5_Opportunity & Constraints Analysis
5.1_**Introduction**

The Key Issues Analysis (Chapter 4) showed that land within Hawkesbury LGA is constrained by a range of factors including conservation areas, bushfire prone land, flooding and lack of infrastructure. The area is also recognised for its high amenity rural and natural setting.

With these constraints and the State Government’s direction to provide for more sustainable and consolidated models of urban growth, the Hawkesbury Residential Strategy uses the Sustainable Development Framework to ensure future dwellings are located in close proximity to centres, transport, services and facilities. As outlined in Section 3.3.6, 90% of additional dwellings (5,400 dwellings) will be located in existing or expanded urban areas where they can access such services and facilities. Only 10% of future development will be located on non-urban sites complying with the Sustainability Matrix for neighbourhood centres.

The Constraints Severity Index (CSI Index) has been used to assist with the identification of future development sites. CSI brings together the different layers of key issue analysis to build a picture of development constraints and opportunities across the LGA. This analysis identifies locations that are not suitable for development, thereby identifying sites that could be further investigated for the possibility to locate the 6,000 dwellings. The analysis reviews both infill and Greenfield opportunities.

It is noted that this is a high-level modelling exercise and is a guide to assist Council in undertaking more site specific detailed investigations and studies. The modelling is based on the data available and using criteria and weightings developed in consultation with Council Officers.

5.2_**Constraints Severity Index (CSI)**

The concept behind the Constraints Severity Index works on the understanding that environmentally or otherwise constrained land should generally not be used for urban development. The Constraints Severity Index is a GIS tool which can identify locations which are constrained by a range of factors and therefore may not be suitable for urban development.

The Constraints Severity Index works by analysing a series of constraints indicators, it also takes into account opportunity indicators that may support development, it then evaluates the level of constraint in the study area. The locations with lower constraint are given positive values and are earmarked for further investigations.

The tool overlays a weighted index of opportunities and constraints to estimate locations which could be investigated for future urban development:

**Opportunities**

Opportunities include elements such as:
- Proximity to centres
- Availability of services and facilities (ie commercial, retail and community)
- Availability of existing or planned key infrastructure (ie road, transport and sewer)

Opportunities including their sub-categories have been weighted from +5 being the greatest opportunity to +1 being the least opportunity. Opportunities investigation areas are identified in green tones.

**Constraints**

Constraints predominately relate to environmental constraints including:
- Flooding
- Acid sulphate soils
- Bushfire prone land and buffers
- Significant vegetation communities
- Slope
- Riparian zones and buffers

Constraints also include impacts associated with existing uses such as Richmond Air Base, heritage items as well as lack of infrastructure.

Constraints, including their sub-categories have been weighted from -5 being the most constrained to -1 being least constrained. Constraints are identified in red tones.

The final part of the assessment overlays the opportunity and constraints mapping into a single map that will show areas with potential for future development.

Table 5.1 outlines the opportunity and constraint indicators that were used for this assessment. The assessment has been limited to available data.
5.2.1 Process
The following process was used to determine the severity of each constraint and opportunity:

1. Identify indicators (including sub-categories) with available spatial data.
2. Assign weighting to each indicator including sub-categories, if any. Opportunities are given a positive value (0 to 5) and constraints are given a negative value (0 to -5).
3. Divide the LGA into a grid of uniformly sized square cells to standardise the spatial unit of analysis. The cells within the grid measure 400m by 400m.
4. Each indicator data set is analysed to identify how much of the criterion measured (by that indicator) falls within each cell. Since the units of indicators vary depending on what is being measured, they are all standardised against the maximum value in any cell on a scale of 0 to 100. This process is repeated for each opportunity and constraint indicator data set.
5. These standardised indicator values are aggregated into a single dataset after taking into account their assigned weights. This provides a picture of the opportunities and constraints combined together.
6. The final output weights the ‘severity’ or combined impact of the opportunity or constraint indicators in each grid cell, to identify whether the combined impacts are high or low.
7. A high (positive) index value indicates higher potential, and a low (negative) index value indicates low or no potential for additional residential development. Therefore, cells with higher index values are identified for further investigation for their suitability to accommodate future development.

5.2.2 Calculations
CSI can be calculated as sum of all indicators multiplied by their respective weightings, divided by the respective maximum values and converted to percent, by multiplying the resulting value with 100.

Mathematically it can be represented as:

$$CSI = \sum_{i=1}^{n} \left( \frac{l_i \cdot W_i}{l_{\text{max}}} \right) \times 100$$

Where:
- CSI = Constraint Severity Index
- $l_i$ = Indicator value (area of land occupied in a cell by the criterion or number of items in a cell)
- $W_i$ = Weighting of the $l_i$ indicator
- $l_{\text{max}}$ = Highest values of the indicator in any cell of the grid
- $n$ = Total number of indicators
5.3_Opportunity and Constraint Indicators

Table 5.1 outlines the indicators and data used to develop the Opportunity and Constraints severity mapping.

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Source</th>
<th>Unit</th>
<th>Type</th>
<th>Weighting</th>
</tr>
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<tbody>
<tr>
<td><strong>CONSTRAINT MAPPING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flood prone land</td>
<td>1:100</td>
<td>sqm</td>
<td>Constraint</td>
<td>-5</td>
</tr>
<tr>
<td>Other</td>
<td>Council GIS</td>
<td>sqm</td>
<td>Constraint</td>
<td>-3</td>
</tr>
<tr>
<td>Bushfire prone land</td>
<td>Vegetation Groups 1</td>
<td>Council GIS</td>
<td>sqm</td>
<td>Constraint</td>
</tr>
<tr>
<td></td>
<td>Vegetation Group 2</td>
<td>Council GIS</td>
<td>sqm</td>
<td>Constraint</td>
</tr>
<tr>
<td></td>
<td>Buffer</td>
<td>Council GIS</td>
<td>sqm</td>
<td>Constraint</td>
</tr>
<tr>
<td></td>
<td>ANEF RAAF</td>
<td>Council GIS</td>
<td>sqm</td>
<td>Constraint</td>
</tr>
<tr>
<td></td>
<td>&gt;20</td>
<td>Council GIS</td>
<td>sqm</td>
<td>Constraint</td>
</tr>
<tr>
<td></td>
<td>Acid Sulphate Soils</td>
<td>Council GIS</td>
<td>sqm</td>
<td>Constraint</td>
</tr>
<tr>
<td></td>
<td>&gt;15 degrees</td>
<td>Council GIS</td>
<td>sqm</td>
<td>Constraint</td>
</tr>
<tr>
<td></td>
<td>Vegetation/Ecology</td>
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<td>sqm</td>
<td>Constraint</td>
</tr>
<tr>
<td></td>
<td>W C1, C2, C3, C4 (Priority Order 1)</td>
<td>Council GIS</td>
<td>sqm</td>
<td>Constraint</td>
</tr>
<tr>
<td></td>
<td>URT, O1, O2, O3 (Priority Order 2)</td>
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<td>sqm</td>
<td>Constraint</td>
</tr>
<tr>
<td></td>
<td>S1, S2 (Priority Order 3)</td>
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<td>Constraint</td>
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<td></td>
<td>Riparian</td>
<td>HASSELL</td>
<td>sqm</td>
<td>Constraint</td>
</tr>
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<td></td>
<td>Heritage</td>
<td>Council GIS</td>
<td>Item</td>
<td>Constraint</td>
</tr>
<tr>
<td></td>
<td>Lack of sewer</td>
<td>Council GIS</td>
<td>sqm</td>
<td>Constraint</td>
</tr>
<tr>
<td><strong>OPPORTUNITY MAPPING</strong></td>
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<td></td>
<td></td>
</tr>
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<td>Centre catchment</td>
<td>Town centre</td>
<td>HASSELL</td>
<td>800m buffer</td>
<td>Opportunity</td>
</tr>
<tr>
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<td>Village</td>
<td>HASSELL</td>
<td>600m buffer</td>
<td>Opportunity</td>
</tr>
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<td>Small Village</td>
<td>HASSELL</td>
<td>400m buffer</td>
<td>Opportunity</td>
</tr>
<tr>
<td></td>
<td>Neighbourhood Centre</td>
<td>HASSELL</td>
<td>150m buffer</td>
<td>Opportunity</td>
</tr>
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<td>Residential zone</td>
<td>Council GIS</td>
<td>Zone area</td>
<td>Opportunity</td>
<td>5</td>
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<tr>
<td>Business zone</td>
<td>Council GIS</td>
<td>Zone area</td>
<td>Opportunity</td>
<td>2</td>
</tr>
<tr>
<td>Access</td>
<td>Rail Station</td>
<td>Council GIS</td>
<td>1km buffer</td>
<td>Opportunity</td>
</tr>
<tr>
<td></td>
<td>Bus Route</td>
<td>Council GIS</td>
<td>400m buffer</td>
<td>Opportunity</td>
</tr>
<tr>
<td></td>
<td>Roads</td>
<td>Council GIS</td>
<td>metres</td>
<td>Opportunity</td>
</tr>
<tr>
<td>Local open space</td>
<td>Council GIS</td>
<td>400m buffer</td>
<td>Opportunity</td>
<td>4</td>
</tr>
<tr>
<td>Recreational facilities</td>
<td>Council GIS</td>
<td>400m buffer</td>
<td>Opportunity</td>
<td>4</td>
</tr>
<tr>
<td>Community facilities</td>
<td>Council GIS</td>
<td>400m buffer</td>
<td>Opportunity</td>
<td>4</td>
</tr>
<tr>
<td>Heritage</td>
<td>Council GIS</td>
<td>Item</td>
<td>Opportunity</td>
<td>2</td>
</tr>
<tr>
<td>Sewer</td>
<td>Council GIS</td>
<td>sqm</td>
<td>Opportunity</td>
<td>5</td>
</tr>
</tbody>
</table>
Figure 5.1: Opportunity and Constraints Analysis, Hawkesbury LGA
Source: HASSELL (October, 2009)
5.4 LGA Wide Opportunities and Constraints

Figure 5.1 illustrates the opportunity and constraints severity index for the Hawkesbury LGA. The key findings of this analysis are as follows:

The majority of the LGA is classified as ‘high constraint’ showing the area contains significant implications to future urban development. Future urban development should not be considered in these areas without detailed investigation and analysis of the identified constraints.

It is important to note that the Opportunity and Constraints Analysis is a tool to identify areas for future investigation. As it measures opportunities and constraints at a high level, local level investigations may identify other areas appropriate for urban development.

The south-eastern part of the LGA has more potential for future urban development with some areas of ‘high opportunity’, particularly around the centres of Richmond, North Richmond, Windsor and the corridor between Windsor and Bligh Park, subject to the resolution of flood constraints.

Some areas within the south-eastern part of the LGA are “neutral” for future development (shaded yellow/gold) these areas have some constraints but do not contain many of the factors which are considered important to support future urban development such as transport infrastructure and facilities for example. These areas may require investigation and subject to provision of services and elements in Sustainability Index may be suitable for urban development.

In general, the Opportunity and Constraints Severity Index analysis for Hawkesbury LGA supports the principles of the Sustainable Development Framework for the LGA, by indicating that centres contain the most opportunity to support additional development.
Figure 5.2: Opportunity and Constraints Analysis, Hawkesbury LGA Southern Areas
Source: HASSELL (October, 2009)
5.5 Southern Areas Opportunities and Constraints

Figure 5.2 is a detail of the opportunity and constraints analysis for the south-eastern areas of the LGA, which is currently the focus of residential development. The key findings of this analysis is as follows:

- The areas with the greatest potential for future development generally align with the location and catchment of the existing centres. Richmond, North Richmond, Windsor, South Windsor and Mulgrave have areas with high opportunity for development.
- There is a corridor of high urban development potential between Windsor and Bligh Park. Which may require further investigations to determine extent and capacity of services and facilities and resolution of flood and flood evacuation constraints.
- While there is potential for future urban development in some of the existing smaller centres such as Clarendon, Vineyard, Glossodia, Kurrajong, Wilberforce and Pitt Town. Some of these centres are constrained and others may be lacking the services and facilities to support future growth, particularly sewer services. Investigation into current extent and capacity of services and facilities may identify long term opportunity for these centres.
5.6_Future Investigation Areas

The CSI mapping has identified areas with high opportunity for future development that should be further investigated to determine the area’s ability to support additional or new housing development. Future investigation areas have been identified from high level data, which has considered:

_areas with high opportunity for future development
_areas with high opportunity lay in areas within or adjacent to centres. This Residential Strategy implements a centres based strategy and seeks to locate much of the future growth within existing areas in accordance with the Sydney Metropolitan Strategy. The analysis has reviewed areas within existing centre catchments to identify future investigation areas.

This analysis will also assist Council in locating a proportion of development within and adjacent to existing urban areas.

Based on the outcomes of the opportunity and constraints analysis identified most opportunity lay in areas within or adjacent to centres. This analysis identified most opportunity lay in areas within or adjacent to centres. This Residential Strategy implements a centres based strategy and seeks to locate much of the future growth within existing areas in accordance with the Sydney Metropolitan Strategy. The analysis has reviewed areas within existing centre catchments to identify future investigation areas.

This analysis will also assist Council in locating a proportion of development within and adjacent to existing urban areas.

Based on the outcomes of the opportunity and constraints analysis the following areas were the focus of this review:

Richmond
North Richmond
Windsor
Wilberforce
Glossodia

Investigations in Glossodia may need to consider a reduction in extension of residential zone amending some of this zoned land to include large lot residential in recognition of environmental and servicing constraints.

The investigation areas on the following pages are each assigned a Sustainability Matrix criteria for the centre type (as shown in Table 4.4). This centre type classification should not be considered as the definitive classification and may change, up or down, subject to the required detailed structure planning.

The remaining centres identified in the Residential Strategy that have not been identified as investigation areas, are considered to be subject to unacceptable impacts for future development in the short-long term. These areas are as follows:

**Vineyard** - The future planning will be subject to the North West Growth Centre.

**Pitt Town** - The future development has previously been addressed by the Department of Planning in 2008 as part of a Part 3A Concept Approval, which is considered to supply Pitt Town with an adequate supply of zoned residential land for the duration of the Residential Strategy. Pitt Town has longer term development potential in zoned areas.

**Clarendon** - Clarendon has been identified in the Employment Land Strategy 2008 for commercial and industrial use. Clarendon also has significant constraints to development such as flooding and inadequate road infrastructure.

**Mulgrave/McGraths Hill** - This area has been removed from the investigation areas as it is subject to unacceptable flooding and evacuation impact.

**South Windsor** - South Windsor has been removed as it is predominantly a service industrial centre. Future investigation should consider the removal of land identified in the current MDP due to unacceptable flooding and servicing.

**Non-urban flood prone land** - All non-urban zoned land currently affected by the 1:100 year flood event is not considered suitable for intensification of residential development.

The CSI mapping has also shown the potential for a corridor between Windsor and Bligh Park subject to the resolution of flood related constraints. Corridor development can be consistent with the Centres Based planning model as long as all dwellings are within proximity to a centre. This may be achieved by locating additional smaller centres within the corridor to meet the convenience needs of the local population.

Detailed Structure Planning to determine land capacity and ability to meet dwelling targets of the investigation areas has not been undertaken as part of this study and is required to be undertaken in future investigations.

As part of the Future Investigation processes, each centre should be reviewed against the Sustainability Matrix (Refer to Chapter 6) to ensure the centre has sufficient services, infrastructure and facilities to support additional development.

Structure Planning of centres will also assist in developing a coherent and comprehensive approach to increasing residential development in suitable investigation areas.
5.6.1 Richmond Future Investigation Areas

Investigations must consider the Sustainability Matrix criteria for a Town Centre to ensure the centre has the required level of services and facilities to accommodate future population.

Further Investigations are subject to:
- The ability to appropriately service development in a timely manner
- Flood evacuation
- Detailed structure planning of town centre and investigation areas.

Development must address potential landuse conflicts in this location.

*Investigation areas identified may extend beyond the time scales of this Residential Study.

*The inclusion of the areas for investigation does not guarantee that the whole of that land can be developed in the future.
5.6.2 North Richmond Future Investigation Areas

Investigations must consider the Sustainability Matrix criteria for a Village to ensure the centre has the required level of services and facilities to accommodate future population.

Increased density and investigation areas are subject to:
- Resolution of road access, traffic and transport issues
- Investigation into bushfire prone areas
- Detailed structure planning of the village and investigation areas
- Provision of an increased range of services and facilities

Source: HASSELL (September, 2010)

Investigate additional density within existing area and catchment

Longer term opportunity subject to provision of shops, transport infrastructure, community infrastructure and services outside catchment

*Investigation areas identified may extend beyond the time scales of this Residential Study.
*The inclusion of the areas for investigation does not guarantee that the whole of that land can be developed in the future.
5.6.3 Wilberforce Future Investigation Areas

Investigations must consider the Sustainability Matrix criteria for a Sm Village to ensure the centre has the required level of services and facilities to accommodate a future population.

Increased intensity of development and investigation areas subject to:
- Provision of sewerage infrastructure
- Resolution of flood evacuation
- Timely provision of infrastructure
- Detailed structure planning of investigation areas
- Provision of additional services and facilities

Opportunity for increased density and infill subject to the expansion of commercial, retail and community services to accommodate a larger population

Medium to long term opportunity for rural residential development

Short term opportunity for development adjacent to existing urban area

Source: HASSELL (September, 2010)

*Investigation areas identified may extend beyond the time scales of this Residential Study.

*The inclusion of the areas for investigation does not guarantee that the whole of that land can be developed in the future.
5.6.4 Glossodia Future Investigation Areas

Investigations must consider the Sustainability Matrix criteria for a Neighbourhood Centre to ensure the centre has the required level of services and facilities to accommodate future population.

Increased intensity of development and investigation areas subject to:
- Resolution of transport, access and traffic issues particularly road infrastructure crossing the river
- Provision of sewage for increase in density of development
- Detailed structure planning to review residential types and distribution
- Review of extent of zoning to determine appropriateness of the scale and density of development within the centre

Extent and type of residential zoned land to be reviewed subject to sewerage, the expansion of commercial, retail and community services to accommodate a larger population.

Larger lot residential is to be investigated within the urban zoned around fringe.

Source: HASSELL (September, 2010)

*Investigation areas identified may extend beyond the time scales of this Residential Study.
*The inclusion of the areas for investigation does not guarantee that the whole of that land can be developed in the future.
5.6.5 Corridor Future Investigation Area

There is an opportunity for a corridor between Windsor and Bligh Park containing a range of densities. Additional smaller centres within the corridor are to ensure the convenience needs of the local population are met. Increased intensity and development of investigation areas are subject to:

- Resolution of existing flood evacuation;
- Provision of additional services and facilities;
- Detailed structure planning of town centre and investigation areas; and
- Timely provision of infrastructure.

Investigate additional density within existing area and catchment

Longer term opportunities to increase densities subject to resolution of flood evacuation issues

Area (known as Bligh Park North) is subject to significant flooding and flood evacuation issues that must be resolved prior to any future development

Source: HASSELL (October, 2009)

*Investigation areas identified may extend beyond the time scales of this Residential Study.
*There are no investigation areas nominated in Vineyard due to the fact that all suitable area in this locality has been included in the North West Growth Centre
*The inclusion of the areas for investigation does not guarantee that the whole of that land can be developed in the future.