summarises this previous work and provides infrastructure development strategies for servicing of the area.

4.3.1 Existing Infrastructure

Existing infrastructure within the Ripley catchment is limited to a 225mm diameter sewer which services the existing Ripley Town. The location of this sewer is shown indicatively on Figure 2.2 prepared by MWH in Appendix E for reference. Capacity checks undertaken by MWH suggest that this sewer has capacity for an additional 10L/s or the equivalent of 700EP.

4.3.2 Trunk Requirements

The ultimate servicing of the Ripley Valley catchment will be through a gravity sewer discharging to the Bundamba Trunk sewer at Robertson Road to the north of the Cunningham Highway. The Bundamba Trunk sewer discharges to the Bundamba Sewer Treatment Plant. Upgrades will ultimately be required to enable the Bundamba Trunk sewer to carry this ultimate discharge. Funding for these works would be provided through Queensland Urban Utilities (QUU). These works are to be considered the long term servicing strategy (10+ years) for servicing the Ripley catchment and will not be suitable for the short to medium term servicing.

In their investigation MWH provided four options for phasing of the interim trunk servicing of Ripley Valley. These options are summarised broadly as follows:

Option A

The establishment of a pump station within the Urban Core area and multiple rising mains which discharge to the Bundamba trunk sewer at Robertson Road. The configuration adopted in MWH's analysis comprises a 375mm diameter and 250mm diameter rising main.

Option B

Diversion of initial flows from the development to an existing sewer within the Deebing Creek sewer catchment by a pump station and 4.5km 250mm diameter rising main. The Deebing Creek sewer has been estimated to currently have capacity for an additional 75L/s, however it is noted that further development proposed within this catchment could reduce this capacity to an additional 50L/s. Once the capacity of this sewer has been reached discharge would be to Robertson Road as per Option A;

Option C

Initially flows discharged from the development would utilise the spare capacity within the existing gravity sewer at Fischer Road. Once the capacity of this sewer has been reached, an augmentation of the gravity sewer at Fischer Road would be required which would consist of the construction of 2km of 600mm diameter gravity main. This gravity main would drain to a pump station established at the Centenary Highway. The pump station would then convey all flows by rising main to the Robertson Road discharge point. Staging of the rising mains would be required to convey ultimate flows.

Option D

Establishment of 1750m of a 1200mm diameter gravity main connection from Robertson Road to the Centenary Highway. Flows from the Urban Core are conveyed by staged pump station and rising mains to this discharge location.

The recommendations from the MWH report, which included a comparative cost analysis and qualitative assessment, conclude that Option A was the preferred option under the principles and constraints considered. The estimated costs of the capital works associated with this option were estimated to be $25M.

An additional, non-infrastructure option of discharge of sewage to a holding tank and tankering to an offsite disposal location was also considered. It was concluded that this option would be viable for up to 500EP. Beyond this development population, risk and cost of this strategy becomes too great. Projections from MWH's analysis indicated that this point could be expected to be reached approximately 14 months into the development.

Establishing a temporary sewage treatment plant onsite is a further option that has the potential for application on the site. Potential advantages in developing an onsite treatment scheme include reduction in potable water demand due to reuse of treated effluent, potential for reduction in sizes of external infrastructure trunk mains required and potential for reduction in service costs associated with traditional wastewater providers. Typically onsite treatment schemes would be established and operated by a private service provider. Further detailed feasibility investigations would be required together with negotiations with the ULDA, ICC, QUU and a third party operator to determine whether such a scheme would be appropriate for the Ripley Valley development.

During recent preliminary discussions with Queensland Urban Utilities (QUU), it was indicated that a combination of tankering in the initial phases of development, followed by a strategy utilising the same general concept as that presented in Option C above, was preferred. The rationale for this preference was not discussed, however in their report MWH do note that QUU are concerned about the poor condition of the existing Fischer Road sewer. This option provides an opportunity to replace this sewer and establish some permanent improved infrastructure to the area.

Figure 6.3 prepared by MWH showing the details of this strategy is attached in Appendix E for reference.

Application of this strategy would be subject to further discussions with QUU and assessment of a feasibility analysis of the works.

The arrangements detailed above are broadly consistent with the infrastructure plans prepared by both ICC and the ULDA. The ULDA are in the process of establishing an infrastructure funding framework for the delivery of these works.

4.3.3 Internal Reticulation

Servicing of the development will be provided by a series of internal mains which are anticipated to range from 150mm diameter to 450mm diameter in the ultimate development. Internal mains will provide a network for collection and discharge to either the holding tank or pump station associated with the development, depending on the stage of the trunk sewer works. An indicative internal sewer main layout is shown attached for reference in Appendix E.

It is anticipated that staging of some of the larger internal mains may be necessary for the early phases of the development. Detailed analysis and staging strategies will be produced during the detailed phases of the development.

4.4 Power and Telecommunications

An assessment of the power and telecommunications supply to the development was undertaken by JJ Van de Boor & Associates in October 2010. This assessment made the following conclusions:

Power

- Electrical service to the site is primarily from Ipswich;
- Current supplies have little spare capacity to service the site however planned upgrades will be sufficient to service the initial phases of the development; and
- A total of four new zone substations are proposed for the area to service the ultimate development with the first to be constructed in 2015.

Telecommunications

- Current supplies have little spare capacity to service the site however planned upgrades will be sufficient to service the initial phases of the development; and
- A total of four new zone substations are proposed for the area to service the ultimate development with the first to be constructed in 2015.

Telecommunications

- Preliminary discussions were commenced with Telstra regarding the servicing of the development with Telstra noting that the estate would be anticipated to be connected to the National Broadband Network.

Further discussions with both Energex and Telstra will be conducted as the development progresses.

The developer has met with NBN Co. regarding the installation of fibre to the development and has confirmed that this residential part of the estate would be suitable for connection to this network. NBN Co. does not currently have a commercial application for their technology. Negotiations are ongoing between NBN Co. and other service providers to determine the most appropriate type of service connection to the development.

4.5 Gas

Gas is available to the site from Swanbank and Flinders View. It was noted in preliminary discussions with APA Group that both Sekisui House Australia Pty Ltd and APA Group are keen to provide gas to the development. Further discussions between both parties will be required to determine the commercial arrangements of the proposed supply.

5.0 Street and Movement Networks

The Urban Core is located in the vicinity of a number of major road and movement networks which provide a number of opportunities for interface with the proposal. The major considerations include the following:

- Ripley Road orientating north to south through the Urban Core;
- Centenary Highway through the southern part of the Urban Core; and
- A future transit corridor traversing east to west through the Urban Core.

The locations of these items are shown in Appendix A for reference.

Also in the vicinity of the site is the Cunningham Highway to the north.

Development proposals have previously been investigated by Bitzios Consulting, on behalf of Sekisui House Australia on a local road network scale; the Urban Land Development Authority, concentrating on Ripley Road; and by various consultants working on behalf of the Department of Main Roads on a much broader scale. Limited information was made available by the Department of Main Roads during the development of the Context Plan.

5.1 Road Network

The proposed road network for Ripley Valley consists of external regional links and internal thoroughfare routes. Regional links connect major inter-city and regional areas (i.e. Ipswich CBD and Brisbane), and the internal road network provides connectivity within Ripley Valley and to the external regional links. The local road network needs good connectivity to minimise short trips on the regional links.

The *Ripley Valley Urban Development Area – Development Scheme*, Urban Land Development Authority (October 2011) identifies the following road hierarchy for this area:

1) Regional Link – major regional through traffic function providing for long distance travel, typically highways.
2) Inter-suburban Link – arterial routes which cater for major through traffic and connect suburbs to / from regional links.
3) Suburban Link – sub-arterial routes which provide key connections for through traffic within suburbs and links from suburbs to inter-suburban links and regional links.
4) Neighbourhood Link – collect traffic from within a neighbourhood and distribute it onto suburban and inter-suburban links. They are not through traffic routes.
5) Local Street – provide access to properties and other local streets.

The road hierarchy within the Urban Core Context Plan has been developed based on the framework developed by the ULDA. A number of roads within the Urban Core have been specifically identified and are described in detail within the Context Plan. In general, the suggested road hierarchy within the Urban Core consists of the following road types:

1) Inter-suburban Link - Arterial Route
   - Ripley Road and Ripley Avenue;
   - Major through traffic route for Ripley Valley;
   - Typically higher traffic volumes and vehicle speeds with intersections at key locations (up to 50,000 vpd); and

2) Neighbourhood Main Street
   - Ripley Main Street;
   - Key connections within the Urban Core linking the transit centre to the town park;
   - Typically low vehicle speeds; and

3) Neighbourhood Connectors (Types A and B)

- Ripley Loop, Green Street and Park Terrace;
- Connector roads within neighbourhoods linking to neighbourhood destinations;
- Typically low traffic volumes and vehicle speeds with mainly minor intersections (up to 6,000 vpd); and

4) Neighbourhood Local Streets

- Satoyama Way;
- Provide access to properties and other local streets. Not a through traffic route;
- Typically low traffic volumes and vehicle speeds with minor intersections and direct access to properties (up to 6,000 vpd); and

5) Minor Streets and Rear Lanes

- Local access to properties and minor streets. Not a through traffic route;
- Typically low traffic volumes and vehicle speeds with frequent direct property accesses; and

The proposed road network has been reviewed in relation to the development scheme developed by the ULDA in association with Ipswich City Council. Departures include minor shifts to the locations of the Wensley Road connection with the Centenary Highway, the linkage to the Swanbank development and the avenue connection through the southern part of the development. The Wensley Road connection is discussed further in section 5.3. The linkage to the Swanbank development has been moved marginally south of the location identified by the previous planning to better align with the anticipated road network on the eastern side of Bundamba Creek, to align with property ownership boundaries and to provide for an enhanced open space within the proposed town parklands. An additional crossing of Bundamba Creek has also been proposed at the northern part of the site to provide a looped connection to the commercial precinct within Swanbank. To the west of Ripley Road, the avenue connection identified previously adjacent to the transit corridor has been moved south within the current planning. As with the connections to Swanbank, this adjustment is proposed to provide a better looped road network and will also assist with the connectivity to public transport for the residential precincts through which it passes. Preliminary assessment of these modifications identified that these proposed changes will not alter the intended function of these key corridors. Detailed assessment of the road network would be undertaken in the detailed phases of the project.

Street typologies have been developed based on the road sections identified by the ULDA and with reference to connections with open space, water sensitive urban design and people movement. These sections are shown attached in Appendix G for reference. These road sections are consistent with those developed by the ULDA and will provide the same traffic movement functionality. Further description of specific roads is detailed further in the Context Plan.

An indicative street hierarchy for the Urban Core is shown attached in Appendix G for reference. This hierarchy has been developed with reference to previous traffic models developed for the area without detailed traffic modelling being undertaken. Planning undertaken by the ULDA and Ipswich City Council have indicatively located a number of signalised intersections through the Urban Core. The Context Plan has been developed using this planning as the basis for the intersection locations.

The required intersection types may include signalised, roundabout or sign controlled and may include banned movements i.e. left-in / out only. The Ripley Road Design Guidelines prepared by the ULDA and dated November 2011 identifies six signalised intersections within the Urban Core. Intersection locations within the context plan have been located generally in accordance with this guideline. An additional intersection is proposed at the location of the proposed Ripley Main Street with the dual purpose of providing access to this street and providing connectivity to the transit network node at Ripley Road. The final intersection types will

be dependent on traffic volumes, routes and road hierarchy and will be subject to detailed analysis during further phases of the development.

Careful consideration is required when establishing a road hierarchy to ensure that the road design and layout complements the intended function of the road. It is crucial to designate an adequate and appropriate external road network (i.e. highways and arterial routes). The internal road network can be designed to allow flexibility in the future in terms of form and function to cater for changing demands.

The following items have been identified as areas where more detailed analysis is required:

- Identify intersection control types; and
- Identify areas where local area traffic management can be applied.

5.2 Ripley Road

Ripley Road is the main arterial route through this area, providing key connections to the Centenary and Cunningham Highways as well as suburban links and neighbourhood collectors. Incorporated into Ripley Road will be landmarks which will mark the gateways to the Urban Core.

The *Ripley Road Design Guidelines – Part B: Engineering Design Guide*, Urban Land Development Authority (November 2011) provides specifications for the design of Ripley Road. The guidelines include typical road reserve cross sections for the various sections of Ripley Road and suggested locations of intersections. Within the Urban Core the sections denoted Core and Frame East are applicable. Ripley Roads cross section within these areas typically consists of a dual carriageway comprising two 3.5m vehicle lanes, a 4.5m transit/ parking lane and a 5 metre verge. The carriageways are separated by a 5m planted median.

5.3 Centenary Highway

The Centenary Highway is located through the southern part of the Urban Core. Planning completed by Ipswich City Council, the Urban land Development Authority and the Department of Transport and Main Roads indicates that ultimately the connection between the Centenary highway and Ripley Road is proposed to provide the primary access into the development. Establishment of this location as the primary access is critical in providing the traffic volumes necessary to successfully establish the early phases of the Urban Core centre. The high traffic volumes projected on Ripley Road for the ultimate development will be detrimental to the accessibility of the Urban Core Centre. A secondary interchange at Wensley Road to the western boundary of the Urban Core has been considered in the planning and provides an option for a secondary access to the Urban Core. The current intersection arrangement between Ripley Road and the Centenary Highway is a roundabout. DTMR have provided preliminary design details for the ultimate interchange arrangement which comprise a diamond interchange with signalised on and off ramps. This planning is based on Traffic Studies that indicate Ripley Road will carry approximately 50,000 vpd when the ultimate development of Ripley Valley is complete. DTMR advise that under this arrangement the first intersection along Ripley Road north of the intersection should be kept some 400m away from the intersection to suit queuing distances. This is incompatible with the ICC and ULDA planning for Ripley Road which show the first intersection from the highway at a distance significantly less than 400m.

Previous planning for the area located Wensley Road in a location which was suitable for an underpass The planning identified the provision of an underpass on the existing alignment of Wesley Road with no connection provided onto the highway from Wesley Road. As the road reserve exists it is a logical location for the underpass.

The work carried out to establish the guiding principles to be used as the basis of the Context Plan identified that the location for the extension of Wesley Road across the highway would be better suited if it were moved further to the west. The intersection would then be an overpass. A preliminary assessment of the highway intersection spacings indicated that this proposed move should not have an adverse impact on the performance of the highway intersection spacings.

The locations and layouts of the Ripley Road and Wensley Road Intersections with the Centenary Highway needs to be considered in conjunction with the planning for the Urban Core. Further discussions with ULDA, ICC and DTMR will be required to find the best long term solution for the intersection.

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The locations and layouts of the Ripley Road and Wensley Road Intersections with the Centenary Highway needs to be considered in conjunction with the planning for the Urban Core. Further discussions with ULDA, ICC and DTMR will be required to find the best long term solution for the intersection.

5.4 Transport Corridor

A future transit corridor traverses the southern part of the Urban Core in an east west direction. Current planning for this corridor is for a rail connection to the valley. Preliminary designs for this infrastructure provided by DTMR indicate a passenger interchange for the transit corridor is planned for within the Urban Core centre. The location of the corridor and the proposed interchange provide an opportunity to provide a transit focus with the development in this area to be considered a transit centre that provides intermodal change for passenger rail, regional and local buses, taxis, cycles and pedestrians.

While the transit corridor is preserved within the proposed development proposal, further detailed planning is required to determine the ultimate configuration appropriate within the context of the urban development. It is anticipated that this planning would be undertaken in consideration of this setting and in consultation with the developers of the area.

Ultimately, it is anticipated that the transit interchange will consist of a fully functional, inter-modal transport facility with connections to other forms of public transport including bus and cycle facilities. This facility would be a transit orientated development with high accessibility to the Urban Core through a transit square and activation to the square through retail, cafe and restaurant uses.

In the immediate term, the transit corridor is preserved as a linear park that connects pedestrians, cyclists, and potentially regional bus movements, between Ripley and Ipswich.

5.5 Public Transport

With sustainability as a focus, establishment of a highly efficient and consumer friendly public transport network is a key initiative of the Urban Core development. As noted previously, the transit interchange will provide a focus to this network.

Critical in establishing the behaviours necessary for future use of this network will be the provision of accessible public transport within the early phases of the development. The public transport network will consist of regional, local, and specialised neighbourhood transport which is anticipated to be phased over the development of the Urban Core.

In the short term, neighbourhood public transport will be essential to connect the local communities to the Urban Core Centre and establish community behaviours. It is anticipated that initially regional connections would be provided by buses with the bus stop established in the vicinity of the ultimate transit centre interchange.

As development proceeds it is anticipated that bus movements would increase resulting in the expansion of the transit square and regional, local and neighbourhood public transport options. Simple pedestrian and cycle access across Ripley Road will be accommodated at traffic lights. A significant component of the medium term delivery of the transit centre will be the establishment of a bicycle hub. This is a recreation, commuter and local bike facility, including change rooms and storage that enables bicycle travel to be encouraged within the Urban Core Centre.

In the long term, the transit centre will be delivered as a fully functional, inter-modal transport facility. The underground railway station is to be connected to a significant bus facility, potentially also below grade, with local and neighbourhood buses also accommodated and within the public domain. The centrepiece remains the complete transit square which should include a significant light well to the platforms below grade. Station entrances provide access to rail and bus as well as connectivity beneath Ripley Road to provide seamless access to the Urban Core Centre. Transit orientated development around the transit square and over the multi-modal facility will provide activation to the square through retail, cafe and restaurant uses.

5.6 Pedestrian and Cycle Network

Establishment of pedestrian and cycle networks within the Urban Core have been a focus of the development of the structure for the area.

Three tiers of formalised cycle networks have been identified within the Urban Core:

- Regional connections providing connections to the development;
- Local connections consisting of a combination of on road and off road linkages throughout the Urban Core; and
- Recreational connections consisting of pathways within open space and parks.

The Queensland Government has developed a 'SEQ Principle Cycle Network' which identifies regional connectors to the development along the Centenary Highway and Ripley Road. These connections have been considered within the Context Plan and are identified as the regional connectors. All other networks are located within the Urban Core road and open space networks.

Likewise, pedestrian movement has been considered within the development by the inclusion of shared pathways through the Urban Core and in the development of the road reserves and cross sections.

6.0 Summary and Conclusions

This report investigates the engineering and environmental issues associated with developing the Urban Core within Ripley Valley. Some of the key design principles used by the consultant team in preparation of the Context Plan included:

- Consideration and enhancement of the sites natural value and characteristics;
- Providing a connected open space network;
- Consideration of all users in developing the movement networks;
- Reduction of demand on traditional water and wastewater systems; and
- Incorporation of sustainability initiatives.

Infrastructure is either available or can be provided such that development can proceed in a timely, orderly, integrated and coordinated manner.

Key constraints to development have been identified in this report such as

- Mine related undermining of a small area in a north-east section of the site;
- Possible areas of contaminated land;
- Dispersive soils;
- Bundamba Creek environmental corridor;
- Water quality in downstream receiving waters; and
- Flood levels in downstream receiving waters.

Principals have been established and strategies proposed within the report so that all of the identified constraints can be suitably addressed to mitigate any impact on the environment and adjoining landowners.

This report has shown that, in broad terms, the development proposed for the Urban Core is consistent with the development scheme that the ULDA has developed in association with Ipswich City Council. Departures include minor shifts to the locations of the Wensley Road connection with the Centenary Highway, the linkage to the Swanbank development and the avenue connection through the southern part of the development. Preliminary assessment of these modifications identified that these proposed changes will not alter the intended function of these key corridors.

From the investigations undertaken it is clear that

- the Context Plan is based on sound engineering and environmental principles;
- the development proposed complies with the requirements of the strategic plan for the Ripley Valley UDA area; and
- the proposal can be developed in such a way that it complies with the guidelines and policies of the ULDA and the ICC.

Development of the Urban Core as identified in the Context Plan should be endorsed by the ULDA and ICC as the appropriate development strategy for the area.

Referenced Reports

Overall Planning

'Ripley Town Centre Master Plan – Report on Engineering Infrastructure and Transportation'
KBR Pty Ltd. 12 April 2005.

Environmental

'Ripley Valley Urban Core Major Neighbourhood Masterplan – Cultural Heritage Impact'
JM Pearce Architects Pty Ltd. 30 March 2009.

'Ripley Valley Urban Core – Ecological Constraints Analysis'
Cardno Pty Ltd. 4 December 2009.

Ripley Valley Urban Core – Ecological Impact Assessment and Mitigation Report'
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'Draft Desktop Hydrogeological Assessment Ripley Valley Urban Core, Ripley Valley, QLD'
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Butler Partners Pty Ltd. 8 August 2011.

Electrical, Telecommunications and Gas

'Ripley Urban Core – Report on Electrical Services'
JJ van der Boor & Associates. 13 October 2010.

Flooding

'Ripley Valley: Urban Core (UC) Neighbourhood Masterplan – Updated Flood Modelling'
Cardno Pty Ltd. December 2009.

'Ripley Valley: Urban Core (UC) Neighbourhood Masterplan – Flooding Report'
Cardno Pty Ltd. 14 September 2010.

Geotechnical

'Preliminary Geotechnical Investigation Urban Core and Town Centre Ripley Road Ripley Valley'
Butler Partners Pty Ltd. 5 February 2008.

'Preliminary Geotechnical Assessment Ripley Valley – Urban Core'
Cardno Bowler Pty Ltd. 17 February 2010.

Stormwater

'Ripley Valley: Urban Core (UC) Neighbourhood Masterplan Conceptual Stormwater Management Plan'
MPN Consulting Pty Ltd. 23 November 2009.

Sustainability

'Ripley Valley: Urban Core (UC) Neighbourhood Masterplan Water Cycle Management – Water Budget'
Cardno Pty Ltd. 17 September 2010.

Transport and Traffic

'Ripley Valley: Urban Core (UC) Neighbourhood Masterplan Town Centre Traffic Assessment'
Bitzios Consulting Pty Ltd. December 2009.

Water and Sewer

'Ripley Valley: Urban Core Neighbourhood Masterplan Water Supply and Sewerage Report'
Cardno Pty Ltd. 9 December 2009.

'Ripley Valley Bundamba Sewerage Planning – Interim Stages'
MWH Pty Ltd. October 2010.

Appendices

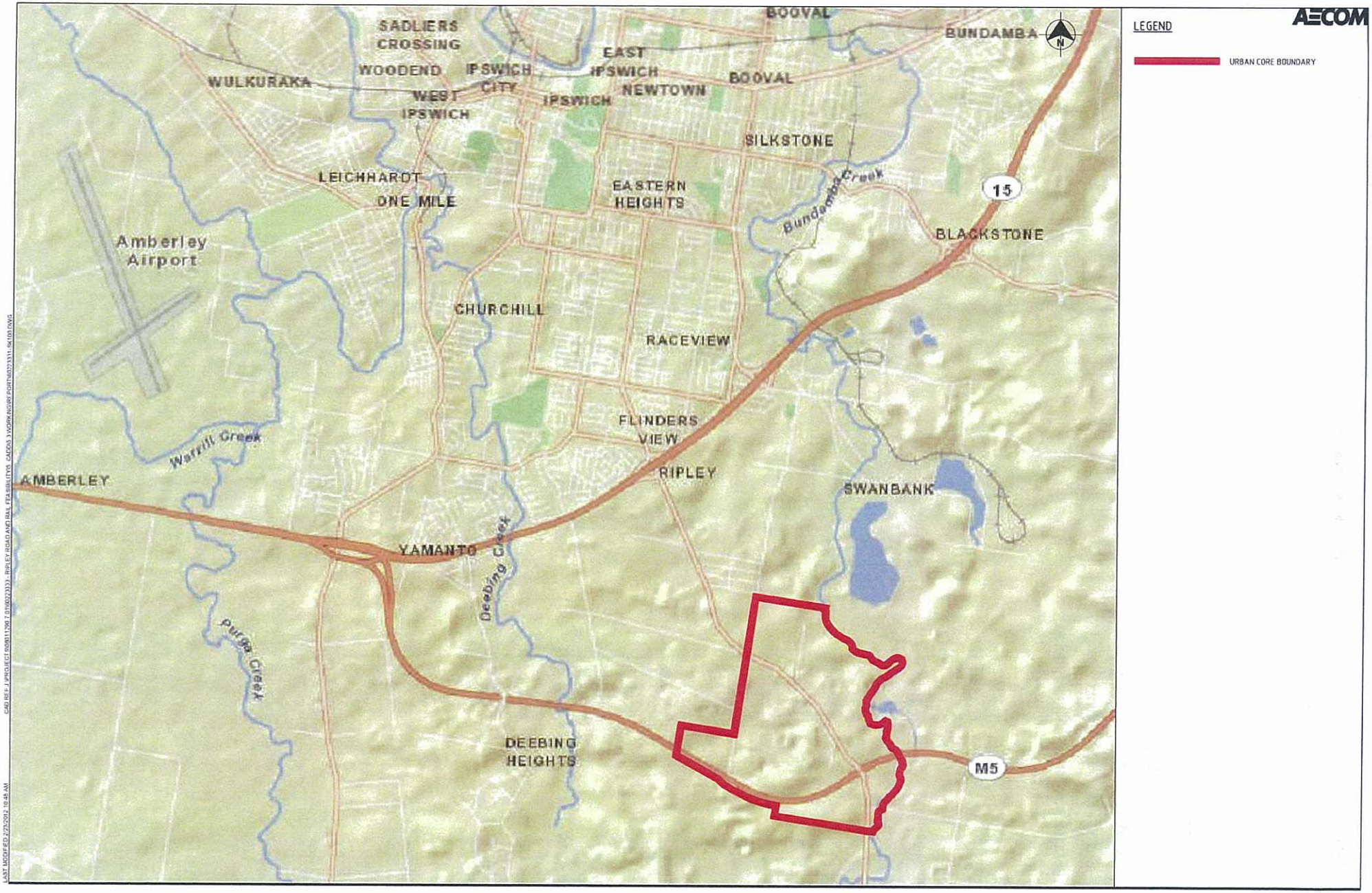
Appendix A

Sk100 - Locality Plan

Sk101 – Urban Core Boundary

Sk102 - Major Constraints

Framework Plan – Hames Sharley



RIPLEY URBAN CORE
LOCALITY PLAN
NOT TO SCALE

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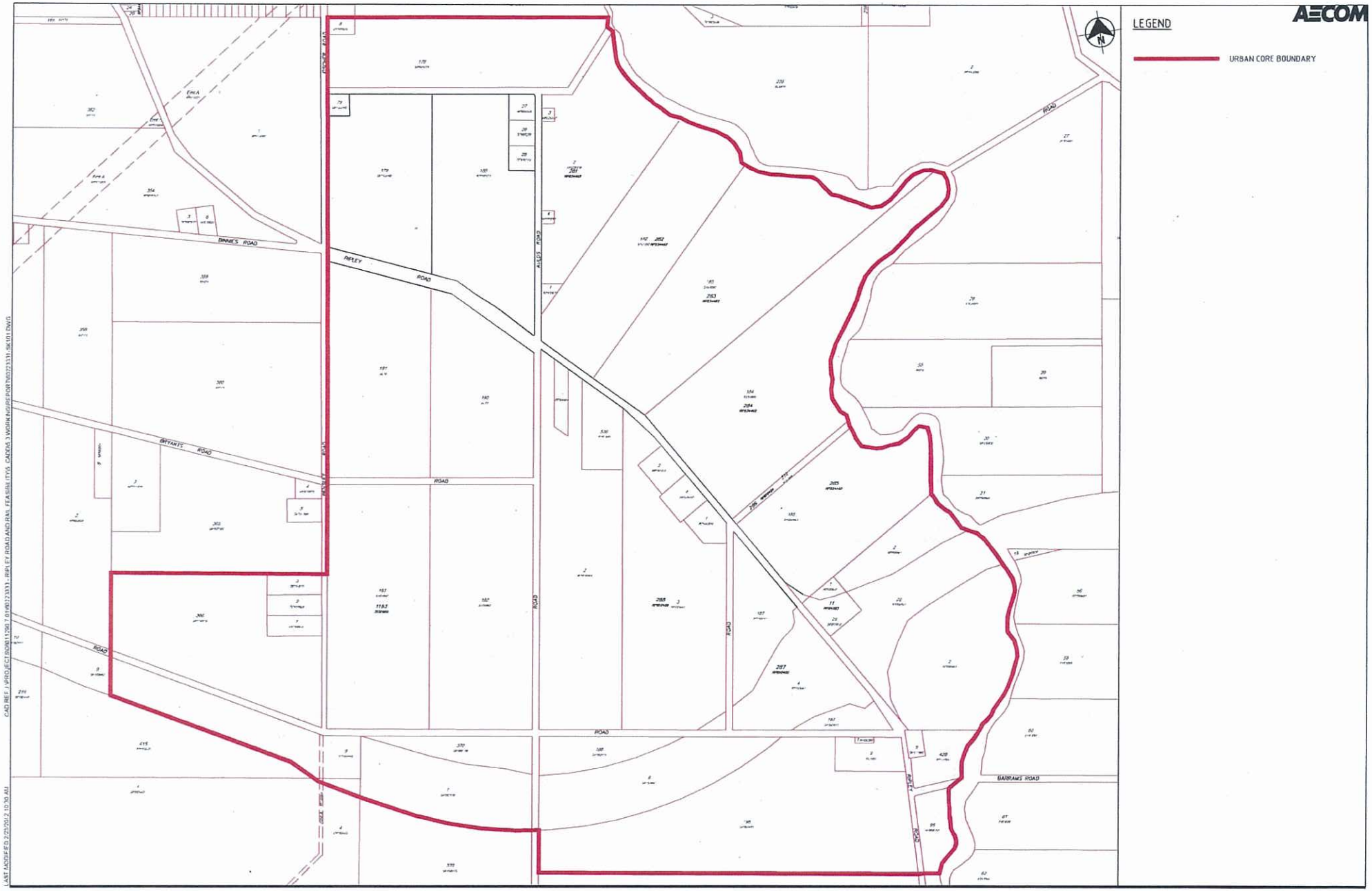

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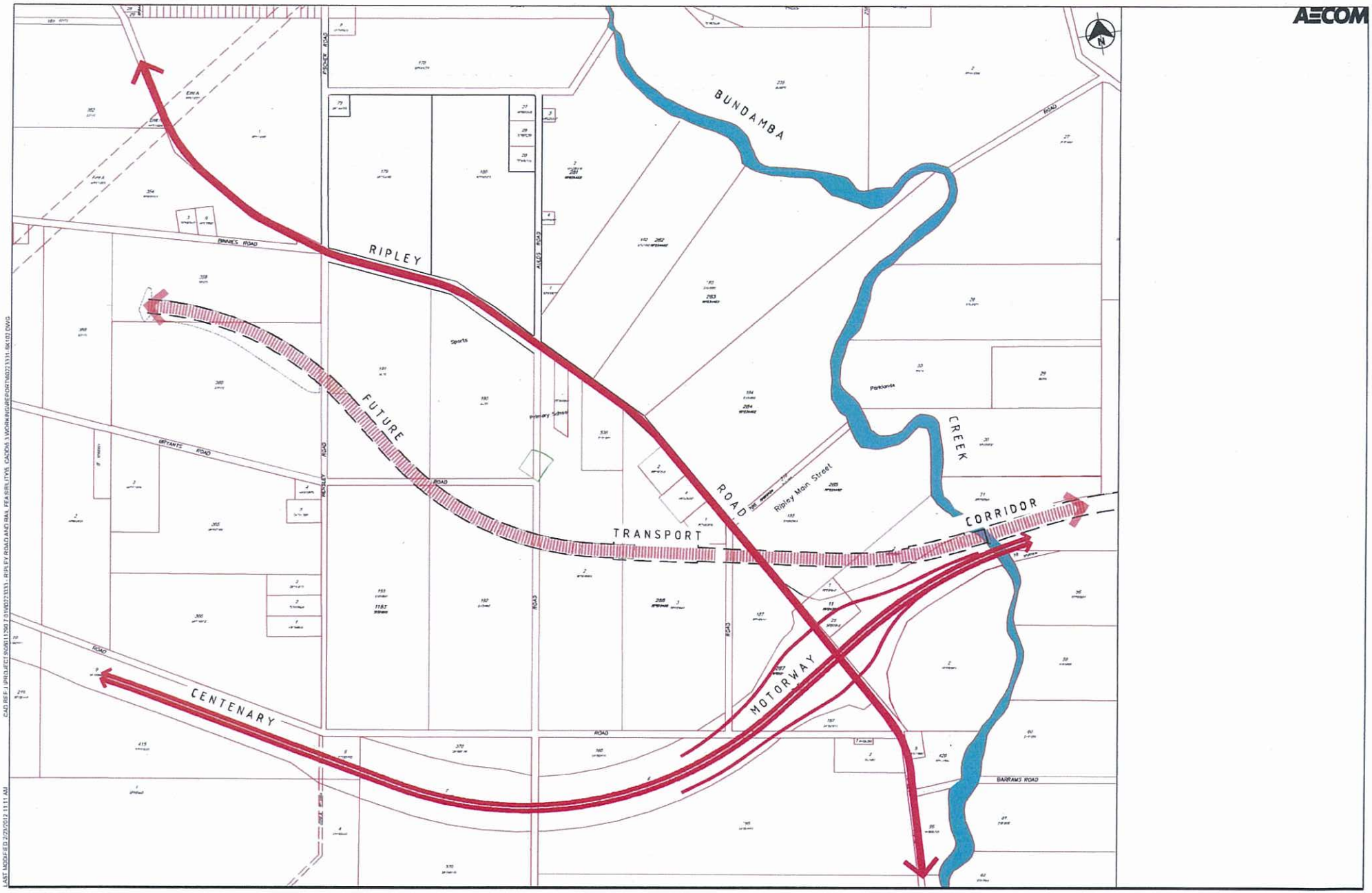
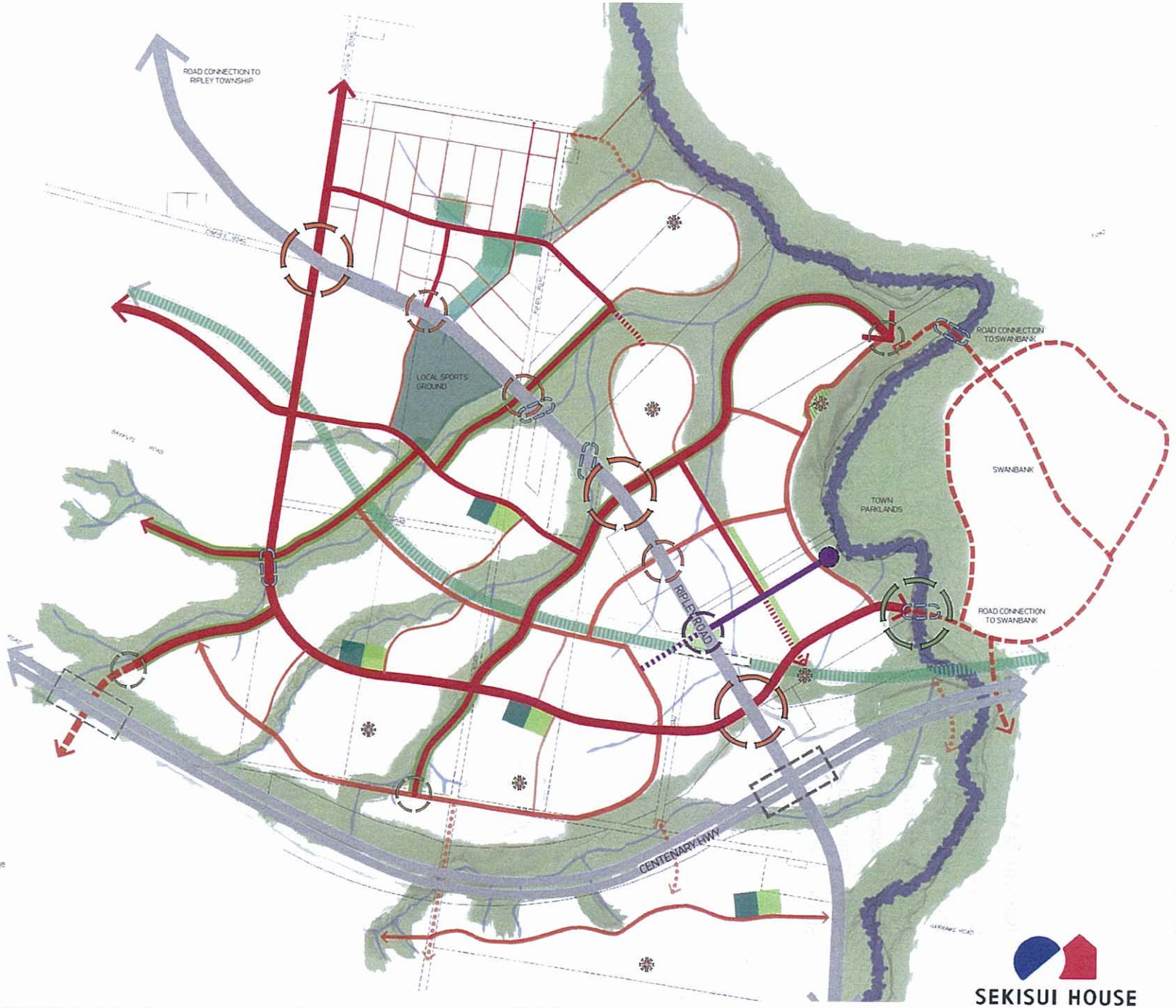


RIPLEY URBAN CORE
MAJOR CONSTRAINTS

60223331-SK102

A



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SCALE 15000 @ A1

DATE 14/02/2012

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Appendix B

Sk103 - Slope Analysis Plan

Sk104 - Previous Geotechnical Investigations Locality Plan

Sk105 - Vegetation Overlay

Sk106 - Ecological Constraints Plan

Sk107 - Contaminated Land Plan

Sk108 - Q100 Flood Inundation Plan