

Bioretention / Raingardens

Within the Western Plot (North Site) WSUD Boundary a raingarden is proposed to treat flows generated from Darling Drive and adjacent verge areas.

A stormwater bioretention system is a widely accepted WSUD concept that improves the quality of stormwater by filtering water through a biologically influenced media. A typical bioretention system consists of a vegetated surface overlaying a porous filter medium with a drainage pipe at the bottom. Stormwater directed into the bioretention system flows through dense vegetation, and temporarily ponds on the surface, before slowly filtering down through the filter media. Depending on the design, treated flows are either infiltrated to underlying soils, or collected in the underdrain system for conveyance to downstream drainage systems.



Figure 9 – Raingardens configured to treat runoff from roof and adjoining impervious areas
(Sources: Melbourne Water and WSUD.org)

A bioretention system captures and treat stormwater flows from the adjoining urban catchment (e.g. roads, pervious or paved surfaces), before they enter the stormwater drainage system. The vegetated top layer filters sediment and gross pollutants (including plastics, bottles and wrappers) before water gets filtered through a series of layered media (e.g. soil, sand). Together with the plants' root system, the layered media treats the flows to remove nitrogen, phosphorus, sediment, grease and oils before it enters the stormwater system.

Bioretention systems used in the Darling Square development include raingardens and bioretention tree pits.

7.4.4 POLLUTANT LOAD ESTIMATES

Existing and Baseline Scenarios

Total annual pollutant load estimates were derived using MUSIC for the entire Darling Square Precinct under Existing and Baseline (Proposed Development without Treatment) Conditions. These estimates are presented in **Table 2**. The introduction of more vegetated areas (including raingardens along Darling Drive, green roofs on building podiums, and planted areas in Public Domain) has resulted in the decrease of the mean annual pollutant loads for Total Suspended Solids (TSS) and Total Phosphorus (TP) discharging from the Darling Square Development. However, the proposed development has resulted in slight increases in Gross Pollutants and Total Nitrogen (TN) which could be partly attributed to the increase in general urban and vegetated areas respectively. We note that the existing site of the proposed development is dominated by road-type surfaces (including the Darling Drive, roof car park and internal roads and vehicle access areas) which produce 'dirtier' water compared to other land uses.

Table 2 Summary of estimated mean annual pollutant loads for Darling Square

Criteria	Mean Annual Loads (kg/yr)			
	Gross Pollutants	TSS	TP	TN
Existing				
Darling Square Precinct	993	8,020	15	96
Baseline (Proposed Development without Treatment)				
Darling Square Precinct	1,090	5,380	11	99

Proposed Development With Treatment Scenario

The estimated annual pollutant loads and reductions for the 'Proposed Development with Treatment' scenario are presented in Table 3.

Table 3 Summary of mean annual pollutant loads and reductions for Darling Square

Criteria	Pollutant			
	Gross Pollutants	TSS	TP	TN
Total Development Source Loads (kg/yr)	1,090	5,380	11	99
Total Residual Load Modelled (kg/yr)	4.0	816	3.4	39
Target Reduction Required (%)	90%	85%	65%	45%
Total Reduction Modelled (%)	100%	85%	69%	60%

7.5 CONCLUSIONS

7.5.1 TREATMENT PERFORMANCE

The MUSIC modelling for the 'Proposed Development with Treatment' scenario has demonstrated that the proposed stormwater quality management strategy for Darling Square achieves the required reduction targets and also results in lower levels of Gross Pollutants, TSS, TP and TN compared to values resulting from the Existing and Baseline Scenarios.

7.5.2 SOCIAL ENVIRONMENTAL AND ECONOMIC BENEFITS

The stormwater management strategy proposed for Darling Square utilises the latest technology for water quality management; is functional; delivers the required technical performance; avoids environmental degradation and pressure on downstream ecosystems and infrastructure; and

provides for a sustainable solution for stormwater management within the site. In particular, the key features of the proposed strategy are as follows:

Social

- Enhanced visual amenity through landscaping
- Integration with other land uses consistent with the achievement of environmental and social objectives

Environmental

- Limited downstream discharge peaks and velocities
- Provision of a rainwater tanks, vegetated buffers, bioretention systems, gross pollutant traps and filtration devices to achieve water quality
- Improved water quality of outflows to Darling Harbour

Economic

- Proposed water quality improvement measures that keep recurrent maintenance tasks and costs to a minimum

8 REFERENCES

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APPENDIX A

FLOODING & STORMWATER REPORT (SSDA2)



SYDNEY INTERNATIONAL CONVENTION, EXHIBITION AND ENTERTAINMENT PRECINCT
THE HAYMARKET PRECINCT

FLOODING AND STORMWATER

FOR SSDA2 5752-2012



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DARLING HARBOUR LIVE

SICEEP – THE HAYMARKET

FLOODING AND STORMWATER FOR SS DA2

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Report No DN00342

Date 15.03.2013

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1

INTRODUCTION

This report supports a State Significant Development Application (SSDA2 5752-2012) submitted to the Minister for Planning and Infrastructure pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

The Application seeks approval for the establishment of building envelopes and design parameters for a new neighbourhood and a community hub (referred to as The Haymarket) as part of the Sydney international convention, exhibition and entertainment precinct SICEEP Project at Darling Harbour.

The project will develop The Haymarket into one of Sydney's most innovative residential and working districts. Through the delivery of the overall Project, Darling Harbour will also become home to Australia's largest convention and exhibition facilities, Sydney's largest red carpet entertainment venue, and a hotel complex of up to 900 rooms.

The SICEEP Project importantly forms a critical element of the NSW Government's aspiration to "make NSW number one again".

2

OVERVIEW OF PROPOSED DEVELOPMENT

The proposal relates to a staged development application and seeks to establish concept plan details for The Haymarket, located within the southern part of the SICEEP Site.

The Haymarket will include student housing, public car parking, a commercial office building, and four mixed use development blocks (retail/commercial/residential podium with residential towers above) centred around a new public square to be named Haymarket Square.

More specifically concept approval is sought for the following:

- Demolition of existing site improvements, including the existing Sydney entertainment Centre (SEC), Entertainment car park, and part of the pedestrian footbridge connected to the Entertainment car park and associated tree removal;
- North-west block – construction of a part public car park and part commercial/office building;
- North-east block – construction of a mixed use podium (comprising retail, commercial, above ground parking, and residential);
- South-east block - construction of a mixed use podium (comprising retail, commercial, above ground parking, and residential);
- South-west block - construction of a mixed use podium (comprising retail, commercial, above ground parking, and residential);
- North block – construction of a low rise mixed use building comprising retail, commercial and residential;
- Student housing – construction of two buildings providing for student accommodation;
- Public domain improvements including a new square, water features, new pedestrian streets and laneways, streetscape embellishments, and associated landscaping. (It is intended that a Stage 2 DA seeking approval for parts of the part of the public domain (The Boulevard and Haymarket Square) will be lodged with the first residential stage);

3 BACKGROUND

The existing convention, exhibition and entertainment centre facilities at Darling Harbour were constructed in the 1980s and have provided an excellent service for Sydney and NSW.

The facilities however have limitations in their ability to service the contemporary exhibition and convention industry which has led to a loss in events being held in Sydney.

The NSW Government considers that a precinct-wide renewal and expansion is necessary and is accordingly committed to Sydney reclaiming its position on centre stage for hosting world-class events with the creation of the Sydney international convention, exhibition and entertainment precinct.

Following an extensive and rigorous Expressions of Interest and Request for Proposals process, Darling Harbour Live (formerly known as 'Destination Sydney' - a consortium comprising AEG Ogden, Lend Lease, Capella Capital and Spotless) was announced by the NSW Government in December 2012 as the preferred proponent to transform Darling Harbour and create the new Sydney international convention, exhibition and entertainment precinct.

Key features of the Darling Harbour Live Preferred Master Plan include:

- Delivering world-class convention, exhibition and entertainment facilities, including:
 - Up to 40,000m² exhibition space;
 - Over 8,000m² of meeting rooms space, across 40 rooms;
 - Overall convention space capacity for more than 12,000 people;
 - A ballroom capable of accommodating 2,000 people; and
 - A premium, red-carpet entertainment facility with a capacity of 8,000 persons.
- Providing up to 900 hotel rooms in a hotel complex at the northern end of the precinct.
- A vibrant and authentic new neighbourhood at the southern end of the precinct, called 'The Haymarket', home to an IQ Hub focused on the creative industries and high-tech businesses, apartments, student accommodation, shops, cafes and restaurants.
- Renewed and upgraded public domain, including an outdoor event space for up to 25,000 people at an expanded Tumbalong Park.
- Improved pedestrian connections linking to the proposed Ultimo Pedestrian Network drawing people between Central, Chinatown and Cockle Bay Wharf as well as east-west between Ultimo/Pymont and the City.

4 SITE DESCRIPTION

The SICEEP Site is located within Darling Harbour. Darling Harbour is a 60 hectare waterfront precinct on the south-western edge of the Sydney Central Business District that provides a mix of functions including recreational, tourist, entertainment and business.

With an area of approximately 20 hectares, the SICEEP Site is generally bound by the Light Rail Line to the west, Harbourside shopping centre and Cockle Bay to the north, Darling Quarter, the Chinese Garden and Harbour Street to the east, and Hay Street to the south.

The SICEEP Site has been divided into three distinct redevelopment areas (from north to south) – Bayside, Darling Central and The Haymarket. The Application Site area relates to The Haymarket as shown in Figure 1.



Figure 1: SICEEP Site Location

5 PLANNING APPROVALS STRATEGY

In response to separate contractual agreements with the NSW Government and staging requirements Lend Lease (Haymarket) Pty Ltd is proposing to submit a number of separate development applications for key elements of the overall Project.

This staged development application involves the establishment of building envelopes and design parameters for a new neighbourhood and a community hub (The Haymarket) within the southern part of the SICEEP Site. Detailed development applications will accordingly follow seeking approval for specific aspects of The Haymarket in accordance with the approved staged development application.

Separate development applications will be lodged for the PPP component of the SICEEP Project (comprising the convention centre, exhibition centre, entertainment facility and associated public domain upgrades) and Hotel complex.

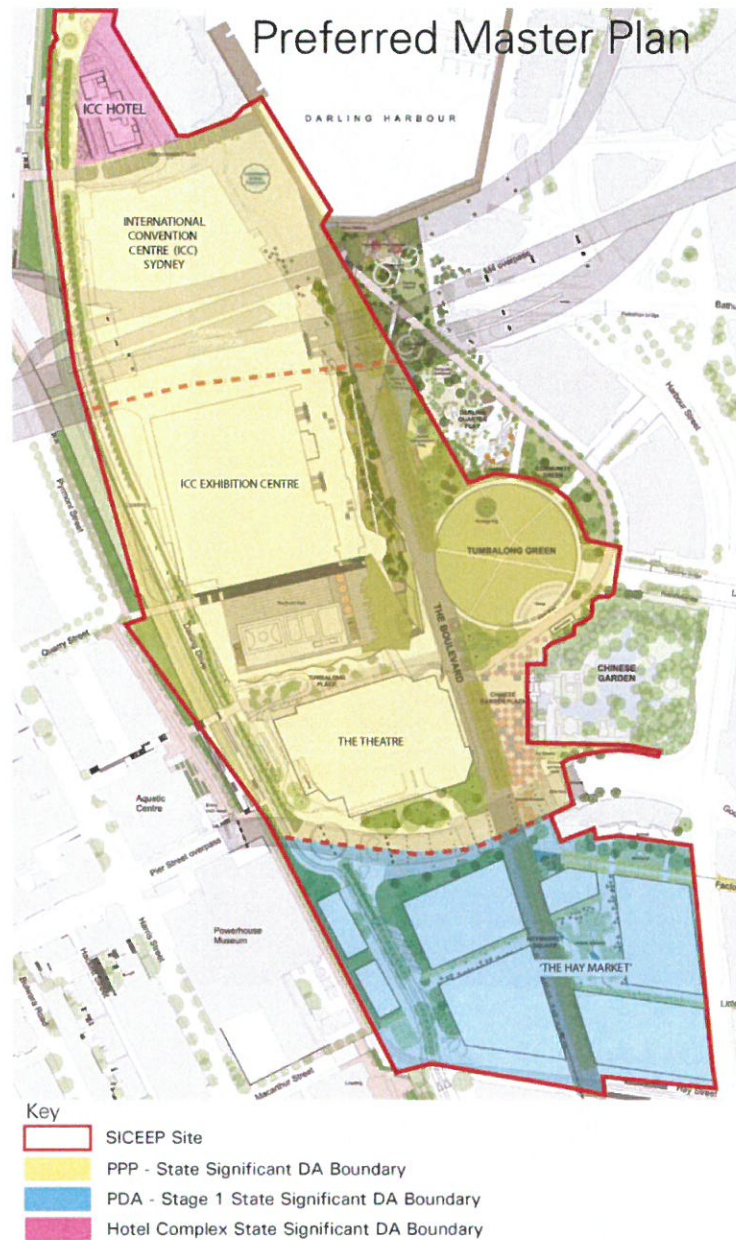


Figure 2: Preferred Masterplan

FLOODING, STORMWATER DRAINAGE & WATER SENSITIVE URBAN DESIGN

Please refer to the Flooding & Stormwater report in Appendix A. The Flood Study, Drainage Management Plan and the Water Sensitive Urban Design plan within that report have been prepared for a separate SICEEP Public Private Partnership (PPP) Stage 2 planning application. The Water Sensitive Urban design component of the Flooding & Stormwater report (Appendix A) focuses on the PPP precinct within SICEEP whilst also assessing The Haymarket at a conceptual level.

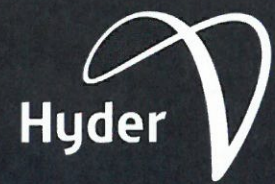
The Water Sensitive Urban Design (WSUD) component of the Site Wide Flooding & Stormwater report in Appendix A reflects design analysis, assessment and commitments for the PPP component of SICEEP only and is based on a level of design resolution for the PPP commensurate with a Stage 2 Development Application.

While The Haymarket will encompass principles of WSUD Design, this Stage 1 Development Application for The Haymarket does not seek approval for specific design, design criteria and commensurate WSUD works.

As noted in the Flooding & Stormwater report in Appendix A, the WSUD for The Haymarket will be the subject of further detailed assessment and design development which will be design developed and lodged at the Stage 2 development application phase.

APPENDIX A

FLOODING AND STORMWATER REPORT



SYDNEY INTERNATIONAL CONVENTION, EXHIBITION AND ENTERTAINMENT PRECINCT
FLOODING & STORMWATER



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DARLING HARBOUR LIVE

SICEEP

FLOODING & STORMWATER

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Report No DN00341

Date 18 March 2013

This report has been prepared for Darling Harbour Live in accordance with the terms and conditions of appointment for Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP) dated 25/01/2013. Hyder Consulting Pty Ltd (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

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GLOSSARY

AEP	Annual Exceedance Probability
ALS	Aerial Laser Scanning
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	Average Recurrence Interval
ARR	Australian Rainfall & Runoff
BOM	Bureau of Meteorology
CoS	City of Sydney
CRC	Cooperative Research Centre
DA	Development Application
DCP	Development Control Plan
DEM	Digital Elevation Model
DECC	Department of Environment and Climate Change
DGR	Director-General's Requirements
DRAINS	Stormwater Drainage System design and analysis program
ESD	Ecologically Sustainable Development
GPT	Gross Pollutant Trap
ha	Hectare
ICC	International Convention Centre
IFD	Intensity-Duration-Frequency
MFEC	Multi-Function Entertainment Centre
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
OEH	Office of Environment and Heritage
OSD	On Site Detention
PDA	Private Development Area
PPP	Public Private Partnership
PMF	Probable Maximum Flood
RMS	Roads and Maritime Services
SHFA	Sydney Harbour Foreshore Authority
SICEEP	Sydney International Convention, Exhibition and Entertainment Precinct
SQID	Stormwater Quality Improvement Devices
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
TUFLOW	Two Dimensional Unsteady Flow (flood simulation software)
WAE	Work-As-Executed
WSUD	Water Sensitive Urban Design

Executive Summary

This flooding and stormwater report, prepared by Hyder Consulting Pty Ltd, is a consolidated assessment of the whole of precinct for SICEEP, which includes the PPP, The Haymarket and ICC Hotels.

The assessment:

- has been carried out in accordance with the Director General's requirements and the INSW project brief as summarised in Tables 2-1 and 2-2 of this report; and
- provides the analysis methodology, findings and recommendations for flooding and stormwater management.

FLOOD STUDY (Section 3)

The SICEEP site is at the downstream of several large stormwater catchments totalling approximately 190 ha, as outlined in Figure A.

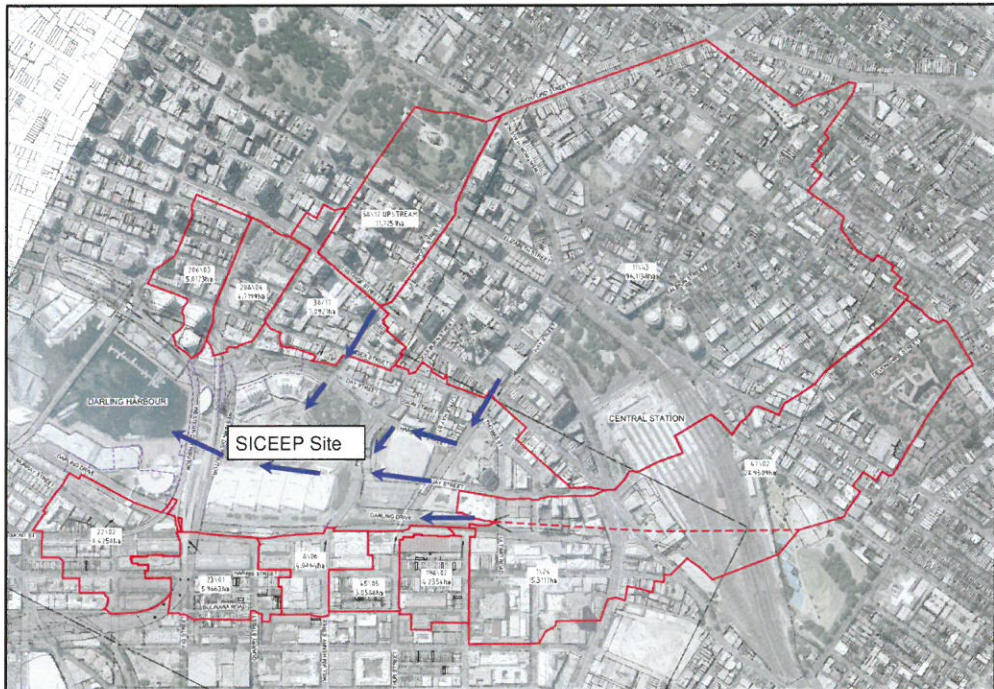


Figure A: Darling Harbour Catchments

There are a number of large Sydney Water underground culvert systems that convey the Darling Harbour catchment runoff through the site and into Darling harbour. However these underground systems do not convey all runoff up to the 100 year ARI flood event and as a result there are a number of significant overland flow paths that run through the site.

The general flood assessment and design approach for the proposed development has been to retain the existing Sydney Water box culvert systems, and mitigate the potential flood impact of the 'Preferred Master Plan' (outlined in Appendix A) on overland flows by amplifying the underground culvert system. The culvert amplification option presented in this report is considered an efficient use of the existing Sydney Water culverts to mitigate potential flood impacts of the 'Preferred Master Plan'.

To demonstrate no adverse flood impacts as a result of the proposed development, a flood assessment has also been carried out for existing conditions. Existing condition, proposed development condition and flood impact figures are all included in Appendix C, and demonstrate conformance to the Director General's requirements and the INSW project brief.

The flood mapping figures are considered adequate for the setting of concept design planning levels, the development of flood emergency response planning, and assessing hydraulic loadings for structural design.

In conclusion to the flood section, it is recommended that alternative flood mitigation measures should be investigated to facilitate future design stages (Section 3.5.5) then several design risks are identified (Section 3.5.6).

STORMWATER DRAINAGE DESIGN (Section 4)

A concept design of the proposed minor (underground conduit) drainage system is outlined for the SICEEP project area in the design drawings that accompany this report. Features of the design include:

- retaining all existing box culvert systems throughout the existing precinct.
- re-use of existing stormwater drainage systems and existing local drainage pipe connections into the existing box culverts where possible. However, where necessary, providing additional/larger stormwater systems and connections.
- provision of open space surface drainage systems with a focus on public safety, giving careful consideration to inlet type and location, and options of porous pavement areas.
- consideration of existing and future overland flow paths throughout the Precinct (as identified in the Section 3 flood study).
- subsoil drainage, as required under pavement areas to ensure appropriate drainage to all areas of subgrade, sub-base and base areas.

Assessment of the proposed stormwater performance has been incorporated into the flood modelling. As such the results are provided in the Appendix C flood mapping, which show significant reduction in proposed flood levels and hazard condition compared to existing conditions.

That said, it is noted that for 20 year ARI conditions along Darling Drive, there are number of local areas where surface water may be improved upon in future design stages as discussed in Section 4.2.

WATER QUALITY ANALYSIS AND WATER SENSITIVE URBAN DESIGN (Section 5)

The catchment considered in the water quality analysis is the entire SICEEP PPP site which has an area of approximately 13 ha. MUSIC modelling set up and catchment definition is described in Section 5.1.

MUSIC modelling was undertaken to estimate the stormwater runoff pollutant loads within the PPP for the following scenarios:

- Existing Conditions
- Proposed development without treatment (Baseline Scenario)
- Proposed development with treatment (Treated Scenario - Practical)
- Proposed development with treatment (Treated Scenario - Desirable)

For the purpose of this report, the "Practical" scenario was explored within the report.

Taken altogether, the MUSIC modelling for the Proposed Development 'Practical' Treated Scenario has demonstrated that the proposed water quality management strategy in the PPP subcatchments will result in achieving the required pollutant reduction levels for Gross Pollutants and Total Nitrogen. With such reductions, pollutant levels in this scenario are lower than the pollutant levels obtained from the Existing and Base Scenario models.

There is 100% retention of Gross Pollutants and 52% retention of Total Nitrogen from the entire SICEEP PPP site; both of which are higher than the 90% and 45% reduction targets set by City of Sydney Council for Gross Pollutants and TN respectively. Taken individually, with 44% reduction achieved, only the Bayside subcatchment is marginally less than the 45% required reduction in TN.

The MUSIC modelling for the Proposed development 'Practical' Treated Scenario has also demonstrated that the proposed water quality management strategy in the PPP subcatchments will result in lower levels of TSS and TP compared to values resulting from the Existing and Base Scenarios. The reduction levels for the entire PPP catchment for TSS and TP are very close to meeting targets set by Council for TSS and TP respectively.

1 INTRODUCTION

This report supports State Significant Development Applications (5752-2012) submitted to the Minister for Planning and Infrastructure pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This report has also been prepared to address the Director-General's Requirements (DGRs) that have been issued for this project, with regard to stormwater, flooding and stormwater quality management (WSUD).

The application seeks approval for construction of the Public Private Partnership (PPP) component of the Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP) project at Darling Harbour.

An additional application also seeks approval for the establishment of building envelopes and design parameters for a new neighbourhood and a community hub (referred to as The Haymarket) as part of the Sydney international convention, exhibition and entertainment precinct (SICEEP) Project at Darling Harbour. The project will develop The Haymarket into one of Sydney's most innovative residential and working districts.

Through the delivery of the overall project, Darling Harbour will become home to Australia's largest convention and exhibition facilities, Sydney's largest red carpet entertainment venue, and a hotel complex of up to 900 rooms.

The SICEEP Project importantly forms a critical element of the NSW Government's aspiration to "make NSW number one again".

This report by Hyder Consulting Pty Ltd presents a concept which identifies in relation to the overall SICEEP project:

- Flood flow regimes (discussed in Section 3);
- Stormwater system design (discussed in Section 4); and
- Management of water sensitive urban runoff (discussed in Section 5).

2 OVERVIEW OF PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The SICEEP Site is located within the Darling Harbour precinct. Darling Harbour is a 60 hectare waterfront precinct on the south-western edge of the Sydney Central Business District that provides a mix of functions including recreational, tourist, entertainment and business.

With an area of approximately 20 hectares, the SICEEP Site is generally bound by the Light Rail Line to the west, Harbourside Shopping Centre and Cockle Bay to the north, Darling Quarter, the Chinese Garden and Harbour Street to the east, and Hay Street to the south.

2.2 TOPOGRAPHY

Darling Harbour is located in the central portion of the Sydney Basin. Darling Harbour is located at Cockle Bay in an area of low undulating topography on the Sydney Harbour Foreshore. Both the Parramatta River and Lane Cove River flow into the Harbour at this point.

Today Darling Harbour is the result of European land management activities including Harbour reclamation. It is situated along a central valley that has been formed by infilling a significant part of the original Cockle Bay. The valley is open and flat, and runs on a north-south axis from Cockle Bay to Tumbalong Park. Ridges rise to the east towards the Sydney CBD and to the west towards Pyrmont from the valley floor (JBA 2007 Part 3A Concept Plan and Environmental Assessment Report (Submitted to Department of Planning on behalf of Sydney Harbour Foreshore Authority)).

Ground levels at the SICEEP site are generally between 2.2m and 5.0m AHD. The lowest lying area within the site includes an area under Pier Street, with high areas located along the western boundary of the site. The light rail corridor runs along an elevated area, along the western boundary of the site.

The topography of the SICEEP site is highly urbanised, with the majority of the area comprising of impervious urbanised areas.

2.3 HISTORY AND HERITAGE

Before the arrival of European settlers the original inhabitants, who were the Gadigal people, who lived in the area around Sydney Cove referred to what is now known as Darling Harbour as Tumbalong (place where seafood is found). When Sydney was founded in 1788, the Bay was called Long Cove, due to the unusual length of the bay.

In 1826 the Bay was again renamed. This time becoming Darling Harbour, in honour of Governor Ralph Darling, who was Sydney's Governor, at the time.

Commissioned by Governor Macquarie in 1812, Darling Harbour developed from a bustling market wharf to what became a major industrial and goods-handling precinct. Initially long jetties were constructed into the tidal waters until land reclamation began to change the shape of the shoreline. By 1836 the town of Sydney had extended to the waterfront at Darling Harbour where warehouses and stores were constructed. The railway at Darling Harbour was opened in 1855 on the western side of Darling Harbour. Goods yards were included with the rail line making Darling Harbour the centre of Sydney's freight network. Industrial expansion continued on the eastern side of Darling Harbour with the construction of foundries, wharves, warehouses, bond stores and ship yards.

However, by the mid 1970's the area had become neglected with abandoned warehouses, wharves and train lines.

In 1984, the NSW State Government, under Labor Premier Neville Wran, announced the redevelopment of the area, from its previous industrial uses to better serve the public and tourist industry. In 1988, Darling Harbour re-opened during Australia's Bicentennial Celebrations.

2.4 PROPOSED DEVELOPMENT

The existing convention, exhibition and entertainment centre facilities at Darling Harbour, constructed in the 1980s, have provided an excellent service for Sydney and NSW.

The facilities however have limitations in their ability to service the contemporary exhibition and convention industry which has led to a loss in events being held in Sydney.

The NSW Government considers that a precinct-wide renewal and expansion is necessary and is accordingly committed to Sydney reclaiming its position on centre stage for hosting world-class events with the creation of the SICEEP Project.

Following an extensive and rigorous Expressions of Interest and Request for Proposals process, Darling Harbour Live (formerly known as 'Destination Sydney'- a consortium comprising AEG Ogden, Lend Lease, Capella Capital and Spotless) was announced by the NSW Government in December 2012 as the preferred proponent to transform Darling Harbour and create the new Sydney International Convention, Exhibition and Entertainment Precinct.

Key features of the Darling Harbour Live Preferred Master Plan include:

- Delivering world-class convention, exhibition and entertainment facilities, including:
 - Up to 40,000m² exhibition space;
 - Over 8,000m² of meeting rooms space, across 40 rooms;
 - Overall convention space capacity for more than 12,000 people;
 - A ballroom capable of accommodating 2,000 people; and
 - A premium, red-carpet entertainment facility with a capacity of 8,000 persons.
- Providing up to 900 hotel rooms in a hotel complex at the northern end of the Precinct.
- A vibrant and authentic new neighborhood at the southern end of the precinct, called 'The Haymarket', home to an IQ Hub focused on the creative industries and high-tech businesses, apartments, student accommodation, shops, cafes and restaurants.
- Renewed and upgraded public domain, including an outdoor event space for up to 25,000 people at an expanded Tumbalong Park.
- Improved pedestrian connections linking to the proposed Ultimo Pedestrian Network drawing people between Central, Chinatown and Cockle Bay Wharf as well as east-west between Ultimo/Pymont and the City.

The SICEEP Site has been divided into three distinct redevelopment areas (from north to south) – Bayside, Darling Central and The Haymarket. The PPP Application Site area is located within Bayside and Darling Central as shown in Figure 2-1.