Australian Government

Department of Infrastructure, Transport, Regional Development and Communications

CHRISTMAS ISLAND STORMWATER, LANDSLIDE AND ROCKFALL MITIGATION WORKS PROJECT

Christmas Island, Indian Ocean Territories (IOT)

Statement of Evidence

to the

Parliamentary Standing Committee

on Public Works

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Introduction

1. The purpose of this Statement of Evidence is to provide information to the Australian public to comment on, and the Parliamentary Standing Committee on Public Works (PWC) to inquire into, works proposed under the Christmas Island Stormwater, Landslide and Rockfall Mitigation Works Project (the Project).

2. The Project will be delivered on Christmas Island, a small island of 136 square kilometres in the Indian Ocean located approximately 2,600 kilometres north-west of Perth and 490 kilometres south-west of the Indonesian capital of Jakarta, as shown in Attachment 1.

3. The Project proposes upgrading ageing, damaged or inadequate infrastructure used to protect Christmas Island's residents and visitors from flooding and landslides. Monsoonal rains and cyclonic weather in recent years have led to multiple landslides down the island's steep cliffs onto neighbourhoods below the escarpment, damaging landslide protection barriers and community infrastructure, threatening public safety, disrupting community life, and impacting tourism operations. Flooding on the island's central plateau caused by inadequate suburban drainage infrastructure has worsened landslide impacts and further damaged community infrastructure.

4. As Christmas Island is administered by the Department of Infrastructure, Transport, Regional Development and Communications (the Department), the Australian Government has a duty of care to protect people and assets and provide a level of service comparable to similar mainland communities.

5. The proposed works will generate multiple benefits for the Christmas Island community and Government by reducing the risk of injury or death and damage to assets from flooding, falling boulders (rockfall) and streams of rock and mud (debris flow), ensuring safer, more liveable communities and continuity of economic activity.

Purpose of the Works

Project Aim

6. The Project aims to reduce the risk of injury or death, asset damage, and social and economic disruption from flooding, rockfall and landslides on Christmas Island by installing fit-for-purpose stormwater and landslide mitigation infrastructure. This will enable the

Department to meet its obligations to provide essential services and facilities to the non-self-governing communities of Australia's Indian Ocean Territories (IOT).

Project Objectives

7. The Project objectives are as follows:

   a. To upgrade suburban drainage infrastructure in the island's Drumsite Precinct to reduce local flooding and stormwater discharge onto the adjacent escarpment.

   b. To completely upgrade landslide protection barriers along the escarpment to reduce hazards from landslides.

   c. To consider, assess and mitigate environmental and cultural heritage impacts at proposed work sites and any other areas affected by the works.

   d. To ensure the proposed works respond to community concerns and considerations and provide opportunities for local economic activity.

   e. To meet the Department's obligations to provide communities in the IOT with access to levels of service comparable to similar mainland communities.

Need for Works

Background

8. A significant proportion of Christmas Island's residents[1] live clustered around Flying Fish Cove, a small sheltered bay on the island's northern tip that includes five neighbourhood precincts that line the shore or sit high on the island's central plateau. The almost continuous series of steep cliffs that descend from the island's flat summit pose significant landslide hazards to locals and visitors. High rainfall and geological instability heighten landslide risks, with emergency alarms activated when specific rainfall and seismic activity levels are met.

9. The Kampong, Flying Fish Cove and Smith Point Precincts, which sit at the foot of the 200-metre-high escarpment along the shoreline, face the greatest risk from landslides of all neighbourhoods. This residential area hosts multistorey apartments, houses, shops, community facilities including places of worship, a school and the island's main beach where the internationally renowned red crab migration is viewed. Port facilities are located at the

[1] As of the 2016 Australian Census, the population of Christmas Island was 1,843

northern end of the precinct while the main road through the settlement provides access to tourism attractions, heritage buildings, a wastewater treatment plant, fuel storage and fuel delivery infrastructure on the west side of the bay.

10. Excessive stormwater runoff from the Drumsite Precinct, located on the plateau immediately above the Kampong Precinct, increases both the risk and impact of landslides down the steep cliffs, as well as local flooding. The Drumsite Precinct is mostly residential but also hosts the Christmas Island District High School and some businesses. Attachment 2 shows a locality plan of key areas relevant to this Project.

11. Dangers posed by landslides have been studied since the 1990s and protective measures have been in place for more than 20 years. Fencing and earthen berms were installed in six locations across the foot of the escarpment in the Kampong Precinct in the late 1990s and early 2000s to capture boulders that fall, and debris flow predominantly during the wet season. These measures to reduce the risk of fatality at Flying Fish Cove were approved by the Parliamentary Standing Committee on Public Works in 1996.

12. Multiple landslides over the past five years, following heavy rains, have damaged these barriers, destroyed community infrastructure, and threatened public safety. Boulders, mud, and rock strewn across roads and carparks have cut access to services and facilities and disrupted community life. Fears of worse landslides occurring has led to road and beach closures and impacted tourism activities. Stormwater has simultaneously flooded local streets, properties and parks on the island's high and low areas, and worsened run-off over the escarpment. Dangerous flood levels have been recorded at the Christmas Island District High School.

13. Examples of recent flooding and landslide events and their impacts are as follows:

a. **October 2016.** Three landslides occurred following approximately 500 millimetres of rain in three days. This event contributed to Christmas Island's 2016 rainfall total of 5.12 metres, which was more than double the annual average of 2.2 metres. The three landslides resulted in:

(1). significant damage to down-gradient infrastructure including a landslide protection barrier;

(2). large volumes of rock, soil and debris engulfing vehicles and blocking access to key island infrastructure, including the wastewater treatment plant, fuel farm and tourism sites;

(3). flooding of roadways and low-lying buildings; and

(4). erosion and deposition damage throughout the settlement areas downhill of the escarpment.

b. **May–June 2017.** Three landslides occurred following a three-day rainfall event of approximately 300 millimetres, destroying an existing landslide protection barrier. Landslide debris extended up to 20 metres beyond the barrier near the local Boat Club, closing the car park and reducing access for 18 months. Clean-up and repair costs were significant. Flooding of low-lying buildings also occurred in the Drumsite Precinct.

14. Investigations determined the following factors contributed to these events:

a. inadequate drainage infrastructure in the Drumsite Precinct; and

b. ageing, damaged, or inadequate landslide protection barriers in the Kampong Precinct.

15. Loss of life and injury are the most severe potential outcomes of landslides and flooding at the Kampong and Flying Fish Cove. However, incidents can also undermine the area's liveability and have economic impacts by restricting tourism activities, reducing access to economic hubs and employment areas, impeding suburban development and damaging business and community infrastructure. After a landslide event, impacts on day-to-day life can be long lasting.

16. Christmas Island's mining, tourism and government service sectors rely on continuous access to the Kampong, Flying Fish Cove and Smith Point Precinct, particularly the port where bulk phosphate is shipped for export and cargo, and private vessels dock. Residents are also heavily dependent upon reliable port facilities for deliveries of essential food and supplies by sea-freight.

Organisational Basis of the Need

17. Christmas Island is governed directly by the Australian Government, which fulfils the role of federal and state governments. Some infrastructure delivered by the Australian Government is maintained by the Shire of Christmas Island on behalf of the Commonwealth, including stormwater. Landslide mitigation infrastructure is maintained by the Indian Ocean Administration on behalf of the Department.

18. In circumstances where the Commonwealth (through the Department) provides services and facilities to the non-self-governing Territories communities, it is likely to be subject to a duty of care to avoid foreseeable harm arising from those undertakings, and breaches are likely to result in an obligation on the Commonwealth to pay damages. In addition, under the *Work Health and Safety Act 2011* (Cth) (WHS Act), the Commonwealth and Officers of the Department have obligations to ensure safe working conditions. A breach of these WHS obligations could result in criminal prosecution of the Commonwealth.

19. Ageing and non-compliant infrastructure on Christmas Island impacts the Commonwealth's capacity to effectively manage risk of injury or death and meet its duties and obligations. If this infrastructure is not upgraded:

a. existing safety risks will remain;

b. maintenance and repair costs will increase; and

c. in the event of an incident, the Commonwealth, and Commonwealth officers engaged in the administration of the IOT, may be subject to criminal prosecution for the injury or death of any community member or visitor.

20. Addressing safety risks posed by deficient infrastructure is a high priority for the Government given its obligations under the *Services to Territories Program 4.1* to deliver essential infrastructure that supports a comparable level of service to similar mainland communities.

Existing Stormwater Infrastructure

21. Technical assessment of existing stormwater infrastructure at the Drumsite Precinct conducted in 2017 found it failed to adequately manage stormwater during periods of heavy rain.

22. Stormwater modelling and technical assessments identified three distinct catchment areas within the Drumsite Precinct – Northern, Central and Southern (as shown in Attachment 2). The Northern and Central catchments were found to contribute stormwater runoff onto the escarpment above the Kampong Precinct, worsening landslide risks and impacts, and generating local flooding on the central plateau. The Southern areas were found to discharge through the school site.

23. Upgrading and expanding the Drumsite Precinct's stormwater system was recommended to direct stormwater away from the escarpment and reduce local flooding in

built-up areas. High-priority works were identified in consultation with key stakeholders and determined to be urgent.

24. In 2017–18, $1.5 million was provided by the Administrative Capital Budget (ACB) to design and deliver an early works package (Stormwater Remediation Stage 1) needed to mitigate immediate safety risks. Early works were completed in 2018. Specific activities included:

a. **Northern Drumsite** – Installation of pit and pipe to connect existing drainage pipework where overland flow had previously existed.

b. **Central Drumsite** – Installation of pit and pipe adjacent and underneath Murray Road, extension of pipework to and culverting under Nursery Road, and construction of concrete protected bunding adjacent to the Christmas Island Phosphate Conveyor and Nursery Road.

c. **Southern Drumsite –** Installation of a culvert to the south of the Christmas Island District High School.

25. The 2018–19 and 2019–20 ACBs provided a total of $1.476 million ($976,000 in 2018–19 and $500,000 in 2019–20) to fund the development of detailed design and cost estimates for Stormwater Remediation Stage 2 (Project Element 1 of this submission).

26. This funding was also used to install a monitoring system in 2019 to capture near to real-time data on weather conditions, stormwater flows and seismic activity and provide early warning of potential landslides or floods.

Existing Landslide Mitigation Infrastructure

27. Technical assessment of existing landslide protection barriers (seven fences and two earthen berms spread across six sites, as shown in Attachment 2) at the Kampong Precinct conducted in 2018 determined the following:

a. All fences are beyond their 20-year design life and cannot be relied upon to protect people and assets from debris flow or rockfall. Modelling shows fences should be able to withstand 5,000 kilojoules of energy, however they are only equipped for 1,000 kilojoules, the maximum fence capacity on the market at the time of installation. Some fences have been damaged and repairs are difficult.

b. Three rockfall fences at Sites A and B, and part of a fourth fence at Site E (the Christmas Island Club Fence, which sits across Sites E and F) pose an unacceptable risk for loss of life and should be immediately replaced. These fences are currently being replaced.

c. Three fences in Sites C and D, and the remainder of the Christmas Island Club Fence in Site F are in poor condition and their remaining efficacy is unknown.

d. Earthen berms located at Sites C and D require upgrading due to their poor condition, inadequate armour, and uncertainty around the maximum energy they can withstand.

28. In 2018, an emergency early works package to replace the four rockfall fences at sites A, B and E was funded from the Department's internal Administered Capital Budget to mitigate immediate safety risks. Construction works commenced in October 2020 and are expected to be completed in late 2021 at a tender price of approximately $7 million.

Options Considered

Project Elements

29. Proposed works are comprised of two elements:

a. Project Element 1 – Stormwater Remediation (Stage 2) Works; and

b. Project Element 2 – Landslide Mitigation Works.

30. Options to upgrade each project element were examined through separate processes. Analysis was informed by stakeholder consultation, site investigations and existing condition reviews. Opportunities to optimise existing infrastructure were considered alongside new infrastructure solutions.

Options for Stormwater Remediation (Stage 2) Works

31. Stormwater drainage options were considered for each of the three catchment areas within the Drumsite Precinct, with qualitative and quantitative assessments used to determine the preferred options.

32. Options analysis considered constructability and costs; heritage values (for example, of the existing incline and non-operational railway tracks and railway station); environmental

impacts (such as vegetation clearing and impacts on red crabs and birds); existing ground conditions; and land availability and spatial limitations.

33. **Northern Drumsite.** Existing drainage infrastructure in this catchment was assessed as insufficient for minor and major rainfall events. Stormwater flows over the escarpment and floods the Kampong Precinct (including the port), and also causes flooding of local roads on the plateau (Lam Lok Loh and Murray Road). Options considered include:

a. **Option 1 – Do Nothing.**

b. **Option 2 – Direct stormwater flow down the incline without compensation.** This option diverts stormwater flows down the incline to the ocean outfall.

c. **Option 3– Create compensation within the Northern Drumsite then direct stormwater flow down the incline with further detention adjacent the George Fam incline (recommended).** This option creates new drainage infrastructure within the Drumsite Precinct. It directs stormwater through detention basins and overflow structures to slow its dispersal and avoid impacting the downstream system. Location of the works is shown in Attachment 3 (Pg. 34-35).

d. **Option 4 – Direct water off the incline and construct one large new basin.** This option creates a new basin near the Christmas Island Phosphate workshops on the central plateau and increases the size of the basin between the George Fam incline and the Poon Saan and Silver City Precinct.

34. **Central Drumsite.** This catchment is a high priority for remediation works as stormwater flows over the incline were a primary contributor to the 2016 and 2017 landslides in the Kampong Precinct. Significant shortcomings in the existing system also cause flooding of local parks and roads (Lam Lok Loh and Murray Road). Options considered include:

a. **Option 1 – Do Nothing.**

b. **Option 2 – Central Drumsite Basin.** This option includes construction of a large compensation basin for this area.

c. **Option 3 – Combination of infrastructure upgrades to local roads and installation of a diversion bund (recommended).** This option includes installing and upgrading pits and pipework along Murray Road, Lam Lok Loh and Golden Bosun Road, and the construction of a diversion bund that was undertaken as part of the Early Works. Location of the works is shown in Attachment 3 (Pg. 35).

35. **Southern Drumsite.** This catchment is also a high priority for remediation works due to local flooding impacts. Significant shortcomings in the existing system have resulted in flooding of local roads (Murray Road) and the school, with stormwater then flowing west to the coastline south of the fuel farm and wastewater treatment plant. Options considered include:

a. **Option 1 – Do Nothing.**
b. **Option 2 – Upgrade the existing drainage system through the school.** This option improves drainage infrastructure within the school site to manage the stormwater flows into the school network.
c. **Option 3 – Installation and upgrade of pits and pipework along Murray Road and discharge to bushland to the south of the school oval.** This option directs flows to a new basin west of the high school oval, which is then discharged into the existing flow path. It requires significant upgrades of downstream discharge infrastructure.
d. **Option 4 – Combination of new basin, cut-off drain and speed hump south of the school site, early capture of flow into Murray Road and reshaping of school entrance roads (recommended).** This option includes a combination of elements intended to direct stormwater to the east and south of the high school, as shown in Attachment 3 (Pg36). It proposes installing pipework to redirect flow from the school entrance, a cut-off drain and a new water main alongside Murray Road.

Options for Landslide Mitigation Works

36. Landslide mitigation options were considered for each of the three sites within the Kampong Precinct (Sites C, D and F as shown in Attachment 4), with qualitative and quantitative assessments used to determine the preferred option.

37. Options were assessed on their ability to reduce risk, constructability, maintenance requirements, environmental impact, risk to life during construction, cost, and ability to meet modelled energy capacity requirements.

38. Six possible infrastructure interventions were considered for each site, specifically:

a. **Rockfall barrier fence** – A fence consisting of metal posts anchored into the slope with wire mesh panels designed to block and detain landslides.

b. **Reinforced earthen berm –** A raised mass of compacted soil wrapped with wire mesh designed to block and detain landslides.

c. **Reinforced gabion wall** – A wall of wire mesh baskets filled with rocks designed to block and detain landslides.

d. **Rigid concrete barrier –** A wall of large steel reinforced concrete structures designed to block and detain landslides.

e. **Supplemental baffles –** Arrays of vertical pylons designed to dissipate landslide energy by impeding debris flow.

f. **Channelised attenuation –** Strategically positioned retaining walls designed to deflect debris flow away from the element at risk and trap it in a focused discharge point.

39. Once site-specific mitigations were selected, three overall options were developed for the project element and assessed alongside a Do-Nothing option:

a. **Option 1A (not recommended) –** Complete upgrade of fences (remove existing and replace with new) at Sites C, D and F and repair and maintain berms at Sites C and D.

b. **Option 1B (not recommended)–** Complete upgrade of fences (remove existing and replace with new) at Sites C, D and F and removal of berms at Sites C and D.

c. **Option 2 (recommended) –** Removal of fences at Sites C and D, complete upgrade of fence at Site F and complete upgrade of berms (remove existing and replace with new) at Sites C and D.

Preferred Options

40. **Project Element 1 – Stormwater Remediation (Stage 2) Works.** In general, preferred options connect to, or direct stormwater flow into existing drainage infrastructure to maximise its use. Some infrastructure must be upgraded so it can cope with new inflows. Solutions focus on capturing and redirecting stormwater flows away from the escarpment above the Kampong and Port areas, particularly in the Central and Northern Drumsite catchment. New detention infrastructure is required in the Northern and Southern catchments to slow the floodwater, including a large basin south of the school and a basin within the Northern Drumsite and adjacent the incline. New pipework and pit infrastructure proposed

across all areas of the Drumsite will be used to reduce road flooding. All infrastructure has a design life of 50 years or more. The preferred option for each catchment was determined to be:

a. Northern Drumsite. Option 3 – Installation of additional pit and pipe drainage throughout the area along with creating compensation within the Northern Drumsite then directing stormwater flow down the George Fam Incline with further detention adjacent the George Fam Incline.

b. Central Drumsite. Option 3 – Installation of additional pit and pipe drainage to local roads and installation of a diversion bund adjacent Nursery Court.

c. Southern Drumsite. Option 4 – Combination of the installation of additional pit and pipe drainage on local roads, a new basin to the south of the Christmas Island school, installation of an on roadway speed hump diversion south of the school site, and reshaping of school entrance roads to redirect stormwater flows in this area.

41. **Project Element 2 – Landslide Mitigation Works.** Analysis indicates that rockfall barrier fences and reinforced earthen berms are the only geographically appropriate interventions. The preferred option generally replaces existing 1,000-kilojoule-capacity fences and berms (of unknown capacity) with 3,800-kilojoule-capacity berms to provide a strong first line of defence for the community. Berms have a lifetime of 100 years, require limited maintenance, remain operational during repairs, and prevent the community from encroaching on the slope. However, land geometry dictates that a fencing solution be adopted at one site, where a 5,000-kilojoule-capacity fence with a design life of 20 years will be installed. The preferred option was determined to be:

a. **Option 2** – Removal of fences at Sites C and D, complete upgrade of fence at Site F and complete upgrade of berms (remove existing and replace with new) at Sites C and D.

42. The Department considers that these preferred options represent the best value for money to the Commonwealth. They address identified needs, enable the Department to fulfill its duties and obligations, and are affordable within the Project budget. Options incorporate the critical infrastructure required to mitigate key health and safety risks to the Christmas Island community and visitors.

43. Expected Project benefits include:

a. **safer and more secure community and infrastructure** by preventing rockfall and debris flow down the escarpment causing injury or death and damaging infrastructure, and reducing flooding of suburban neighbourhoods;

b. **more efficient, effective response management** by instilling greater confidence in mitigation infrastructure;

c. **unlocked livability potential** by protecting against road, business and community facility closures due to landslide and flooding, and reducing disruptions to economic activity and community life; and

d. **reduced total cost of ownership** by providing infrastructure that enables ease of maintenance and minimises sustainment costs.

Scope of Works

Location of the Project

44. The Project will deliver works at the Drumsite Precinct, located on the central plateau 2.5 kilometres from the Christmas Island Airport, and the Kampong and Smith Point Precinct, located on the shoreline three kilometers north-west of the airport. Refer to Attachment 2.

Project Scope

45. This proposal seeks to manage the risks of flooding and landslide on Christmas Island through the delivery of:

a. Project Element 1 – Stormwater Remediation (Stage 2) Works; and

b. Project Element 2 – Landslide Mitigation Works.

Project Element 1 – Stormwater Remediation (Stage 2) Works

46. Stormwater Remediation (Stage 2) Works comprise the design and construction of new drainage infrastructure to better manage stormwater flows within, and discharge from, the Drumsite Precinct to reduce landslides and flooding at Flying Fish Cove, the port and Kampong.

47. Works include installing new lined basins, bunding, culverts, pits, extensive pipework, open drains, basins, and stormwater diversion structures in key locations. Works at the Southern Drumsite also include installing a section of new water main that forms part of

upgrade works planned by the Water Corporation. The proposed works are shown in Attachment 3. The design of proposed remediation works has been informed by data gathered from the new monitoring system installed in 2019 (refer to point 26).

48. Works will be delivered within three distinct catchments:

a. **Northern Drumsite** – located near the Christmas Island Phosphate workshops and the George Fam incline (refer to Attachment 3 (Pg. 34-35)). The works extend from Sung Miaw Low in the south to the George Fam incline and into undeveloped land south of the Poon Saan and Silver City Precinct. Works will capture stormwater flow from the northern catchment area, slowing it down and redirecting water toward the drainage path on the George Fam incline and away from the Kampong Precinct, particularly the port. Works include drainage upgrades adjacent to, and located on, the George Fam incline, ensuring sufficient capacity exists in the system to cater for the increased discharge.

b. **Central Drumsite** – located between Sung Miaw Low and Golden Bosun Road (refer to Attachment 3 (Pg. 35)). Works relate to drainage on, and adjacent to, Murray Road between Sung Miaw Low in the north and Tutor Close in the south. Works include installing additional pipework and pit infrastructure to reduce road flooding and direct water discharge into early works drainage upgrades and away from the Kampong Precinct, particularly the port.

c. **Southern Drumsite** – located near the Christmas Island District High School (refer to Attachment 3 (Pg. 36)). Works focus on the area adjacent to the school and the southern section of Lam Lok Loh and Murray Road, and extend to a proposed basin located south-west of the school oval. Works will improve drainage networks and direct water away from the school. Activities include installing a new lined basin and drainage pipework and pit infrastructure, supported by amendments to the roadway design at the school entrances and south of the school.

Project Element 2 – Landslide Mitigation Works

49. Landslide Mitigation Works comprise the design and construction of new landslide and rockfall protection barriers across the bottom on the escarpment in the Kampong Precinct to reduce the impact of landslides, particularly the risk of injury or death and asset damage.

50. Works involve the demolition and removal of defunct infrastructure and construction of new fences and berms (within existing fence or berm corridors/footprints), in order to minimise earthworks, clearing, and impact on flora, fauna and heritage sites.

51. Works will be delivered at Sites C, D and F – where the potential impact from landslide and rockfall is the greatest – between community buildings at each site. The proposed works are shown in Attachment 4 and can be broadly described as follows:

a. **Site C.** Two fences at Site C (Fences 412A and 412B) will be removed and a single berm (Berm 2) will be demolished, with a new berm installed. Site C is located behind Block 413. The fences and berm are in close proximity to residential buildings and community members have built some chicken coops and gardens upslope of the berms. Utilities such as a galvanised iron potable water main and a sewer main are buried beneath the berm.

b. **Site D.** The single fence at Site D (Fence 408) will be removed and a single berm (Berm 1) will be demolished. (Berm 2, largely contained in Site C, also stretches into this site). A new berm will then be installed. Site D is located behind Block 409, and the existing fence and berm are in close proximity to residential buildings. The berm also contains buried utilities.

c. **Site F**. The fence at Site F (Christmas Island Club Fence) will be upgraded. Due to the geometry and layout of this site, upgrading the fence is the only viable option. Site F is located behind Block 403. The lower section of this fence is partially located in Site E and is being upgraded through the early works package.

Planning and Design Concepts

Design Philosophy

52. The general design philosophy for the Project is that proposed works will:

a. provide readily and safely constructable, low-maintenance and long-design-life solutions that optimise whole-of-life costs for the asset;

b. reduce the risk associated with debris flow, rockfall and flooding;

c. use existing infrastructure to minimise capital costs, where possible, while considering capacity limitations;

d. use readily available, durable, and long-life materials that minimise maintenance, transportation, and installation costs;

e. protect environmental and heritage values, for example, by minimising the clearing of vegetation and aesthetic impacts of drainage infrastructure and landslide protection barriers; and

f. recognise site constraints including existing ground conditions, space limitations and existing services.

Relevant Legislation, Codes and Standards

53. The following key legislation, standards, codes, and guidelines are applicable:

a. *Building and Construction Industry (Consequential and Transitional Provisions) Act 2016* (Cth);

b. *Building and Construction Industry (Improving Productivity) Act 2016* (Cth);

c. *Environment Protection and Biodiversity Conservation Act 1999* (Cth);

d. *Work Health and Safety Act 2011* (Cth);

e. *Disability Discrimination Act 1992* (Cth);

f. *Fair Work Act 2009* (Cth);

g. *Fair Work (Building Industry) Act 2012* (Cth);

h. *Environment Protection and Biodiversity Conservation Act 1999* (Qld);

i. National Construction Code 2019;

j. Shire of Christmas Island Local Planning Strategy;

k. Our Christmas Island, 2030 Strategic Plan;

l. Christmas Island Local Planning Scheme;

m. Western Australian planning legislation, supported by a service delivery arrangement with the Western Australian Department of Planning, Lands and Heritage;

n. Western Australian State Planning Policy 3.4 – Natural Hazards and Disasters;

o. Australian Geomechanics Society's A National Landslide Risk Management Framework for Australia 2007;

p. Australian Standard AS1726:2017 – Geotechnical site investigations;

q. Australian Standard AS4678:2002 – Earth-retaining structures;

r. Australian Standard AS5100.3:2017 – Bridge design, Part 3: Foundation and soil-supporting structures;

s. Australian Standard AS3600 – Concrete structures;

t. AGS Volume 42 No 1; 2007 – Australian Geomechanics Society; Practice Note Guidelines for Landslide Risk Management 2007;

u. CIRIA 637 – Design guidance; Soil nailing best practice;

v. BS8006:2017 – British design standard; Grouted anchor code of practice;

w. MRTS03 – Queensland Government Department of Transport and Main Roads Guidance for Drainage, Retaining Structures and Protective Treatments;

x. R64 – Roads and Maritime Services (NSW) guidance for soil nailing; and

y. EAD 340059-00-0106 – Falling Rock Protection Kits.

54. Proposed works will comply with all relevant standards, codes, and guidelines. Refer to Attachment 5 for a list of reference materials that will be used as the basis of design.

55. Subject to Parliamentary approval, a qualified and practising engineer will certify compliance of the design and inspect construction onsite to confirm works are undertaken in accordance with specifications. Manufacturers will certify the compliance of prefabricated components such as fences.

Land, Zoning and Approvals

56. The Shire of Christmas Island Town Planning Strategy (2015) provides the statutory framework for land use and development on Christmas Island, in accordance with Western Australian planning legislation. No changes to existing land use and water use conditions are proposed by the Project. Acquisition of land is not required.

57. **Project Element 1 – Stormwater Remediation (Stage 2) Works.** Works will occur on Commonwealth land, within roads and road reserves, within land zoned for public purposes (including services), and on land leased by Christmas Island Phosphates, who have agreed to the proposed scope. Access arrangements will be required for regular, ongoing maintenance, in addition to construction works. Basin 1 within the Northern Drumsite has

been located within a commercially zoned area, consistent with Local Planning Scheme No. 2.

58. **Project Element 2 – Landslide Mitigation Works.** Works will occur on Commonwealth land, and services impacted by barrier installation may be relocated to the Shire-owned road reserve. The following approvals are required:

a. referral under the *Environment Protection and Biodiversity Conservation Act 1999* (Qld) for Permits 9 and 13 pertaining to environment and heritage;

b. a clearing permit from the Western Australian Planning Commission where the site area exceeds five hectares; and

c. permits or approvals from the Shire of Christmas Island to undertake any works required within the road reserve or car park.

Master and Site Planning

59. Proposed works are consistent with the intent of *Our Christmas Island, 2030 Strategic Plan*, the community's plan to ensure a prosperous, sustainable, and diverse future for Christmas Island and a key document guiding planning and development. This includes the *Our Infrastructure Actions – I 3.1 h - Improve asset management to ensure that critical infrastructure is maintained and renewed in a timely manner to mitigate public risks and economic disruptions to the local economy*. This plan supports the island's continued growth as an harmonious multicultural community and development as a tourism destination, with strong international education and agricultural sectors.

Workplace Health and Safety Measures

60. The Project will comply with the Department's WHS Policy and the WHS Act.

61. In accordance with *Section 43 of the Building and Construction Industry (Improving Productivity) Act 2016* (Cth), contractors will be required to hold full work health and safety accreditation from the Office of the Federal Safety Commissioner under the Australian Government Building and Construction Work Health and Safety Accreditation Scheme.

62. The Design Consultant will employ a Safety in Design approach to address risk mitigations and document safety measures to be adopted in both construction and operation of the works. The Construction Contractor will be required to develop and adhere to a safety management plan for the construction phase, which incorporates Safety in Design mitigations

identified by the Design Consultant as well as other relevant risk mitigations, prior to commencing any works.

Structural Design

63. Concept designs for drainage and barrier works have been informed by site investigations and geotechnical and topographical conditions. Schematic and detailed designs for structural elements will be developed by suitably qualified engineers, and in accordance with Australian Standards.

Civil Design

64. The Project's civil works include services relocations, clearing and excavation, and construction of drainage infrastructure, roads, and hardstands at multiple sites. Geotechnical investigations have been undertaken to inform the detailed design process, which will be undertaken by suitably qualified engineers, and in accordance with Australian Standards.

Hydraulic Services

65. Hydraulic/hydrological modelling and design has been completed for the proposed stormwater remediation (Stage 2) works. Detailed design and construction works – including for new pipework, pits, and culverts – will be undertaken in accordance with Australian Standards.

66. The Water Corporation has been consulted to ensure existing services are protected and incorporated into the stormwater system's design.

67. The section of new water main along Murray Road has been designed in accordance with Water Corporation and relevant Australian Standards. The water main and proposed drainage pipes will share a trench to minimise the construction footprint and installation costs.

Security Measures

68. The security design for proposed works will address risks associated with controlling unauthorised access, vandalism, or unintended damage.

69. **Project Element 1 – Stormwater Remediation (Stage 2) Works.** Purpose-designed permanent fencing will be installed at key locations to keep people safe and protect wildlife, particularly migratory crabs. Headwalls located in publicly accessible areas will be fitted with security screens and safety barriers to prevent unauthorised access, especially by children.

70. **Project Element 2 – Landslide Mitigation Works.** Gates will be installed to enable emergency services and maintenance access, while discouraging unauthorised access for illegal dumping or the establishment of gardens, storage, or chicken coops within the unprotected landslide areas.

Materials

71. Materials have been selected for their durability and ease of maintenance in a tropical climate. Where possible, designs adopt materials that can be locally sourced such as fill material and rock from the local quarry. However, many components are not available on Christmas Island and have therefore been selected on the basis of being prefabricated and lightweight to make transportation and installation easier and safer, and the keeping of critical spares sustainable.

Environmental Sustainability

72. A key Departmental requirement is for the Project to deliver a sustainable outcome for the Australian Government by improving the safety of the island community and by re-using or upgrading existing infrastructure (where appropriate).

73. The Project will improve Christmas Island's environmental sustainability by reducing the impacts of major rainfall events on infrastructure and natural areas. Controlling stormwater flows will reduce the risk of landslides and erosion to avoid future degradation of natural areas and damage to developed areas.

74. Strategies adopted by the Project to achieve cost-effective, ecologically sustainable development include:

a. **Measures to reduce energy and water use.** Low-maintenance solutions such as berms have been selected to minimise energy and water use during the operational phase. Additionally, works associated with the partial construction of a replacement water main are expected to yield significant water savings once fully commissioned by reducing leakage.

b. **Commitment to re-use existing structure**. Opportunities to re-use existing infrastructure were considered throughout the design development and options review processes, resulting in partial re-use at some sites. Proposed drainage works, for example, will connect to, or direct stormwater flow into, existing

drainage infrastructure at some locations. Materials contained within existing berms will also be re-used, and existing tracks and paths will be reinstated.

c. **Careful demolition and disposal of existing structures.** The demolition of existing infrastructure will be undertaken in accordance with *AS 2601: 2001 – The demolition of structures*. Material will be disposed of on-island in the first instance, where it is permitted to do so, or disposed of at appropriately licenced facilities off-island, giving priority to the Australian mainland before using an overseas location.

d. **Minimisation of waste.** The design of cut-and-fill activities will work with existing site levels to minimise the need to import materials.

e. **Considered choice of construction materials.** Materials and finishes will be selected for their functionality, durability, and low-maintenance features to minimise environmental impacts and generate long-term cost-efficiencies.

f. **Prudent asset management.** An asset management plan will establish the required maintenance and replacement schedule for the assets to optimise the design life and minimise whole-of-life costs of the infrastructure.

Potential Impacts

75. Rigorous assessment has identified potential environmental and community impacts and informed the development of mitigation measures. Results can be summarised as follows:

a. **Visual impacts –** The Project is not expected to cause a material change to the visual character of sites, as proposed works will replace or augment infrastructure already visible to the public. Following clearing and construction works, disturbed areas such as drainage basins will be revegetated with suitable endemic species.

b. **Noise impacts** – Community members may experience some short-term noise impacts during construction from equipment used for clearing, excavation, and reinstating roadworks. However, significant impacts are unlikely and will be managed through a noise management plan. Community members will be informed of upcoming construction works and likely timeframes. Construction

noise and vibration may also temporarily affect local fauna, but it is unlikely to have a permanent impact.

c. **Environmental impacts –** Environment and heritage assessments were completed for both project elements. Key findings include:

(1). **Project Element 1 – Stormwater Remediation (Stage 2) Works.** Analysis considered, in detail, where works might generate action due to the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). A Flora and Fauna Assessment has been undertaken for the Project and the Clearing Permit Application was approved by the Department of Water and Environmental Regulation (DWER) in August 2019 to clear up to 2 ha of native vegetation for the Project, until 23 September 2024. The project was also referred under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) on the basis of impacts to vegetation and heritage features. The Department of Agriculture, Water and the Environment's referral decision was that the project was a 'non-controlled' action, meaning no further assessment is required and works can start immediately. Environmental risks posed by the Project will therefore be managed through site-specific construction environmental management plans.

(2). **Project Element 2 – Rockfall and Landslide Mitigation Works.** At Sites C and D, minimal vegetation clearance will be required to prepare barrier foundations. No impacts on protected flora or fauna are anticipated, however, migration paths for the red crab species (*Gecarcoidea natalis*) must be maintained as it is likely that crabs will move down the escarpment to the cove. Minimal vegetation clearance is also required at Site F, with no impacts to flora and fauna expected. Removing existing fences at Sites C and D will allow a greater space for flora and fauna to thrive.

d. **Heritage impacts –** Assessment and design has taken into account the presence of items of heritage value and in general the new infrastructure is to be constructed at a safe distance to avoid damaging these structures. Heritage risks associated with the Project are minor and can be managed through site-specific cultural heritage

management plans. Elements of the proposed works will provide greater protection to culturally significant sites from landslide hazards.

e. **Traffic, transportation, and road impacts –**Traffic and population numbers will increase during construction as numerous large vehicles will be required to deliver materials to work sites. Traffic plans prepared by contractors as part of broader site management plans will be used to manage effects on local road networks.

f. **Existing local facilities –** During delivery of drainage works, some facilities may be temporarily relocated, or cut off to the public, during construction to enable use as laydown or to prevent hazards. The Department will engage with the Shire of Christmas Island, the community, and the Construction Contractor to manage, and determine the duration of the impact.

Related Projects

76. Emergency early works have been, or are currently being, undertaken for both project elements. The Project must consider the interface between these early works and proposed activities:

a. **Project Element 1 – Stormwater Remediation (Stage 2) Works.** Early Works were completed in August 2018 and involved the construction of pit and pipe infrastructure to connect existing drainage pipework where overland flow had previously existed in the Northern Drumsite. In the Central Drumsite construction works included the installation of pit and pipe infrastructure adjacent and underneath Murray Road, extension of pipework to and culverting under Nursery Road, and construction of concrete protected bunding adjacent to the Christmas Island Phosphate Conveyor and Nursery Road. The construction works in the Southern Drumsite consisted of the installation of a culvert to the south of the Christmas Island District High School.

b. **Project Element 2 – Landslide Mitigation Works.** Early works involve the construction of a portion of fence in Site E that stretches into Site F (known as the Christmas Island Club Fence), which is the focus of this Project. Attachment 4 shows the location of this fence with reference to Sites E and F. Detailed design and planning activities will ensure that further construction of the fence, through this Project, will integrate seamlessly with early works.

Consultation with Key Stakeholders

77. The Department recognises the importance of providing local residents, statutory authorities, and other interested stakeholders an opportunity to provide input into, or raise concerns relating to, the proposed works. Where practical, community consultation for the Project will be conducted concurrently with consultation for related projects.

78. Key stakeholders have contributed to the Project from its inception by participating in consultation meetings on Christmas Island (from 2017 to 2021), regular monthly teleconferences, project workshops and review processes for key deliverables.

79. Consultation has been undertaken, and will continue to occur, with the following stakeholders:

a. Australian Government:

   (1). Administrator of the Territories of Christmas Island; and

   (2). Indian Ocean Territories Administration, including the Emergency Management Officer (EMO).

   (3). Indian Ocean Territories Power Services;

   (4). Department of Agriculture, Water, and the Environment; and

   (5). Parks Australia

b. Western Australian Government:

   (1). Department of Water and Environmental Regulation;

   (2). Water Corporation;

c. Christmas Island Phosphates (CIP).

d. Local government:

   (1). Shire of Christmas Island.

e. Emergency Management Committee (EMC).

f. Community stakeholders.

g. Ports user groups.

Cost Effectiveness and Public Value

Project Costs

80. The estimated out-turned cost of the Project is $28.9 million (excluding Goods and Services Tax). This includes management and design fees, construction costs, contingencies, and a provision for escalation.

81. No increase in operating costs is expected as a result of the proposed works. The maintenance of the new infrastructure will be managed from within the Department's Administered Operational Budget.

Project Delivery System

82. Subject to Parliamentary approval, a Construct-Only Head Contractor form of contract is planned to deliver the works. One Head Contractor will be appointed to deliver both packages of work as separable portions, with engagement of local subcontractors and suppliers as appropriate. It is expected that the Head Contractor will prepare some limited design documentation for the landslide mitigation works project element, as this will be based on a proprietary system.

83. A Construct-Only Head Contractor form of contract offers the Commonwealth a high level of quality control and budget certainty. By retaining responsibility for design, the Department can realise procurement synergies across sites and better manage key risks. This approach also promotes opportunities for small-to-medium enterprises on Christmas Island, by apportioning project risk where it can be best managed.

84. A Project Manager Contract Administrator will be appointed to manage the Project's delivery phase.

Construction Program

85. Subject to Parliamentary approval, construction is expected to commence in January 2022, with completion of works occurring by May 2023. Anticipated key milestones are shown in the table below.

Anticipated key milestone dates

Task No.	Task	Completion Target Date
1	Head Contractor engagement	December 2021
2	Commence construction	January 2022
3	Construction complete – Project Element 2	January 2023
4	Construction complete – Project Element 1	May 2023
4	End of Head Contractor defects liability period	May 2024

Public Value

86. The Project was assessed to be in the public interest. It will provide significant community benefits by:

a. **Meeting health and safety needs**. The Project will reduce risks to life and property on Christmas Island posed by flooding and landslides, strengthening community confidence in hazard mitigations.

b. **Providing employment opportunities.** The Project will generate job opportunities on Christmas Island in the short term, predominantly in the construction labour market, and then for the ongoing maintenance and repair of infrastructure. Off-site job opportunities will also be generated through the manufacture and transportation of materials during construction. This positive economic stimulus is likely to benefit small and medium enterprises.

c. **Mitigating the economic impacts of landslide and flooding.** The Project will reduce the risk of disruption to economic activity from landslides and flooding, enabling continued access to employment areas and continuity of business operations. It will also avoid costs associated with repairing and replacing damaged or destroyed assets and infrastructure.

d. **Providing ongoing opportunities for local industry and Indigenous businesses.** General area and access maintenance, and fence and berm maintenance can be undertaken by locals with existing skills on Christmas Island.

87. Although many project benefits such as more liveable communities and unhindered public access to recreational and community facilities cannot be quantified, some benefits were able to be captured by cost-benefit analysis such as the value of preventing loss of life.

Revenue

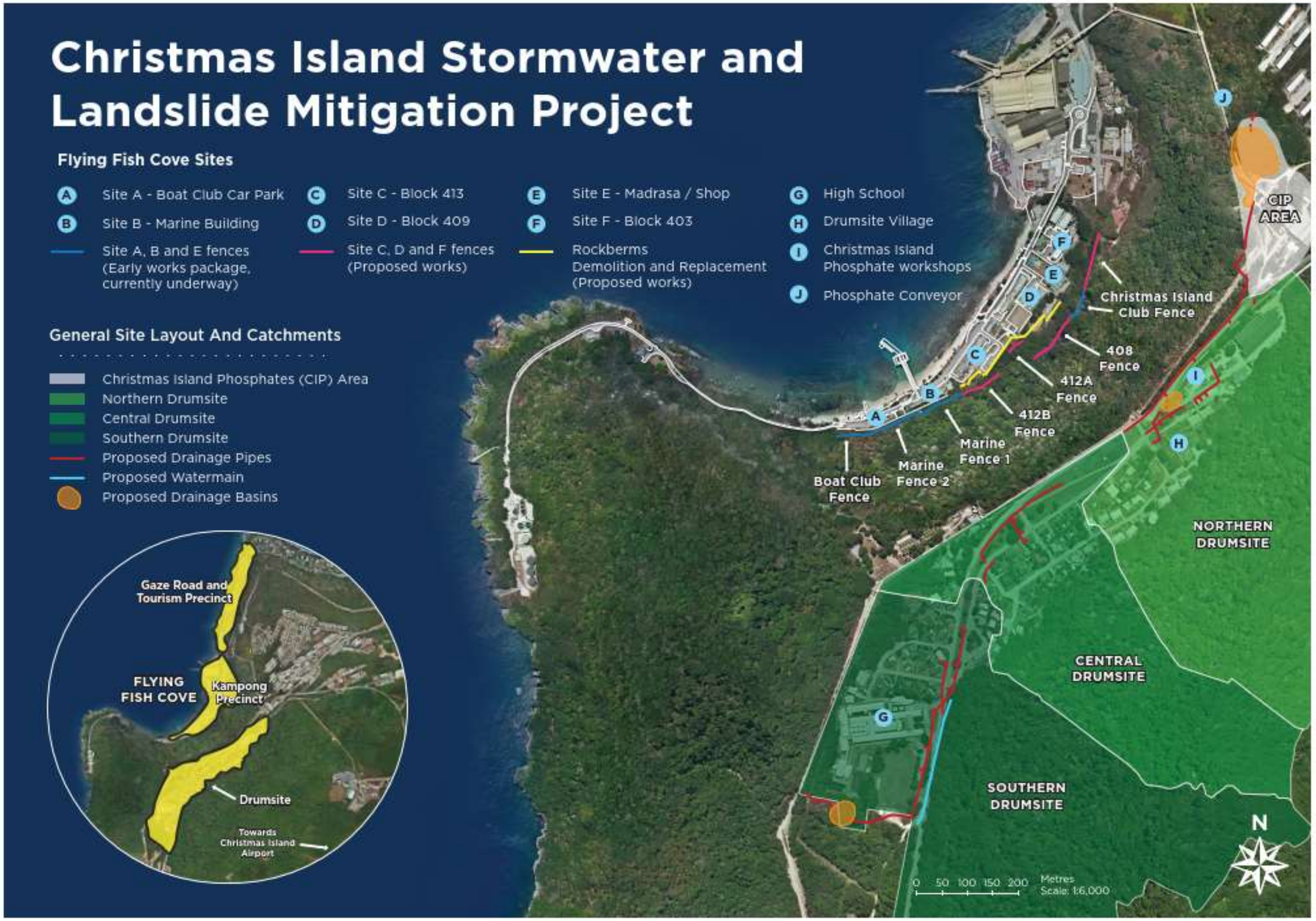
88. No revenue will be derived from the Project.

Attachments

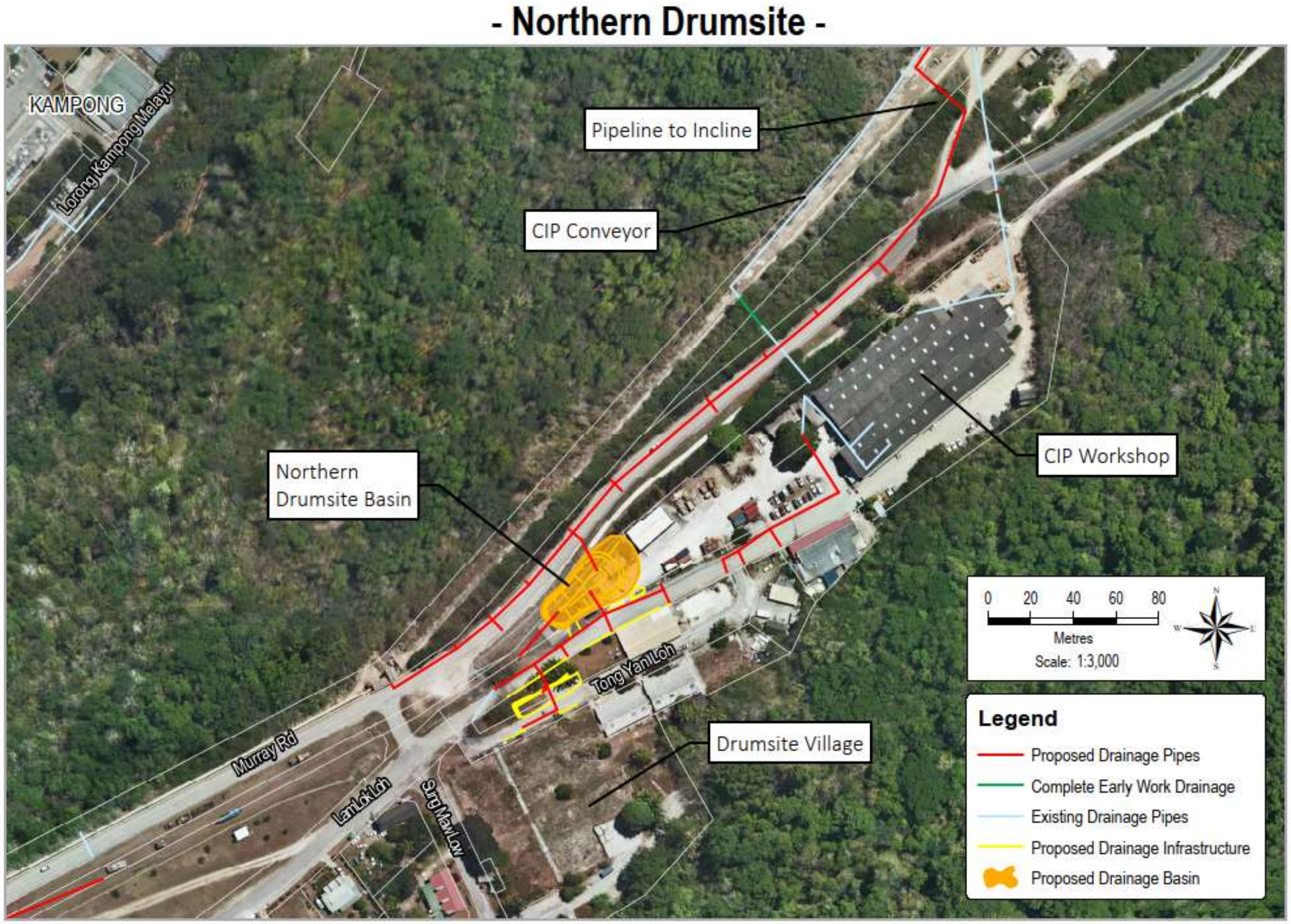
1. Location Plan – Christmas Island
2. Project Locality Plan
3. Project Element 1 – Stormwater Mitigation Works – Layout Plans
4. Project Element 2 – Landslide Mitigation Works – Layout Plans
5. Relevant Legislation Standards, Codes and Guidelines

Attachment 1. Location Plan – Christmas Island

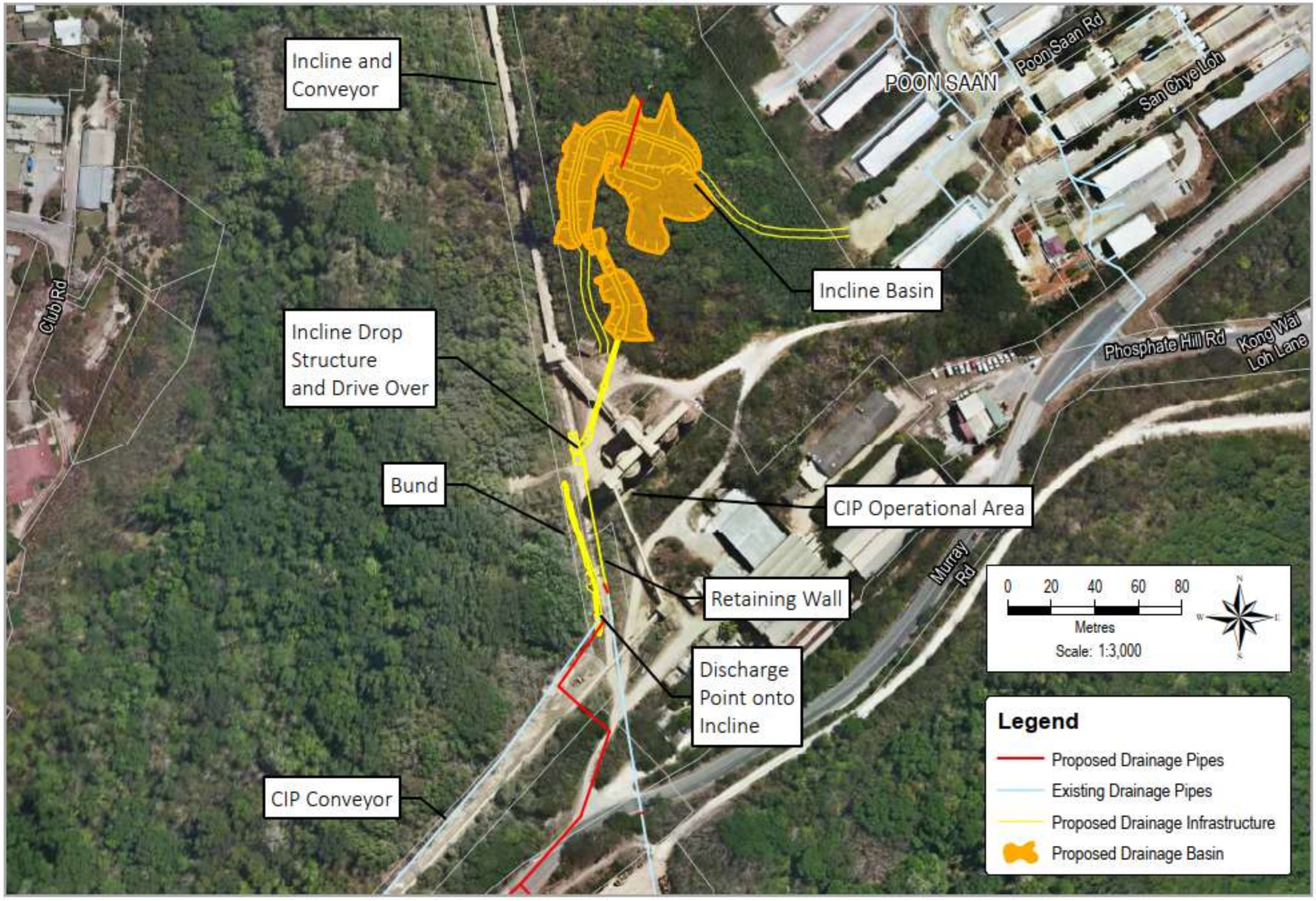
Attachment 2. Project Locality Plan



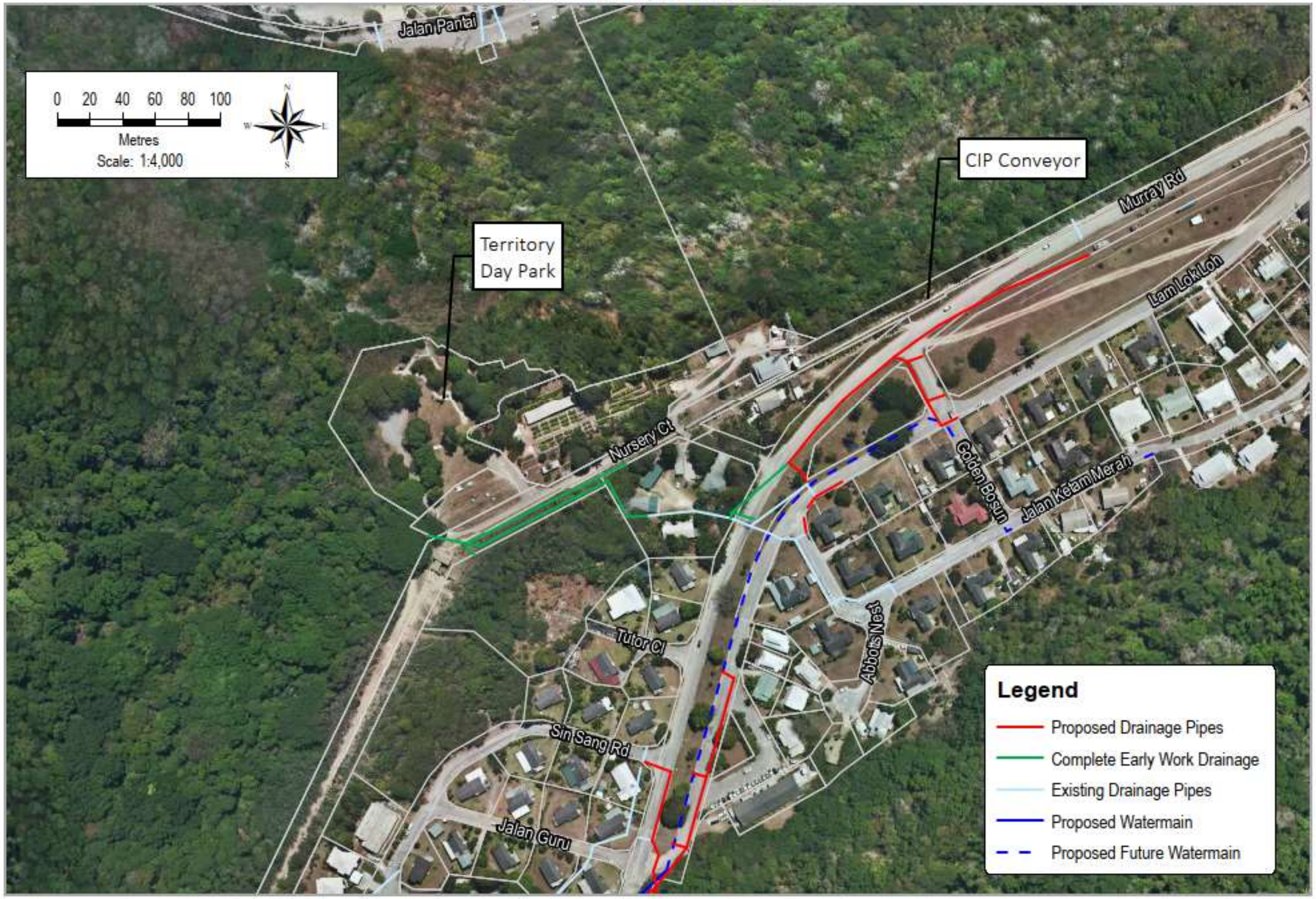
Attachment 3. Project Element 1 – Stormwater Remediation Works – Layout Plans



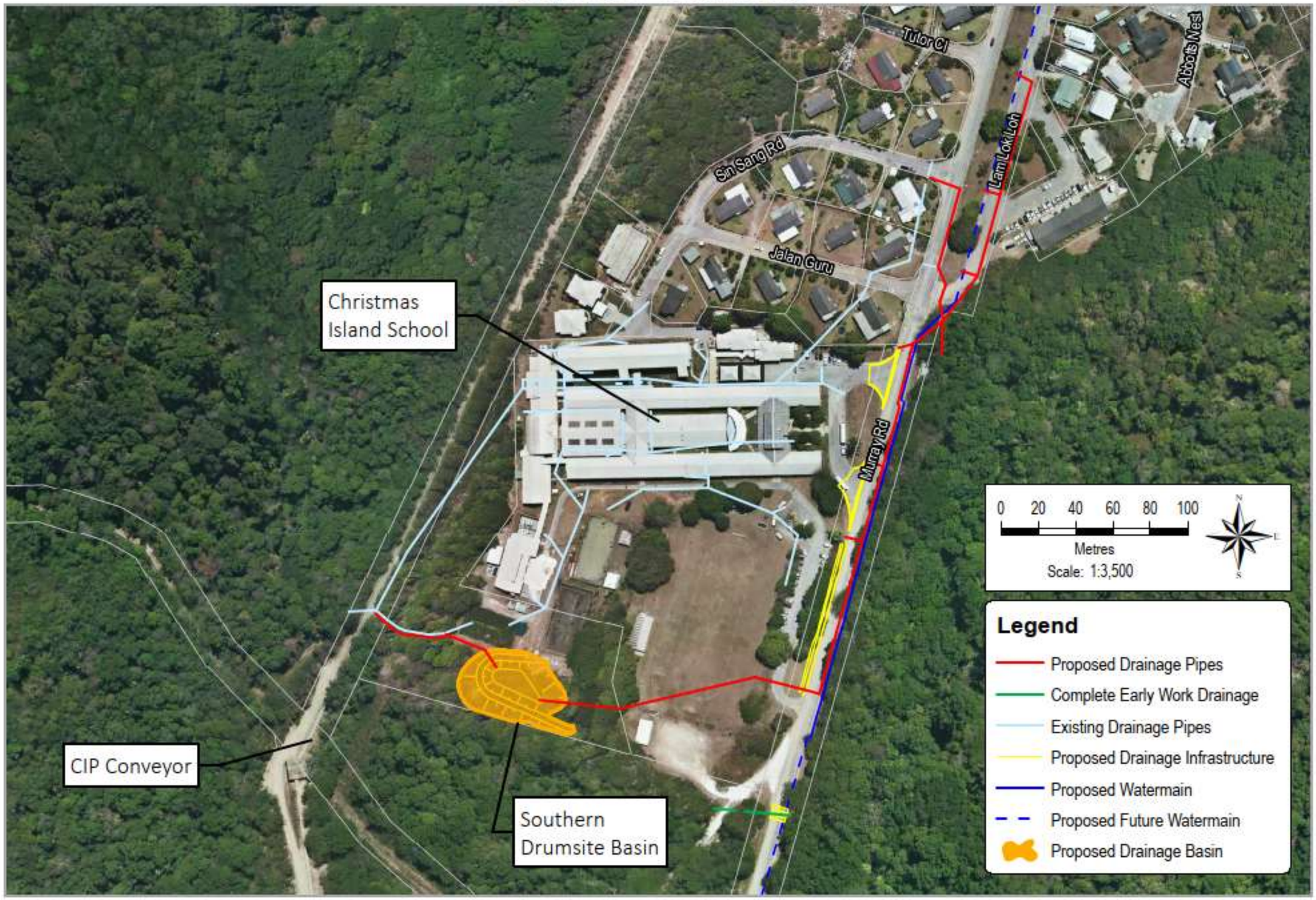
- Incline -


Incline and Conveyor
Incline Basin
Incline Drop Structure and Drive Over
Bund
CIP Operational Area
Retaining Wall
Discharge Point onto Incline
CIP Conveyor
POON SAAN
Poon Saan Rd
San Chye Loh
Club Rd
Phosphate Hill Rd
Kong Wai Loh Lane
Murray Rd
0 20 40 60 80
Metres
Scale: 1:3,000
Legend
Proposed Drainage Pipes
Existing Drainage Pipes
Proposed Drainage Infrastructure
Proposed Drainage Basin

- Central Drumsite -



- Southern Drumsite -



Attachment 4. Project Element 2 – Landslide Mitigation Works – Layout Plans

- Flying Fish Cove Landslide Mitigation - Proposed Fence and Berm Construction -

Attachment 5. Design Standards, Guidelines and Codes

Standard/ Reference	Description
ARR (1997), ARR (2019)	Australian Rainfall and Runoff (various)
DoW (2007)	Stormwater Management Manual for Western Australia.
DoW (2008)	Urban Water Management Plan: Guidelines for preparing plans and complying with subdivision conditions.
WAPC (2008)	Better Urban Water Management
Austroads (2013)	Guide to Road Design - Part 5: Drainage – General and Hydrology Considerations
Austroads (2013a) & (2013b)	Guide to Road Design - Part 5A: Drainage – Road Surface, Networks, Basins and Subsurface and Part 5B: Drainage – Open Channels, Culverts and Floodways
IPWEA (2017)	Local Government Guidelines for Subdivisional Development
MRWA (20200	Code of Practice Traffic Management for Works on Roads
UPCoP (2018)	Utility Provider Code of Practice – Western Australia
SWA (2018)	Code of Practice Excavation Work & Code of Practice Construction Work
SWA (2020)	Code of Practice How to Safely Remove Asbestos
NOHSC (2005)	Code of Practice for the Safe Removal of Asbestos 2nd Edition
DS 50 (2019), DS 60 (2018), DS 63 (2020), DS 65 (2020), DS 80 (2015)	Design Standard (various)
AS 1012.1, AS 1012.3.1, AS 1012.9	Methods of testing concrete (various)
AS 1100.401	Technical Drawing – Engineering survey and engineering survey design drawing
AS 1111.1	ISO metric hexagon bolts and screws - Product grade C - Bolts
AS 1141, AS 1141.11.1, AS 1141.60.1, AS 1141.60.2, AS 1141.60.3	Methods for Sampling and Testing Aggregates (various)
AS 1214	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)
AS 1237	Plain washers for metric bolts, screws and nuts for general purposes
AS 1289, AS 1289.3.1.1, AS 1289.3.3.1, AS 1289.3.6.1, AS 1289.5.1.1, AS 1289.5.2.1, AS 1289.5.3.1, AS 1289.5.4.1, AS 1289.5.7.1, AS 1289.5.8.1, AS 1289.6.3.2, AS 1289.6.9.1	Methods for Testing Soils for Engineering Purposes (various)
AS 1379	Specification and Supply of Concrete
AS 1478, AS 1478.1, AS 1478.2	Chemical admixtures for concrete, mortar and grout (various)
AS 1597.1	Precast Reinforced Concrete Box Culverts, Part 1: Small Culverts (not exceeding 1200 mm span and 1200 mm height)
AS 1597.2	Precast reinforced concrete box culverts - Large culverts (exceeding 1200 mm span or 1200 mm height and up to and including 4200 mm span and 4200 mm height)
AS 1646	Elastomeric Seals for Waterworks Purposes

Standard/ Reference	Description
AS 1725	Chain-link fabric security fences and gates
AS 1742, AS 1742.3	Manual of uniform traffic control devices (various)
AS 1831	Ductile cast iron
AS 2124	General Conditions of *Contract*
AS 2439.1	Perforated plastics drainage and effluent pipe and fittings - Perforated drainage pipe and associated fittings
AS 2758.1	Aggregates and rock for engineering purposes-Concrete aggregates
AS 2865	Confined spaces
AS 2876	Concrete kerbs and channels (gutters) – Manually or machine placed
AS 3582.1, AS 3582.2, AS 3582.3	Supplementary cementitious materials (various)
AS 3610	Formwork for Concrete
AS 3700	Masonry Structures
AS 3705, AS 3706.1, AS 3706.4, AS 3706.5, AS 3706.7, AS 3706.9, AS 3706.11	Geotextiles (various)
AS 3743	Potting mixes
AS 3798	Guidelines on earthworks for commercial and residential developments
AS 3799	Liquid membrane-forming curing compounds for concrete
AS 3972	General Purpose and Blended Cements
AS 3996	Access Covers and Grates
AS 4100	Steel Structures
AS 4139	Fibre Reinforced Concrete Pipes and Fittings
AS 4198	Precast Concrete Access Chambers for Sewerage Applications
AS 4419	Soils for landscaping and garden use
AS 4454	Compost, soil conditioners and mulches
AS 4586	Slip resistance classification of new pedestrian surface materials
AS/NZS 1252	High strength steel bolts with associated nuts and washers for structural engineering
AS/NZS 1254	PVC-U pipes and fittings for stormwater and surface water applications
AS/NZS 1428.2	Design for access and mobility - Enhanced and additional requirements - Buildings and facilities
AS/NZS 1477	PVC Pipes and Fittings for Pressure Applications
AS/NZS 1547	On-site domestic wastewater management
AS/NZS 1554.1, AS/NZS 1554.3, AS/NZS 1554.6	Structural steel welding (various)
AS/NZS 2032	Installation of PVC Pipe Systems
AS/NZS 2033	Installation of Polyethylene Pipe Systems
AS/NZS 2416	Water safety signs and beach safety flags
AS/NZS 2425	Bar chairs in reinforced concrete - Product requirements and test methods
AS/NZS 2566.1	Buried flexible pipelines Part 1: Structural design

Standard/ Reference	Description
AS/NZS 2566.2	Buried flexible pipelines Part 2: Installation
AS/NZS 3500.3	Plumbing and Drainage – Stormwater Drainage
AS/NZS 3678	Structural steel - Hot-rolled plates, floorplates and slabs
AS/NZS 3679.1	Structural steel - Hot-rolled bars and sections
AS/NZS 3725	Design for Installation of Buried Concrete Pipes
AS/NZS 3879	Solvent Cements and Priming Fluids for PVC (PVC-U and PVC-M) and ABS and ASA Pipes and Fittings
AS/NZS 4058	Precast Concrete Pipes (Pressure & Non-Pressure)
AS/NZS 4087	Metallic Flanges for Waterworks Purposes
AS/NZS 4129	Fittings for polyethylene (PE) pipes for pressure applications
AS/NZS 4130	Polyethylene (PE) Pipes for Pressure Applications
AS/NZS 4131	Polyethylene (PE) Compounds for Pressure Pipes and Fittings
AS/NZS 4455	Masonry Units, Pavers, Flags and Segmental Retaining Wall Units
AS/NZS 4671	Steel Reinforcing Materials
AS/NZS 4680	Hot-Dipped Galvanized (zinc) Coatings on Ferrous Articles
AS/NZS 4765	Modified PVC (PVC-M) pipes for pressure applications
AS/NZ 5065	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
AS/NZS ISO 10005	Quality management systems - Guidelines for quality plans
AS/NZS ISO 3905.12	Quality system guidelines - Guide to AS/NZS ISO 9001 for architectural and engineering design practices
AS/NZS ISO 9001	Quality management systems - Requirements
ASTM C295	Standard Guide for Petrographic Examination of Aggregates for Concrete
ASTM C1293	Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
ASTM C1074	Standard Practice for Estimating Concrete Strength by the Maturity Method
CIA Z7/04	Good Practice through Design, Concrete Supply and Construction, Concrete Durability Series Recommended Practice
CIA Z7/06	Concrete Cracking and Crack Control, Concrete Durability Series Recommended Practice
CIA Z7/07	Performance Tests to Assess Concrete Durability, Concrete Durability Series Recommended Practice
CIA Z9	Curing of Concrete
HB 90.3-2000	The Construction Industry – Guide to ISO 9001.2000.
SA HB 79	Alkali Aggregate Reaction– Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia