Main Roads

Tonkin Highway
Guildford Road to Hepburn Avenue

Environmental Protection Act Referral Supporting Document

Don Aitken Centre
Waterloo Crescent, East Perth, 6004

31 July 2019

56957/R001 (Rev 1)

JBS&G Australia Pty Ltd T/A Strategen-JBS&G

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1. Summary

1.1 Project Information

Project Title: Tonkin Highway – Guildford Road to Hepburn Avenue.

Project Locations: The Project is located within the existing Tonkin Highway corridor between Hepburn Avenue and Guildford Road (the "Project"), refer to Figure 1.

Project purpose/components:

Main Roads Western Australia (Main Roads) is proposing to undertake modification works within the existing Tonkin Highway road reserve between Guildford Road and Hepburn Avenue. The works are required to allow for:

- Future upgrade of Tonkin Highway to a four lane "all-lane-running" scenario
- Future construction of a mass transit system within the Tonkin Highway median.

The modification works will require realignment and reconstruction of the Tonkin Highway median within an already disturbed footprint.

The Proposal is not expected to have a significant impact on any of the Environmental Protection Authority's environmental factors.

Potential impacts associated with contamination and groundwater are manageable and are well regulated by the *Contaminated Sites Act 2003* and *Rights in Irrigation and Waters Act 1914*, respectively. Consultation will be undertaken, and all necessary approvals obtained, prior to the Proposal being undertaken.

The detailed scope of works include:

- Modification of parts of the existing Tonkin Highway by up to 1m to allow for a future 4th lane without additional road widening
- Realignment of Tonkin Highway and shared paths to accommodate a potential future passenger transfer facility at Broun Avenue
- An underpass under the western carriageway of Tonkin Highway between Guildford Road and Collier Road to allow for a future mass transit system to enter/exit the Tonkin Highway median
- An underpass under the eastern carriageway of Tonkin Highway between Marshall Road and Hepburn Avenue to allow a future mass transit system to enter/exit the Tonkin Highway median
- Installation of infill bridge spans within the median of Tonkin Highway between existing structures at Tonkin Highway/Morley Drive
- Bridge pier protection where road bridges are currently intersecting Tonkin Highway
- Replacement of wire rope barriers in the median with concrete barriers and associated drainage and retaining structures.

Area proposed to be cleared:

Due to previous disturbance from the construction of the NorthLink WA Project, no clearing of native vegetation is expected.

Temporary clearing required:

No temporary clearing is required.

1.2 Impacts to key environmental aspects

The potential impacts to key environmental aspects associated with the Project include:

- **Terrestrial Environmental Quality** – Pyrite cinders from fertilizer manufacturing at the old CSBP factory were buried in the now road reserve, within a relatively small section just north of Railway Parade. This section has been classified by the Department of Water and Environmental Regulation (DWER) as "Contaminated – remediation required" (Figure 3).

  The soil in this section is known to contain localised pockets of high levels of heavy metals and other contaminates at a depth of approximately 5 metres (m). However, this may have changed following construction of the NorthLink WA Project (Senversa 2019a) (Appendix C).

  There is potential for construction activities to disrupt the soil leading to oxidation of the cinders and further leaching of additional contaminates. Furthermore, there is a potential risk to workers undertaking deep excavation in the southern section of the Proposal area due to these contaminates.

- **Inland Waters** – Groundwater in the southern section adjacent to the old CSBP site is contaminated with heavy metals and other chemicals. The groundwater is also acidic with a pH of between 2 and 3.5 (Senversa 2019a). Dewatering activities in this southern section, may pose a potential risk to workers who may come into contact with the groundwater during deep excavation or dewatering.

  There is potential for offsite impacts if dewatering effluent is not collected and treated. In addition, there may be potential downstream impacts if, soil containing pyrite cinders are exposed without treatment, and leach additional contaminates into the surrounding groundwater.

1.3 Key Environmental Management Actions

A Project Environmental Management Plan (PEMP) will be developed and implemented in accordance with Main Roads standard environmental procedures.

Specific environmental management actions relevant to the Project include:

- Contamination (soil and groundwater) – preparation of PEMP to include management measures to address potential exposure to contaminated soil and/or groundwater during construction; development of a dewatering management plan and acid sulfate soil management plan; development of specific management strategies to manage the excavation, storage, treatment and disposal of contaminated soil.

1.4 Summary of Regulatory Approvals

The environment and heritage regulatory requirements for this Proposal are provided in Table 1 below.

Table 1: Summary of Regulatory Approvals Required

Approval Type	Applicable (Yes/No)
Clearing Permit (Part V EP Act)	No
Environment Protection and Biodiversity Conservation Act 1999	No
Environmental Protection Act 1986 – Part IV: Referral of Proposals to the Environmental Protection Authority (EPA) (Section 38)	Yes
Environmental Protection Act 1986 – Part V; Works Approval & Licences.	No
Bed and Banks Permit under the *Rights in Water and Irrigation Act (1999)*	No
Section 18 under the *Aboriginal Heritage Act 1972*	No
Contaminated Sites Act 2003 management of existing sites in accordance with the act .	Yes
Rights in Water and Irrigation Act – 5C Licence for dewatering and water abstraction	Yes

2. INTRODUCTION

The Main Roads Western Australia (Main Roads) is proposing to undertake improvement works within the median of Tonkin Highway between Guildford Road and Hepburn Avenue (the Proposal) within the City of Bayswater and the City of Swan.

2.1 Purpose of this document

Main Roads is referring the Proposal to the Environmental Protection Authority (EPA) for assessment under Section 38 of the *Environmental Protection Act 1986* (EP Act). The purpose of this document is to support the formal referral of the Proposal. The document provides information on the Proposal activities, potential environmental impacts and proposed mitigation measures associated with the Proposal.

This document has been prepared in accordance with *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016* (EPA 2016) and *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual* (EPA 2018)

3. PROJECT DESCRIPTION

The Proposal is located on Tonkin Highway (H017) from north of the intersection of Guildford Road extending north to just south of Hepburn Avenue within the City of Bayswater and City of Swan. The Proposal involves:

- Modification of parts of the existing Tonkin Highway by up to 1m to allow for a future 4th lane without additional bulk earthworks
- Realignment of Tonkin Highway and shared paths to accommodate a potential future passenger transfer facility at Broun Avenue
- An underpass under the western carriageway of Tonkin Highway between Guildford Road and Collier Road to allow for a future mass transit system to enter/exit the Tonkin Highway median
- An underpass under the eastern carriageway of Tonkin Highway between Marshall Road and Hepburn Avenue to allow a future mass transit system to enter/exit the Tonkin Highway median
- Installation of infill bridge spans within the median of Tonkin Highway between existing structures at Tonkin Highway/Morley Drive
- Bridge pier protection where road bridges are currently intersecting Tonkin Highway
- Replacement of wire rope barriers in the median with concrete barriers and associated drainage and retaining structures.

3.1 Proposal Location

The Proposal area is shown in Figure 1. The Proposal is located along Tonkin Highway between Guildford Road and Hepburn Avenue.

The location and boundaries of the study area (5 km radius) for the project are shown in Figure 2.

3.2 Local and Regional context

The Proposal lies along the existing Tonkin Highway alignment and is surrounded by the following land uses (from approximately south to north):

- Guildford Road to Broun Avenue - Industrial land uses to the east and west of Tonkin Highway, with some urban land use on the eastern side between Collier Road and Broun Ave
- Broun Avenue to Reid Highway - Urban land uses to the east and west of Tonkin Highway, with recreation (Lightning Park) to the south west of Reid Highway and Tonkin Highway
- Reid Highway to Marshall Road Industrial land use to the west of Tonkin Highway (Malaga industrial area) and urban to the east
- Marshall Road to Hepburn Avenue Urban land use (Ballajura) to the west and Parks and Recreation (Whiteman Park) to the east of Tonkin Highway.

3.3 The Proponent

The Proponent for the Proposal is the Commissioner of Main Roads and formal contact details are:

PROPONENT	Commissioner of Main Roads PO Box 6202 East Perth WA 6002 ABN/ACN 50 860 676 021
PROJECT KEY CONTACT	John Braid Principal Environment Officer Main Roads Western Australia Don Aitken Centre East Perth WA 6004

3.4 Key Proposal characteristics

Main Roads propose to undertake modification works within the existing Tonkin Highway road reserve between Guildford Road and Hepburn Avenue. The works are required to allow for:

- Future upgrade of Tonkin Highway to a four lane "all-lane-running" scenario
- Future construction and operation of a mass transit system within the Tonkin Highway median by others.

The modification works will require realignment and reconstruction of the Tonkin Highway median within an already disturbed footprint.

The Proposal Area has been developed to provide an upper limit to disturbance. This extent includes the carriageway, PSP, earthworks, drainage and fencing.

Although entirely unrelated, the Proposal is located within the clearing footprint for the Northlink WA Project. The summary of the Proposal is shown in Table 2.

Table 2: Summary of the Proposal

PROPOSAL TITLE	Tonkin Highway - Guildford Road to Hepburn Avenue
PROPONENT NAME	Commissioner of Main Roads
SHORT DESCRIPTION	Main Roads Western Australia (Main Roads) is proposing to undertake modification works within the existing Tonkin Highway road reserve between Guildford Road and Hepburn Avenue. The works are required to allow for: • Future upgrade of Tonkin Highway to a four lane "all-lane-running" scenario • Future construction and operation of a mass transit system within the Tonkin Highway median by others. The modification works will require realignment and reconstruction of the Tonkin Highway road and median within an already disturbed footprint.

Key Proposal characteristics that quantify the limits or context of the physical and operation elements are presented in Table 3.

Table 3: Key Proposal characteristics

ELEMENT	LOCATION	PROPOSED EXTENT
Physical elements		
Clearing and disturbance for road and path upgrades, underpass construction and amendments to associated infrastructure including drainage, lighting, signs and road barriers.	Figure 1 Proposal area	No clearing of native vegetation within a disturbance envelope of 162.3 ha

3.5 Proposal stages

3.5.1 Construction

Construction of the Proposal is planned to commence in late 2020 for a period of 2 years. The construction methodology for structures depends on their final form.

Construction will be undertaken using traditional earth-moving equipment and construction techniques. Construction will use both imported fill and cut-to-fill materials from the Proposal Area.

Where underpasses are to be installed, they will either be a pre-cast concrete arch or trapezoid structure, supported on concrete strip footings.

Construction water will be sourced from temporary boreholes under a *Rights in Water and Irrigation Act 1914* abstraction licences, and other water suppliers as required.

3.6 Project Exclusions

This project does not relate to NorthLink WA or Metronet Projects.

3.7 Environmental Impact Assessment Process

3.7.1 *Environmental Protection Act 1986,* Part IV Environmental Impact Assessment

The Proposal will be referred under Part IV of the EP Act which is the primary legislation governing environmental protection and impact assessment in Western Australia (WA). Division 1 of Part IV of the EP Act provides for the referral and assessment of significant and strategic proposals.

The Proposal Area overlaps with the Northlink WA Project which was formally assessed under Part IV of the EP Act (referred in 2013 and Ministerial Statement 1036 issued in 2016).

The decision to refer the project to the WA EPA was based entirely on project risk management, to clearly define this Proposal as a separate proposal to the Public Transport Authority's (PTA) Morley – Ellenbrook rail line. Although it appears that referral to the EPA is not necessary given the minimal impacts on the environment due to the highly disturbed nature of the project area, a level of assessment decision by the authority will provide greater certainty regarding Proposal delivery.

All potential impacts associated with this proposal are considered to be readily managed and are well regulated by the Department of Water and Environmental Regulation (DWER).

3.7.2 Environmental Protection and Biodiversity Conservation Act 1999

A proposed action that may have a significant impact on a Matter of National Environmental Significance (MNES) requires approval from the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Referral under the EPBC Act is not considered necessary as there will be no significant impact on any MNES.

3.7.3 Other Approvals and Regulation

Few additional regulatory approvals will be required to implement the Proposal. These have been summarised in Table 4.

Table 4: Summary of other regulatory approvals required

APPROVAL TYPE
Environmental Protection Act 1986 – Part IV: Referral of Proposals to the Environmental Protection Authority (EPA) (Section 38)
Bed and Banks Permit under the Rights in Water and Irrigation Act 1999
Contaminated Sites Act 2003

3.8 Decision Making Authorities

The authorities listed in Table 5 have been identified as decision making authorities (DMAs) for the Proposal.

Table 5: Decision making authorities for the Proposal

DECISION MAKING AUTHORITY	RELEVANT LEGISLATION
Chief Executive Officer of the Department of Water and Environmental Regulation	*Rights in Water and Irrigation Act 1914 (RIWI Act)* *Contaminated Sites Act 2003*

4. ASSESSMENT OF ASPECTS AND IMPACTS

4.1 Aspects and Impacts

Table 6 provides an evaluation of the potential impacts that the project may have on environmental aspects.

Table 6 Project Aspects and Impacts

<table>
<tr><th>ASPECT</th><th>Existing Environment</th><th>Potential Impact</th><th>Management/Mitigation/Further Studies</th></tr>
<tr>
<td>Aboriginal Heritage</td>
<td>The boundaries of three registered Aboriginal Heritage sites intercept the Proposal area (listed below). Site 20058 occurs exclusively within the Proposal area, while it is anticipated that only the broadly mapped buffers of the other two sites intercept the Proposal area.
<table>
<tr><th>Site ID</th><th>Name</th><th>Type</th></tr>
<tr><td>3426</td><td>Ballajura Camp</td><td>Camp</td></tr>
<tr><td>3692 South</td><td>Bennett Brook</td><td>Mythological</td></tr>
<tr><td>20058</td><td>Temporary Camp</td><td>Camp</td></tr>
</table>
Ten ‘Other Heritage Places’ (OHPs) are mapped within the Proposal area. These sites have a ‘Stored Data / Not a Site’ status, and therefore they have been assessed as not meeting the definition of an Aboriginal heritage site as defined in Section 5 of the Aboriginal Heritage Act 1972.

An existing Section 18 Consent to disturb an Aboriginal Heritage site for the purposes of road construction lies over the Proposal area from 500m north of Benara Road to Hepburn Avenue. The sites listed above occur within this area.</td>
<td>There is the potential for Aboriginal Heritage Site disturbance during clearing and/ or excavation works, however given the current land use, existing disturbance within the Proposal area and the extent of clearing that has occurred, it is unlikely that there will be any significant impact on Aboriginal heritage values.</td>
<td>• Section 18 was granted over part of the Proposal area for the undertaking of the NorthLink WA Project.
• Act in accordance with the Aboriginal Heritage Due Diligence Guidelines (DAA and DPC 2013)
• Clearly demarcate the boundaries of heritage sites for protection where appropriate.
• Ensure on-site construction personnel are aware of potential Aboriginal heritage sites/artefacts and the requirement to protect them.
• A trained and competent person including appointed monitors will be engaged to identify Aboriginal artefacts and monitor all work in the vicinity of sites.
• In the event that human skeletal material is uncovered, work will cease within 25 metres of the material and the location of the material reported to Police.
• In the event that artefacts or material of Aboriginal origin is discovered, work will cease within 25 metres of the material and a qualified archaeologist will investigate the item(s) and take appropriate actions (i.e. contact DPLH, EO and PHO).</td>
</tr>
<tr>
<td>Acid Sulfate Soils</td>
<td>A review of the Perth Groundwater Map (2019) indicates that majority of the site has a moderate to low risk (<3 m from surface) of acid sulfate soil (ASS) with two isolated pockets in the northern and southern western portion which have a high to moderate risk of ASS.</td>
<td>The potential for encountering ASS during construction works such as excavation and dewatering.</td>
<td>• ASS and Dewater Management Plan (ASSDMP) will be prepared and implemented during construction, inclusive of measures such as:
o Treatment of ASS through lime dosing
o Treatment of dewatering effluent prior to disposal via infiltration
o Construction of an ASS treatment pad
• No dewatering effluent discharged directly to waterways, wetlands or drains
• Implementation of the PEMP.</td>
</tr>
</table>

ASPECT	Existing Environment	Potential Impact	Management/Mitigation/Further Studies
Air quality (Construction)	The Proposal area is situated upon Bassendean sands, which have the potential to be mobilised (ie. Dust) during construction.	The proposed project construction activities are unlikely to cause significant impacts to air quality, however the Project will result in minor air (dust) emissions during construction.	• Management of dust through implementation of the PEMP. • Manage dust with consideration of *A guideline for managing the impacts of dust and associated contaminants from land development sites* (DEC 2011), contaminated sites remediation and other related activities. • Establish a complaint register during construction to manage dust complaints. • All dust complaints during construction are to be investigated and addressed within 24 hours of receiving the complaint.
Contamination	Several parcels of land located within the southern section of the Proposal area (Figure 3a and 3b) have been classified by DWER under the *Contaminated Sites Act 2003* (CS Act) as "Contaminated – remediation required". This classification is associated with the adjacent former CSBP / Cresco fertiliser manufacturing site (Figure 3b). Land parcels within the Proposal area have previously been investigated and found to contain pyrite cinder deposits relating to former use by the adjacent Cresco/CSBP fertiliser site. The presence of the cinder deposits has resulted in low pH and elevated concentrations of metals in groundwater. A contaminated sites data gap analysis was conducted across the southern portion of the Proposal area (Senversa 2019a, Appendix A). This report documents the historical contamination sources within this portion of the Proposal area, remediation efforts undertaken to date and recommendations for further work. The findings in this report will inform Main Roads management of contaminated materials within this section.	Disruption of soils containing pyrite cinders may lead to their oxidation and further acid leaching of heavy metals into the receiving environment. Prior to the implementation of the NorthLink WA project, exceedances of relevant criteria did not occur until depths greater than 5 meters, minimising potential impacts. The recent works for NorthLink WA has potentially changed to the soil profile and depth to impact (Senversa 2019a). The need for deeper excavation for underpass construction may expose contaminated soil. This contamination presents a risk to the receiving environment (such as surface and groundwater and a health risk to construction workers) if not appropriately identified and managed.	• Site inductions. • Implement the sampling and analysis quality plan (SAQP) developed by Senversa (Senversa 2019b) (Appendix B). • Outcomes derived from the SAQP will inform site specific management actions to be contained within the PEMP. • Implementation of the PEMP. • Contractor to develop contingency actions to manage asbestos finds. • Development of site-specific dewatering management plan, in consultation with DWER. • Excavation of soils containing pyrite cinders to be treated similar to ASS. Heavy metal concentrations may require treatment to be undertaken off-site. • Default management of pyrite cinders will be to dispose of to an appropriate landfill facility.

ASPECT	Existing Environment	Potential Impact	Management/Mitigation/Further Studies
Declared plants (weeds)	The entire Proposal area has been heavily disturbed by urban development and road construction. It is possible that declared plants (weeds) are present within the Proposal area. One species of declared plant *Zantedechia aeithiopica* (Arum lily) was identified in a previous survey between Collier Road and Guildford Road (360 Environment 2015).	The Project has the potential to introduce or spread declared weeds within, or to areas outside of the Proposal area if not managed appropriately.	• Include declared plant knowledge, identification and reporting into contractor inductions. • Main Roads will report and control any declared pests in accordance with the control requirements specified for a particular species under the *Biosecurity and Agriculture Management Act 2007*. • All plant and equipment used in construction activities is to be certified clean on arrival to prevent the introduction of declared plants to the site. • When working within an area known to contain declared weeds, vehicles must be clean on exit.
Dieback	The entire Proposal area has been disturbed by road construction activities as shown in Figure 1. The proposal area is generally absent of vegetation with no significant areas of fringing vegetation adjacent. While it is possible that Dieback is present within the Proposal area there are no likely pathways of spread to significant areas due to the Proposal.	As the proposal area is devoid of native vegetation and works are being undertaken within the median of Tonkin Highway, no impacts associated with the Proposal are expected.	Implementation of standard hygiene practises contained within the PEMP will be sufficient to prevent any potential impacts.
Groundwater	The site is underlain by the superficial Swan aquifer which is hosted within the Bassendean Sand and Tamala Limestone. A search of the DWER Information Water Information Register (WIR) database and Perth Groundwater Atlas undertaken indicates that groundwater beneath the Proposal area is likely to be encountered between 6 metres below existing ground level (mBGL) and 17 mBGL. Regional groundwater is inferred to generally flow to the south with varying flow to the south, south-south west and south-east towards the Swan River. Groundwater within the southern section of the Proposal area, near Railway Parade, is known to be contaminated due to historical contamination associated with the former CBSP site (Senversa 2019a). The remediation of this site was assessed by the EPA in 2005 (EPA 2005).	Potential of offsite migration of contaminated groundwater to Swan River. Senversa (2019a) discusses how flow of groundwater is generally to the south, towards the Swan River. However, the report also acknowledges that despite the in-situ contamination, there have been no observable impacts on the Swan River Workers may be exposed to contaminated groundwater via direct contact during deep excavations or abstraction of groundwater. Potential for construction incidents (spills etc.) to impact on groundwater throughout the Proposal area.	• Site inductions. • Implement a sampling and analysis quality plan (SAQP) for areas requiring further assessment of contamination in soil and groundwater. • Implementation of the PEMP. • Development of site-specific dewatering management plan, in consultation with DWER. • Excavation of soils containing pyrite cinders to be treated similar to ASS. Heavy metal concentrations may require of site treatment to be undertaken off-site. • Dewatering effluent treated appropriately in consultation with DWER. • All spills will be contained immediately and removed within 24 hours to minimise the potential for contaminants to enter groundwater.

ASPECT	Existing Environment	Potential Impact	Management/Mitigation/Further Studies
	In its report to the EPA, Parsons Brinckerhoff (2004b) outlined that groundwater under the former CSBP site had been impacted such that groundwater concentrations of arsenic, cadmium, chromium, fluoride and lead under the site commonly exceed drinking water guidelines by an order of magnitude (10x) or more. Senversa (2019a) summaries that groundwater within the southern section is acidic (pH between 2.1 and 3.1).		
Public Drinking Water Source Areas	There are no Public Drinking Water Source areas within the Proposal area.	No impact.	No management required.
Hazardous substances	Only common substances, such as fuel, oil and bitumen, will be used and works will adhere to Main Roads standard management actions and Safety Data Sheets.	Potential for spills from project activities to have an adverse impact on water quality in the Swan River and groundwater. Spills may also cause contamination of soil.	• Storage of hazardous substances to be in a bunded container that can accept 125% of the storage capacity within the bunding. • Bunding to be regularly inspected and emptied (if required). • Provision of adequate spill kits at chemical storage locations as well as for any construction works within the Swan River floodplain. • All refuelling to be adequately managed e.g. drip trays and provision of hydrocarbon disposal bins.
Heritage (non-indigenous)	A search of the State Heritage Register (spatial database) identified no properties on the State Heritage Register within the proposal area. A number of European Heritage Sites listed on the City of Bayswater's Municipal Heritage Inventory occur within or in close proximity to the Proposal area. Houses at 33, 41, 44 & 47 Harvest Road, Morley are listed on the City of Bayswater's MHI however these were all demolished as part of the NorthLink WA project.	As the Proposal is contained to the Main Roads road reserve and is heavily disturbed by recent roadworks for the NorthLink WA project, potential impacts to European heritage sites will likely be limited to vibration caused through Proposal construction activities. There will be no impact on Whiteman Park as a result of the Proposal.	• Main Roads to liaise with DPLH and the relevant local government authorities to identify any potential to European heritage sites. • Potential impacts to European heritage associated with vibration will be managed through the measures outlined in 'Noise and Vibration' aspect.

ASPECT	Existing Environment	Potential Impact	Management/Mitigation/Further Studies
	Whiteman Park is listed as a heritage site in the City of Swan and abuts the northern end of the Proposal.		
Land Vesting	The land within the Proposal area is located within the Tonkin Highway road reserve and is owned by Main Roads WA.	N/A.	N/A.
Noise and vibration	Tonkin Highway is currently a noisy environment due to traffic noise. Vibration and ground borne noise may be felt at some sensitive receivers currently due to the construction of the Forrestfield-Airport Link rail tunnel.	Construction: "Regular" construction noise with the potential for out-of-hours works. Traffic noise: This proposal will have no impact on road traffic noise from Tonkin Highway. Vibration: Vibration is likely to be an issue for sensitive receivers adjacent to Tonkin Highway during construction works: Vibration will not have an ongoing impact during operation Construction vibration is likely to have a nuisance effect on some sensitive receivers and may cause structural damage to buildings and structures.	Develop a noise and vibration management plan (NVMP) for construction works that meets the requirements of the *Environmental Protection (Noise) Regulations 1997* The NVMP will include the following mitigation and management measures: • Using equipment with low noise levels and maintaining noise control devices on equipment. • Using broadband reversing alarms on mobile plant. • Maintaining a complaints register. • Notifying residents in writing at least 24 hours prior to undertaking out-of-hours works. • Obtaining local government approval at least 7 days prior to out-of-hours works. • Undertaking property condition surveys of all structures within 100m prior to works and at completion of works. • Monitoring vibration continuously during construction works.
Reserves / Conservation areas	The Proposal area does not intersect any reserves or conservation areas. The following reserves occur within close proximity to the Proposal area: Bush Forever Site 313 is located approximately 1.5 km south west of the Proposal area, Site 307 Lightning Swamp and Adjacent Bushland, Noranda is approximately 200m to the west of the northern section of the Proposal area. Site 304 (1547.9 Ha) is located in Whiteman Park approximately 1km north east of the Proposal area. The Class A Lightning Swamp nature reserve R46880, vested in the City of Bayswater is situated approximately 200 m to the west of the northern section of the Proposal area.	As the Proposal is contained to works within the median and previously disturbed areas, there will no direct or indirect impact on any vested conservation or reserve areas. There will not be any significant impacts as a result of the Proposal.	The following management measures will be addressed in the PEMP to manage potential indirect impacts to surrounding conservation areas: • Staff inductions. • Clearing and access control measures (such as demarcation of clearing boundaries) to ensure no impact on vegetation outside of the Proposal area. • Weed and dieback management. • Erosion and sediment control. • Waste and fire management. • Dust control.

ASPECT	Existing Environment	Potential Impact	Management/Mitigation/Further Studies
	A number of Water Corporation open drains run parallel to Tonkin Highway adjacent or just within the Proposal area. The C class Reserves 32490 and 30061 vested in the Water Corporation are associated with Bayswater Main Drain and occur adjacent to the southern portion of the Proposal area. The Swan River is classified as a conservation wetland and an important regional ecological linkage and is located approximately 1.6 Km south, southwest and south-east of the Proposal area.		
Drainage	A number of Water Corporation open drains run parallel to Tonkin Highway adjacent or just within the Proposal area. Significant improvements and modification to drainage areas occurred due to the implementation of NorthLink WA.	No potential impact to drainage is expected. Drainage was modified as a result of NorthLink WA. The proposed works associated with the Proposal may require further drainage works or modification.	N/A.
Visual amenity	The Proposal area is located within an existing road reserve. The area has recently been significantly modified through the construction of NorthLink WA. Noise walls and visual screens have been installed throughout the Proposal area to mitigate visual impacts from the operation of Tonkin Highway. The Tonkin Highway Industrial Estate (which is predominantly vacant but currently under development), Railway Parade and Guildford Road reserves, and commercial/industrial zoned land and residential properties.	No potential impacts to visual amenity are expected.	N/A.
Wetlands	Seven wetlands are located in or within the vicinity of the Proposal area. These are: • UFI 8431 – Multiple Use (Sumpland). • UFI 15700 – Multiple Use (Dampland). • UFI 8450 – Multiple Use (Dampland). • UFI 15030/15200 – Multiple Use (Sumpland).	There will be no direct impact on any wetland with environmental values. Hydrological values will be maintained through road drainage. Ground disturbing activities on the site between Guildford Road and Collier Road have the potential to expose pyritic cinders, which could	In implementing the above described management measures for contamination and groundwater, potential impacts to wetlands will appropriately managed. In addition, the PEMP will include the following management measures:

ASPECT	Existing Environment	Potential Impact	Management/Mitigation/Further Studies
	• UFI 15033 – Conservation (Sumpland) (Victoria Road Swamp). • UFI 15757 – Resource Enhancement (Sumpland). • UFI 15029 – Multiple Use (Palusplain). All wetlands listed above have been disturbed or destroyed within the Proposal area as a result of the construction of Tonkin Highway. They do not retain any significant environmental values within the Proposal area. The closest wetland of environmental significance is the Gobba Lake, located approximately 1.5 km south of the Proposal area. The wetland is classified in the Geomorphic Wetland Database as a resource enhancement area. The Swan River is classified as a conservation wetland is located approximately 1.6 Km south, south-west and south-east of the Proposal area. The Swan- Canning Estuary (where the Swan and Canning river meet) is listed as a nationally important wetland located 10 km south east of the Proposal area.	result in increased oxidation, chemical solubility and contamination mobilisation, which could potentially impact the Swan River ecosystem via the Beechboro Branch Drain and the Bayswater Main Drain. Senversa (2019a) highlights that there is no complete or potentially complete pathway from the cinder deposits (source) to the Swan River (receptor). It is unlikely that the implementation of the project will lead to significant (or any) downstream impacts.	• No on-site storage of fuel, oils and other contaminant materials will be permitted within 100 m of a watercourse or wetland. • The PEMP includes spill response procedures, erosion/sediment controls and surface water/ drainage management to prevent water quality impacts in nearby wetlands and groundwater. • Testing of construction dewatering effluent, and treatment if necessary, prior to infiltration. • ASS managed through an ASSDMP to prevent water quality impacts to wetlands, in accordance with DWER guidelines. • Stormwater treatment and infiltration in accordance with the Better Urban Water Management framework and WA Stormwater Management Manual. • Embankments adjacent to or within wetlands will be vegetated to minimise erosion and sedimentation of wetlands. Potential impacts due to the presence of pyritic cinders in the southern section will be managed in accordance with the PEMP, ASSMP and through liaison with DWER.
Flora	The desktop assessment identified that *Conospermum undulatum* may occur within the Proposal area. Surveys undertaken in 2014 did not identify any individuals in the Proposal area (360 Environmental 2015). Noting this and the disturbance following recent construction within the Proposal area, no individuals will be impacted. No other conservation significant flora species are likely to be present within the Proposal area. The entire Proposal area has been heavily disturbed by recent roadworks for the NorthLink WA project.	No direct impacts associated with the Proposal	The following management measures will be addressed in the PEMP to manage potential indirect impacts to surrounding ecological communities: • Staff inductions • Clearing and access control measures (such as demarcation of clearing boundaries) to ensure no impact on vegetation outside of the Proposal area. • Weed and dieback management. • Erosion and sediment control. • Waste and fire management. • Dust control.

ASPECT	Existing Environment	Potential Impact	Management/Mitigation/Further Studies
Vegetation	There is no existing remnant vegetation within the Proposal area other than a small (0.6 ha) stand of *Corymbia callophllya* (Marri) to the south east of the Tonkin Highway/ Benara Road intersection. Another small stand of native vegetation occurs just outside the Proposal boundary south west of the Tonkin Highway/Broun Avenue intersection at Wotton Reserve. The remainder of the Proposal area has been heavily disturbed by recent roadworks for the NorthLink WA project.	No clearing of native vegetation is proposed as part of this Proposal.	The following management measures will be addressed in the PEMP to manage potential indirect impacts to surrounding ecological communities: • Staff inductions. • Clearing and access control measures (such as demarcation of clearing boundaries) to ensure no impact on vegetation outside of the Proposal area. • Weed and dieback management. • Erosion and sediment control. • Waste and fire management. • Dust control.
Ecological Communities	The entire Proposal area has been heavily disturbed by recent roadworks for the NorthLink WA project. No known Threatened Ecological Community (TEC) or Priority Ecological Community (PEC) occurs within the Proposal area.	No direct impacts associated with the Proposal.	The following management measures will be addressed in the PEMP to manage potential indirect impacts to surrounding ecological communities: • Staff inductions. • Clearing and access control measures (such as demarcation of clearing boundaries) to ensure no impact on vegetation outside of the Proposal area. • Weed and dieback management. • Erosion and sediment control. • Waste and fire management. • Dust control.
Terrestrial Fauna	No conservation significant fauna or associated fauna habitat occur within the Proposal area. The entire Proposal area has been heavily disturbed by recent roadworks for the NorthLink WA project. The roadside landscaping has only been recently planted and does not provide any fauna habitat.	No direct impacts associated with the Proposal.	Implementation of the PEMP including the following management measures: • Staff inductions. • Reporting of any injured fauna to the Department of Biodiversity Conservation and Attractions Wildcare Helpline. • Clearing and access control measures (such as demarcation of clearing boundaries) to ensure no impact on vegetation outside of the Proposal area. • Weed and dieback management. • Landscaping of earth-worked areas.

ASPECT	Existing Environment	Potential Impact	Management/Mitigation/Further Studies
Black Cockatoos	The entire Proposal area has been heavily disturbed by recent roadworks for the NorthLink WA project. The (0.6 ha) stand of *Corymbia callophllya* (Marri) to the south east of the Tonkin Highway/ Benara Road intersection provides some limited habitat within the Proposal area. Suitable black cockatoo foraging habitat occurs within the Lightning Swamp nature reserve, situated approximately 200 m to the west of the northern section of the Proposal area. Whiteman Park adjacent to the northeast of the Proposal area and riparian vegetation associated with the swan river located approximately 1.6 Km south, southwest and south-east of the Proposal area also provide suitable black cockatoo environment.	The Proposal will not have a significant impact to black cockatoos as no suitable foraging or roosting habitat within the Proposal area will be impacted. There will be no impact on the Marri stand near Benara Road. There will be no indirect impacts to black cockatoo habitat as there is no adjacent habitat to the Proposal area.	• Reporting of any injured fauna to the Department of Biodiversity Conservation and Attractions Wildcare Helpline. • Implementation of the PEMP which will contain management measures to reduce spread of weeds, risk if fire and prevent unauthorised access to areas of vegetation.

5. ASSESSMENT AGAINST EPA FACTORS

5.1 Identification of Environmental Factors

Environmental factors are those parts of the environment that may be impacted by an aspect of a Proposal (EPA 2018b). The EPA has 13 environmental factors, organised into five themes: Sea, Land, Water, Air and People.

The environmental factors and EPA objectives are provided in Table 7. The relevance of each factor to the Proposal is summarised and the significant environmental factors that require further consideration are identified.

Although the Proposal will not have a significant impact on them, further guidance on the assessment against the most relevant environmental factors to the Proposal is provided in Table 8. These factors are:

- Terrestrial Environmental Quality
- Inland Waters
- Social Surroundings.

Table 7: Environmental factors relevant to the Proposal

THEME	FACTOR	OBJECTIVE	RELEVANCE TO PROPOSAL	SIGNIFICANT ENVIRONMENTAL FACTOR
Sea	Benthic Communities and Habitats	To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.	No impacts to benthic habitats.	No
	Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	No impacts to coastal processes.	No
	Marine Environmental Quality	To maintain the quality of water, sediment and biota so that environmental values are protected.	No impacts to marine environmental quality.	No
	Marine Fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained.	No impacts to marine fauna.	No
Land	Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	No impacts to flora and vegetation.	No
	Landforms	To maintain the variety and integrity of significant physical landforms so that environmental values are protected.	Distinctive landforms are not present.	No
	Subterranean Fauna	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	No impact to subterranean fauna expected.	No

	Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected.	Acid Sulfate Soils (ASS) and Contamination are present but manageable within the Proposal Area.	No
	Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	Construction will not result in habitat clearing.	No
Water	Inland Waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.	Contaminated groundwater is present but manageable within the Proposal Area .	No
Air	Air Quality	To maintain air quality and minimise emissions so that environmental values are protected.	Minimal air emissions will be generated during construction of the Proposal.	No
People	Social Surroundings	To protect social surroundings from significant harm.	Proposal Area is within an already highly disturbed footprint.	No
	Human Health	To protect human health from significant harm.	No human health impacts expected..	No

Table 8: Relevant environmental factors, studies, proposed mitigation and regulatory mechanisms

Environmental Factor	Potential impacts	Studies	Proposed mitigation	Regulatory mechanism
Terrestrial Environmental Quality	As discussed in Table 6 the southern section of the Proposal area has been designated by DWER as "Contaminated – remediation required". While the CSBP site underwent remediation, including the excavation and removal of cinder material, this did not include land within the Tonkin Highway Road Reserve. As such, buried cinders are still present on the boundary adjacent to the former CSBP site. In 2005, Parsons Brinckerhoff assessed potential risk posed by the cinder deposits to the environment and human health. Key findings of the investigation were as follows: • Surface soils at the site did not exceed the adopted screening criteria for industrial / commercial land use and hence there was not considered to be a risk to human health receptors under the existing land use scenario. • Soils at depth (5.5 – 7.0 mBGL) contained arsenic at concentrations that exceeded the adopted screening criteria for industrial / commercial land use, and hence a site management plan (SMP) was recommended for intrusive works at greater than 5 mBGL. • Arsenic, cobalt, chromium, cadmium, lead, manganese, nickel	• Senversa Data Gap Analysis (2019), Tonkin Gap Project, Tonkin Highway, Perth WA, (Senversa 2019a). • Senversa SAQP (2019), Tonkin Gap Project, Tonkin Highway, Perth WA, (Senversa 2019b). • 360 Environmental (2014) Tonkin Grade Separation Project – Preliminary Investigation on Site Contamination (Reference 345 BA, client draft, April 2014). • Coffey (2015a) Detailed Site Investigation, Tonkin Grade Separations (Reference NLWA-01-EN- RP-0027, Rev0, 12 May 2015). • Coffey (2015b) Asbestos-in-Soil Site Inspection, Tonkin	• Site inductions. • Implement the sampling and analysis quality plan (SAQP) Senversa (2019b). • Develop and implement a site management plan based on the SAQP findings and the proposed scope of works. • Contractor to develop contingency actions to manage asbestos finds. • Where pyritic cinders are encountered, these will be excavated and disposed of offsite at	*Contaminated Sites Act 2003* **Other Policy and guidance** Assessment and Management of contaminated sites. Identification and investigation of acid sulfate soils and acidic landscapes. Treatment and management of soils and water in acid sulfate soil landscapes.

Environmental Factor	Potential impacts	Studies	Proposed mitigation	Regulatory mechanism
	and zinc were detected in soil at concentrations greater than the adopted ecological assessment criteria. • Concentrations of fluoride, manganese, iron, and pH of groundwater exceeded the adopted assessment criteria; however, concentrations were considered to be representative of groundwater quality in the area. • Further evaluation determined that the arsenic concentrations exceeded HIL- C (300 mg/Kg) and HIL-D (3,000 mg/Kg). The highest concentration of arsenic detected in soil was 19,000 mg/Kg which exceeds both HIL-C and HIL-D by one order of magnitude. Potential impacts due to the implementation of the Proposal include: • Ground disturbing activities on the site have the potential to expose pyritic cinders, which could result in increased oxidation, chemical solubility and contamination mobilisation. • Leaching of heavy metals into the soil profile. Also, potential risk for impacts on the Swan River ecosystem via the Bayswater Main Drain. • Excavation of soils along alignment potentially exposing ASS. • Potential temporary dewatering during construction that may oxidise ASS. • Senversa (2019a) describes how construction activities as part of NorthLink WA has the potential to have disturbed the soil profile, potentially raising contaminated soil to depths shallower than previously detected. There is potential risk to workers through direct exposure to contaminated soils during deep excavation works. It is considered that given the historical nature of the contamination, the abundance of data available and known treatment and management measures, that Main Roads can manage the Proposal to meet the EPA's objective for Terrestrial Environmental Quality. Main Roads will liaise with DWER and CSBP as part of ongoing monitoring and management of the area. The excavation of contaminated soils will be managed in accordance with all relevant	Grade Separations (Reference NLWA-01- EN-RP-0033, Rev 0, 20 July 2015). • Galt Environmental (2018) Installation of Groundwater Monitoring Bores, Northlink WA Southern Section, Guildford Road to Reid Highway (technical memorandum, dated 18 May 2018). • John Holland (2018a) NorthLink WA Southern Section, Guildford Road to Reid Highway, Acid Sulfate Soil Closure Report (3 May 2018). • John Holland (2018b) Groundwater Usage and Monitoring Closure Report 2016-2017, Construction Water Supply GWL 183292(2) (8 August 2018).	an appropriate facility. • Development of Proposal specific management actions for the excavation, storage and treatment of identified contaminated soils. This will include lime dosing of contaminated soil and offsite management and treatment for soils with high heavy metal concentrations. • Implementation of the PEMP. • ASS and Dewater Management Plan (ASSDMP) implemented during construction. • ASS will be treated through lime dosing where appropriate. • ASS managed through an ASSDMP to prevent water quality impacts to groundwater, in accordance with DWER guidelines.	

Environmental Factor	Potential impacts	Studies	Proposed mitigation	Regulatory mechanism
	guidance. The majority of the Proposal area has a moderate to low risk (<3 m from surface) of acid sulfate soil (ASS) with three pockets in the northern and southern portion which have a high to moderate risk of ASS. Potential impacts can be managed to meet the EPA's objective. There are no known contaminated sites within the Proposal area outside of this southern section.			
Inland Waters	Pre-existing cinder deposits may serve as a source of continuing contamination for groundwater (in particular, low pH and metals). The Senversa (2019a) report summarises the condition of the groundwater within the southern portion of the Tonkin Highway Road Reserve, and states that: • Data from six groundwater monitoring sites that were present within the Tonkin Highway road reserved indicated that groundwater conditions were as follows: – pH was acidic (pH between 2.1 and 3.1). – Dissolved metals were present at concentrations that exceeded marine water and irrigation trigger values. – Fluoride, sulfate and nutrients were also elevated. Based on the groundwater data provided from 2003 to 2012 (Senversa 2019a), the groundwater contamination plume was stable and migration of low pH and contaminates had appeared to stop, with attenuation noted at the edges of the plume. Noting the above, the potential impacts to Inland Waters as a result of the Proposal include: • Ground disturbing activities, particularly deep excavation has the potential to expose pyritic cinders, which could result in increased oxidation, chemical solubility and contamination mobilisation, which could potentially impact the Swan River ecosystem via the Bayswater Main Drain. • Abstraction of groundwater as part of dewatering activities has the potential to present risk to downstream receptors if dewatering effluent is not appropriately abstracted, collected and treated prior to discharge. Considering the information above, the abundance of data and	• Senversa Data Gap Analysis (2019), Tonkin Gap Project, Tonkin Highway, Perth WA (Senversa 2019a). • 360 Environmental (2014) Tonkin Grade Separation Project – Preliminary Investigation on Site Contamination (Reference 345 BA, client draft, April 2014). • Coffey (2015a) Detailed Site Investigation, Tonkin Grade Separations (Reference NLWA-01-EN- RP-0027, Rev0, 12 May 2015). • Coffey (2015b) Asbestos-in-Soil Site Inspection, Tonkin Grade Separations (Reference NLWA-01- EN-RP-0033, Rev 0, 20 July 2015). • Galt Environmental (2018) Installation of Groundwater Monitoring Bores, Northlink WA Southern Section, Guildford Road to Reid Highway (technical memorandum, dated 18 May 2018).	• Obtain and review current off-site groundwater monitoring reports and assess their suitability. CSBP have advised that such reports are expected to be made available in 2019. • Dependent on above, initiate discussions with DWER to confirm groundwater assessment and management strategy. • Implement the sampling and analysis quality plan (SAQP) Senversa (2019b). • ASS and Dewater Management Plan (ASSDMP) will be prepared and implemented during	Section 5C - *Water and Irrigation Act (RIWI Act) 1914*. *Contaminated Sites Act 2003.* Department of Water Operational Policy no 5.12 Hydrogeological reporting associated with a groundwater well licence, November 2009. Department of Water Stormwater management manual for Western Australia: a component of integrated water cycle management, 2004-2007. State Planning Policy 2.9 – Water Resources.

Environmental Factor	Potential impacts	Studies	Proposed mitigation	Regulatory mechanism
	ongoing groundwater monitoring that Main RoadsMain Roads can managed the Proposal to meet the EPA's objective for Inland Waters through the consultation with DWER, CSBP and the preparation and implementation of a specific dewatering and acid sulfate soil management strategy.	• John Holland (2018a) NorthLink WA Southern Section, Guildford Road to Reid Highway, Acid Sulfate Soil Closure Report (3 May 2018). • John Holland (2018b) Groundwater Usage and Monitoring Closure Report 2016-2017, Construction Water Supply GWL 183292(2) (8 August 2018).	construction, inclusive of measures such as: o treatment of ASS through lime dosing o Dewatering effluent treated prior to disposal via infiltration. o No dewater will be discharged direct to waterways, wetlands or drains. o All spills will be contained immediately and removed within 24 hours to minimise the potential for contaminants to enter groundwater. • Implementation of the PEMP.	
Social Surroundings	Existing land use within the Proposal area is Tonkin Highway. Given the heavily disturbed nature of the site and high traffic volumes that exist, the implementation of this Proposal will not cause significant impacts to Social Surroundings. Construction noise and vibration may have a temporary impact on sensitive receivers during construction. No significant impact expected.	N/A.	Development and implementation of a NVMP.	*Environmental Protection (Noise) Regulations 1997.* Section 18 consent under the *Aboriginal Heritage Act 1972*.

6. COMMONWEALTH ASPECTS AND IMPACTS

A preliminary assessment involving a desktop analysis of MNES was undertaken. The assessment was used to determine whether the Proposal significantly impacts on a MNES and would require referral to the Commonwealth DoEE.

A desktop assessment against all MNES has been conducted (Table 9). There will be no significant impact on any MNES.

Table 9: Assessment of Existing Environment, Matters of National Environmental Significance and Likely Impact

MNES	EXISTING ENVIRONMENT AND LIKELY IMPACT
Nationally listed threatened species or ecological communities	There is no native vegetation to be cleared within the Proposal area, therefore the Proposal will not have a significant impact on any species or ecological community.
Migratory species	There is no important habitat for any migratory species within the Proposal area, therefore the Proposal will not have a significant impact on migratory species.
Wetlands of International Importance	There are no of wetlands of international importance identified within 5km of the Proposal area. The nearest Ramsar wetland is Forestdale Lake 25.5 km to the south.
World Heritage Properties	No World Heritage properties occur within the Proposal area.
National Heritage Places	No National Heritage properties occur within the Proposal area. The closest National Heritage site to the study area is the Inglewood Post Office situated 3.4 km to the east.
Commonwealth Land or Marine Areas	Proposal activities are not located on or near Commonwealth land or marine areas. Commonwealth land or marine areas will not be impacted by the activities associated with the Proposal.
Nuclear Actions	Not relevant to the proposed activity.
Water Resource	Not relevant to the proposed activity.

7. STAKEHOLDER CONSULTATION

Summary of stakeholder consultation is provided in Table 10.

Table 10: Consultation required to obtain relevant environment and heritage approvals.

Agency/Group	Purpose of Consultation	Comments
DWER (EPA Services)	Pre-referral discussion	Meeting with EPA Services on 25 June 2019 to introduce the Proposal, the rationale for referring and the proposed referral timing.
MetroNet	Interface between PTA's MetroNet and Main Roads	Ongoing liaison between Main Roads and MetroNet to manage interface issues.

8. CONCLUSION

Main Roads is referring the "Tonkin Highway – Guildford Road to Hepburn Avenue" project to the EPA under Section 38 of the EP Act. The decision to refer has been made with regards to:

- Potentially significant impacts to EPA factors:
  - Terrestrial environmental quality
  - Inland waters
- Clearly define this Proposal as a separate proposal to the PTA's Morley – Ellenbrook rail line.

Main Roads considers that the impacts on EPA factors are readily manageable and that the EPA's objectives for these factors will be met.

9. FIGURES

396000 398000 400000

6476000 6474000 6472000 6470000 6468000

HEPBURN AV

MARSHALL RD

REID HWY

BENARA RD

TONKIN HWY

KARRINYUP MORLEY HWY

MORLEY DR

BROUN AV

COLLIER RD

GUILDFORD RD

MIDLAND LINE

Underpass under eastern carriageway

Pier protection on Reid Hwy bridges (if required)

Infill bridges at Morley Drive

Widen median at Broun Ave for future passenger transfer facility

Pier protection works at Collier Road brdge (if required)

Replacement of wire rope barriers with concrete barriers. This includes retaining and drainage structures

Underpass under western carriageway

OVERVIEW MAP

PERTH

Legend:

- Proposal area
- Rail line
- State Road
- Prominent crossroads

strategen JBS&G

0 1 km

Tonkin Highway
Guildford Road to Hepburn Avenue

PROPOSAL AREA

Job No: 56957		Scale 1:27,500 at A4		
Client: Main Roads		Coord. Sys. GDA 1994 MGA Zone 50		
Drawn By: cthatcher	Checked By: ES	Version: A	Date: 02-Aug-2019	**FIGURE: 1**

Document Path: W:\Projects\1)Open\Main Roads\2019\56957 MRO Tonkin Corridor\GIS\Maps\R001_RevA\56957_01_ProposalArea.mxd
Image Reference: SLIP Public Service Locate Imagery 2019

395000 400000 405000

6480000 6475000 6470000 6465000

REID HWY
TONKIN HWY
KARRINYUP MORLEY HWY
MIDLAND LINE
GREAT EASTERN HWY
GREAT EASTERN HWY BYPA
WANNEROO RD
GUILDFORD RD
BREARLEY AV
JOONDALUP LINE
FREMANTLE LINE
THORNLIE LINE
ARMADALE LINE
MITCHELL FWY
MANDURAH LINE
GRAHAM FARMER FWY
AIRPORT DR

Proposal area
BGPA - Reserve
SCRM ACT - River Reserve
Nature Reserve
State Forest
Rail line
State Road

Existing Region Scheme Reserves
Central city area
Civic and cultural
Industrial
Other regional roads
Parks and recreation
Primary regional roads
Private recreation
Public purposes
Railways
Rural
Rural - water protection
State forests
Urban
Urban deferred
Waterways

strategen JBS&G

0 1.5 km

Job No: 56957
Scale 1:55,000 at A4
Client: Main Roads
Coord. Sys. GDA 1994 MGA Zone 50
Drawn By: cthatcher
Checked By: ES
Version: A
Date: 31-Jul-2019

Tonkin Highway
Guildford Road to Hepburn Avenue

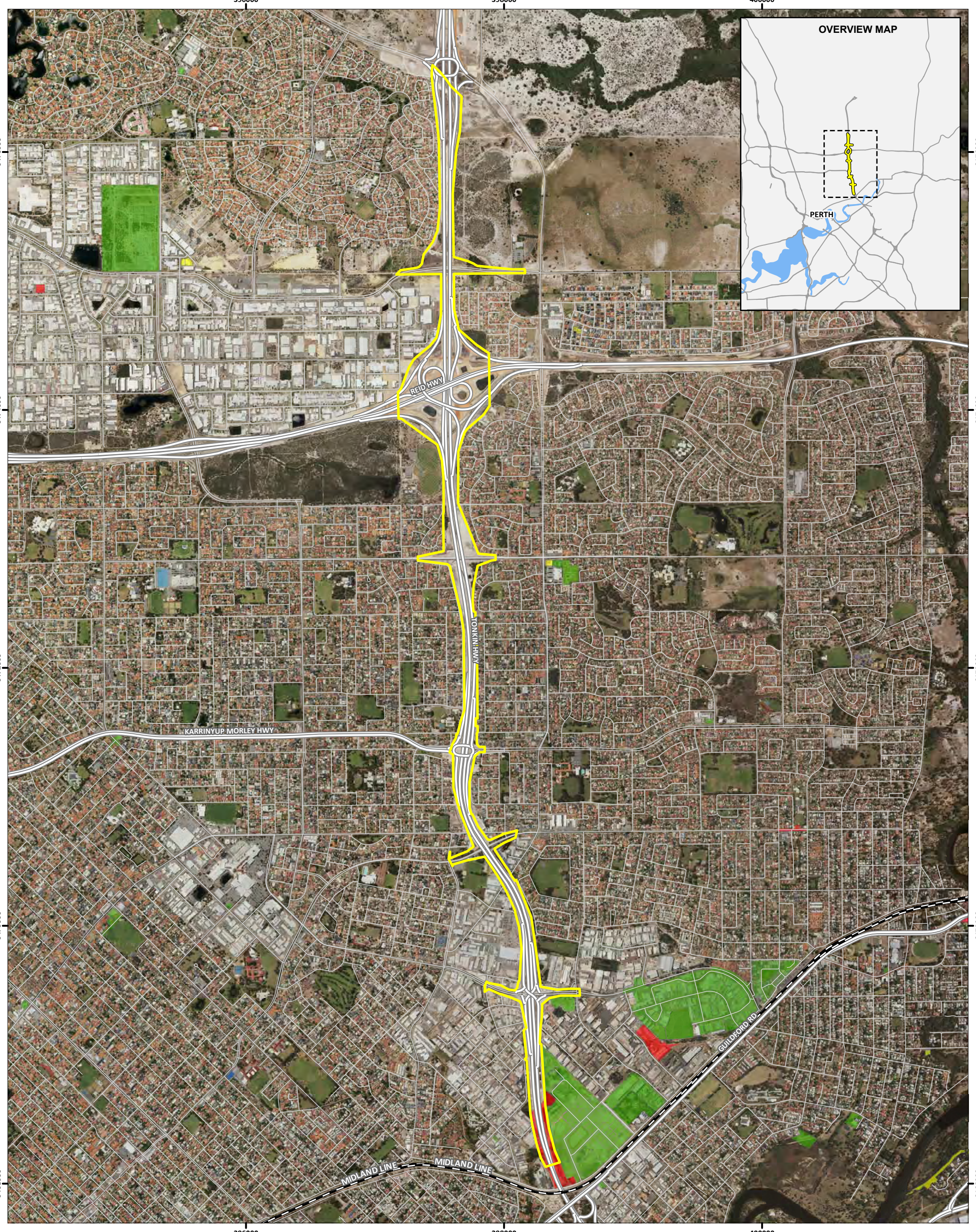
PROPOSAL AREA AND SURROUNDING LAND USE

FIGURE: 2

Document Path: W:\Projects\1)Open\Main Roads\2019\56957 MRO Tonkin Corridor\GIS\Maps\R001_RevA\56957_02_StudyArea.mxd
Image Reference: SLIP Public Service Locate Imagery 2019

396000 398000 400000

6476000 6474000 6472000 6470000 6468000



Legend:

- Proposal area

Contaminated sites (DWER)

- Contaminated - remediation required
- Contaminated - restricted use
- Remediated for restricted use
- Rail line
- State Road
- Local Road

strategen JBS&G

0 1 km

Job No: 56957 | Scale 1:27,500 at A4

Client: Main Roads | Coord. Sys. GDA 1994 MGA Zone 50

Drawn By: cthatcher | Checked By: ES | Version: A | Date: 02-Aug-2019

Tonkin Highway
Guildford Road to Hepburn Avenue

CONTAMINATED SITES ADJACENT TO PROPOSAL AREA

FIGURE: 3A

Document Path: W:\Projects\1)Open\Main Roads\2019\56957 MRO Tonkin Corridor\GIS\Maps\R001_RevA\56957_03A_ContaminatedSites.mxd
Image Reference: SLIP Public Service Locate Imagery 2019

398000
399000
6470000
6469000
6468000
TONKIN HWY
MIDLAND LINE
GUILDFORD RD
MIDLAND LINE

Legend:

- Proposal area

Contaminated sites (DWER)

- Contaminated - remediation required
- Remediated for restricted use
- Rail line
- State Road
- Local Road

strategen JBS&G

0 220
metres

Job No: 56957		Scale 1:7,500 at A4	
Client: Main Roads		Coord. Sys. GDA 1994 MGA Zone 50	
Drawn By: cthatcher	Checked By: ES	Version: A	Date: 30-Jul-2019

Tonkin Highway
Guildford Road to Hepburn Avenue

CONTAMINATED SITES ADJACENT TO TONKIN HIGHWAY BETWEEN GUILDFORD ROAD AND BROUN AVENUE

FIGURE: 3B

Document Path: W:\Projects\1)Open\Main Roads\2019\56957 MRO Tonkin Corridor\GIS\Maps\R001_RevA\56957_03B_ContaminatedSitesSth.mxd
Image Reference: SLIP Public Service Locate Imagery 2019

396000 398000 400000

6476000 6474000 6472000 6470000 6468000

REID HWY

TONKIN HWY

KARRINYUP MORLEY HWY

MIDLAND LINE MIDLAND LINE

GUILDFORD RD

Legend:

- Proposal area
- Rail line
- State Road
- Local Road

Acid sulphate soil risk (DWER)

- High to moderate risk
- Moderate to low risk

strategen JBS&G

0 1 km

Tonkin Highway
Guildford Road to Hepburn Avenue

ACID SULPHATE SOIL RISK MAPPING

Job No: 56957		Scale 1:27,500 at A4		
Client: Main Roads		Coord. Sys. GDA 1994 MGA Zone 50		
Drawn By: cthatcher	Checked By: ES	Version: A	Date: 02-Aug-2019	**FIGURE: 4**

Document Path: W:\Projects\1)Open\Main Roads\2019\56957 MRO Tonkin Corridor\GIS\Maps\R001_RevA\56957_04_ASS.mxd
Image Reference: SLIP Public Service Locate Imagery 2019

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11. APPENDICES

Appendix A Senversa (2019a) Data Gap Analysis, Tonkin Gap Project

Appendix B Senversa (2019b) Sampling and Analysis Quality Plan, Tonkin Gap Project

Document Status

Rev No.	Author	Reviewer	Approved for Issue		
		Name	Name	Signature	Date
2	E. Sutherland	T. Bowra	E. Sutherland		5 August 2019

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