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Draft Threatened Species Management Plan

Grevillea Parviflora sub. *species parviflora*



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Grevillea Parviflora sub. *species parviflora*

Prepared for

AGL Upstream Infrastructure Investments Pty Ltd

Prepared by

AECOM Australia Pty Ltd

Level 8, 17 York Street, Sydney NSW 2000, Australia

T +61 2 8023 9333 F +61 7 8023 9399 www.aecom.com

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Executive Summary

This Threatened Species Management Plan (TSMP) has been prepared to provide an improved understanding of *Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea) and to develop and describe strategies for managing existing populations of this threatened plant within the development footprint for a proposed gas transmission pipeline as part of the Gloucester Gas Project (MP 08_0154, EPBC 2008/4432). *Grevillea parviflora* subsp. *parviflora* is listed as Vulnerable under Commonwealth and NSW State legislation.

AECOM undertook flora and fauna surveys in 2008 within the development footprint as part of the Environmental Assessment for the Project. During these surveys, a number of Small-flower Grevillea plants were identified at kilometre point (KP) 59.8 (AECOM, 2009). The Small-flower Grevillea plants are growing in an existing cleared power easement, to the north of Wallaroo National Park. This TSMP has been prepared specifically for the population of Small-flower Grevillea that occurs at KP 59.8 as part of environmental management commitments detailed in the Environmental Assessment (EA) prepared by AECOM for the Gloucester Gas Project.

The construction of the pipeline will require clearing of the Small-flower Grevillea and other regrowth vegetation within a 15 m wide corridor in the vicinity of KP 59.8. The population extends for approximately 200 m along the easement. As such, the Small-flower Grevillea that occur within an area of approximately 0.3 ha will be cleared. Upon completion of construction, the 0.3 ha cleared area will be rehabilitated with grasses and shrubs and the Small-flower Grevillea will be re-established. The exact number of Small-flower Grevillea that will be cleared will be determined during a targeted survey to be undertaken prior to finalisation of this TSMP.

Potential threats to the Small-flower Grevillea that occur within the development footprint include:

- Land clearing.
- Fire control activities.
- Habitat fragmentation.
- Weed invasion.
- Maintenance of easement (including slashing).
- Low levels of seedling recruitment.
- Excavation works.
- Soil compaction.
- Erosion, sedimentation and dust emissions.
- Spread of the plant pathogen *Phytophthora cinnamomi*.

A number of mitigation measures will be implemented before, during and after construction activities. These include further targeted surveys, construction and operational phase controls, a Biodiversity Offsets Strategy and a monitoring program. The Biodiversity Offsets Strategy will be developed by Alison Hunt and Associates Pty Ltd (AH Ecology). It will aim to offset the biodiversity impacts associated with the Gloucester Gas Project, including impacts to the population of Small-flower Grevillea at KP 59.8. Preparation of the Biodiversity Offsets Strategy will include further targeted surveys for the Small-flower Grevillea and other threatened species in November 2010.

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1.0 Introduction

1.1 Background

AECOM Australia Pty Ltd (AECOM) has prepared this Draft Threatened Species Management Plan (TSMP) for a population of *Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea) that occurs within a proposed Gas Transmission Pipeline. The population occurs to the north of Wallaroo National Park near Clarence Town, NSW (see **Figure F1**).

AGL Upstream Infrastructure Investments Pty Ltd (AGL) has sought approval to develop the Gloucester Gas Project (the Project) under Part 3A of the Environmental Planning Assessment Act 1979 (EP&A Act) which includes extraction of coal seam gas (CSG) within the Gloucester Basin, and transport of CSG from Gloucester to Hexham by a high pressure transmission pipeline. The high pressure pipeline component of the Project will typically be constructed within a 30 metre (m) Right of Way (ROW) and reduced to 15m in environmentally sensitive areas.

The section of the pipeline ROW at approximately kilometre point (KP) 59.8 will be located within an existing powerline easement that is maintained by TransGrid. Construction of the pipeline will result in the removal of Small-flower Grevillea plants growing in the powerline easement, within an area of approximately 0.3 hectares (ha) in the existing 25 m wide powerline easement.

AECOM undertook a flora and fauna assessment for the Project in 2008, including field surveys which were undertaken between August and September 2008 (AECOM, 2009). The Small-flower Grevillea was identified at approximately kilometre point (KP) 59.8 of the pipeline ROW (see **Figure F1**). A specimen was collected and sent to the Royal Botanic Gardens, Sydney, who confirmed the field identification.

Further surveys for the species have not been undertaken during the preparation of this TSMP. However, further surveys will be undertaken prior to finalisation of the TSMP to ensure that all sub populations and individuals in the area are adequately considered. The surveys will be undertaken by AH Ecology as part of development of the Biodiversity Offsets Strategy.

1.2 Purpose

This TSMP has been developed as part of environmental management commitments detailed in the Environmental Assessment (EA) prepared by AECOM for the Gloucester Gas Project. The purpose of this TSMP is to:

- Detail measures that will be undertaken to manage and minimise potential impacts to Small-flower Grevillea associated with construction and operation of the pipeline ROW at KP 59.8.
- Identify management measures for offsets proposed for residual impacts to the Small-flower Grevillea in the pipeline ROW at KP 59.8.
- Provide an improved knowledge of the Small-flower Grevillea and its habitat within the pipeline ROW at KP 59.8.

1.3 Relevant Legislation

The Small-flower Grevillea is listed as a Vulnerable species by the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It is an offence to take an action that has or will have a significant impact on a threatened species, other than those exceptions listed under sections 19 and 197 of the EPBC Act. Chapter 5, Part 13, Division 5a outlines the roles and responsibilities of the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) in the development and implementation of recovery plans for threatened species.

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The Small-flower Grevillea is also considered to be Vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act). Section 91 of the TSC Act states that a licence is required to harm or pick threatened species, populations or ecological communities or damage habitat. A Recovery Plan may be prepared by the NSW Department of Environment, Climate Change and Water (DECCW) for a threatened species under Part 4 of the TSC Act.

No Recovery Plan had been prepared by DSEWPC or DECCW for the Small-flower Grevillea at the time of preparing this TSMP.

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2.0 Existing Environment

The survey undertaken by AECOM in 2008 recorded the Small-flower Grevillea within a previously cleared 25 m wide powerline corridor at approximately KP 59.8 (AECOM 2009). The site supported a range of low forbs, shrubs, grasses and sedges, including *Pultenaea villosa*, *Daviesia ulcifolia*, *Themeda triandra*, *Entolasia stricta* and *Lepidospermum laterale*. The population extended approximately 200 m along the corridor and was estimated to contain several hundred to a thousand plants. An accurate population count was not made during the initial survey as its identity was not confirmed until a specimen was sent to the Royal Botanic Gardens, Sydney. It was also difficult to determine the extent of individual plants as they were coppicing extensively under the current regular slashing regime.

The population is regularly slashed during maintenance works for the powerline and is transected by a maintenance track. The entire powerline easement in the vicinity of this population was traversed by foot or vehicle and no other populations or individuals of this species were observed. Given the high visibility of this species at the time of survey (most plants were flowering profusely), it is considered unlikely that other significant populations were present in the powerline easement as they were not identified during the survey at the time. An individual plant was recorded in remnant open forest approximately 0.5 km north of the main population and therefore, it is possible that other scattered individuals may be present in nearby areas outside the easement. It is also likely that other populations exist in surrounding remnant vegetation (including the nearby Wallaroo National Park).

Plate 1 is typical of the existing environment at KP 59.8 (i.e. an already cleared powerline easement with some regrowth).



Plate 1: KP 66.8, which is typical of the existing environment at KP 59.8

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3.0 Plant Biology

3.1 Description

The Small-flower Grevillea is a low spreading to erect shrub, usually less than one metre high. Its leaves are 2 to 3.5 mm long and less than 1.3 mm wide with silky hairs on the underside and a short pointed tip. Leaf margins are curved back, or even rolled completely under. The small white flowers are spider-like and clustered in groups of 6 to 12 (DECC, 2005).

The plants at KP 59.8 are relatively prostrate and multi-stemmed, but appeared to be otherwise healthy, with most of them flowering at the time of the survey. Several plants were observed growing between the wheel ruts of the maintenance track. No specific management plan is in place for this population, as it was not previously known to be present in the easement. However, the population appears to be coping effectively with the current management regime. NPWS (2002) noted that competition and shading from Tick Bush (*Kunzea ambigua*) can limit the spread of this species, so regular slashing may even assist the population by reducing competition. Comparison of population sizes within the easement and surrounding native vegetation might provide circumstantial support for this possibility.



Plate 1: Flowers and leaves of Small-flower Grevillea

3.2 General Habitat

The Small-flower Grevillea grows in sandy or light clay soils, usually over thin shales. It occurs in a range of vegetation types from heath and shrubby woodland to open forest. It is found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. The species often occurs in open, slightly disturbed sites such as along tracks (DECC, 2005).

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3.3 Reproductive Ecology

Flowering has been recorded in April, May and between July and December. The flowers are insect-pollinated. One to two seeds are released at maturity but have limited seed dispersal, probably of less than 2 m. Plants are capable of suckering or regenerating from the rootstock and rhizomes. Sucker stems usually occur in patches close to the parent plant. After fire or other disturbance, regeneration can occur from both the rootstock and seed in the soil seedbank. However, adult plants can be killed by hot fires and seedling recruitment is uncommon (DSEWPC, 2010).

3.4 Population Demographics

The species is sporadically distributed throughout the Sydney Basin with the main occurrence centred around Picton, Appin and Bargo (and possibly further south to the Moss Vale area). Separate populations are also known further north from Putty to Wyong and Lake Macquarie on the Central Coast and Cessnock and Kurri Kurri in the Lower Hunter (DECC, 2005). The NPWS Wildlife Atlas database contains 46 records of the species from five localities within 20 km of the proposed pipeline, all in the southern section. The majority of these records are from a population about 20 km west of KP 90. The closest records to the population at KP 59.8 occur approximately 10 km to the south east of KP 59.8.

The population at KP 59.8 appears to be at the northern limit of the species extent as it occurs further north than all records of the species in the NPWS Wildlife Atlas.

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4.0 Threats to Small-flower Grevillea during Pipeline Construction and Operation

4.1 Land Clearing

Loss of biodiversity and degradation of habitat following clearing for urban and agricultural development and fragmentation of native vegetation is a key threatening process listed on Schedule 3 of the TSC Act and is relevant for Small-flower Grevillea.

In order to reduce the impacts of clearing on the Small-flower Grevillea, the clearing width for the purpose of construction will be reduced from the usual 30 m to 15 m for the 200 m section at KP59.8. The clearing will occur within an already cleared 25 m powerline easement. As such, the Small-flower Grevillea that occur within an area of approximately 0.3 ha will be cleared. A schematic diagram of the 15 m wide corridor during construction is provided in **Figure 2**.

Small-flower Grevillea plants also occur adjacent to the 15 m corridor (i.e. in the 200 m section of easement and in native forest within the Wallaroo National Park). Measures will be implemented during construction and operation to protect the plants that occur in the vicinity of the development footprint.

It is difficult to determine the number of individual plants that occur in the development area as they were coppicing extensively under the current regular slashing regime. The exact number of Small-flower Grevillea that will be cleared will be determined during a targeted survey to be undertaken in November as part of the Biodiversity Offsets Strategy being prepared by AH Ecology.

Upon completion of construction, the initial cleared area will be rehabilitated to the level of vegetative cover that existed prior to construction works, i.e. groundcover and low shrubs. Rehabilitation will include respreading of the topsoil removed during construction and replanting of the Small-flower Grevillea that are removed.

It should be noted that the population at KP 59.8 appears to have thrived in the disturbed powerline easement and the species may favour the current management practices, which includes regular slashing of the easement.

4.2 Fire Control Activities

Small-flower Grevillea can be killed by fire. However, it is adapted to periodic fires and can regenerate from rootstock protected in the soil and germination of seed in the soil seedbank. High fire frequency resulting in the disruption of life cycle processes and loss of vegetation structure and composition is a major threat. Impacts of high fire frequency may include a decline in the soil seedbank and reduced seedling recruitment. In contrast, low fire frequency may result in poor levels of seed germination and dense growth of other shrub species that can compete with Small-flower Grevillea (DSEWPC, 2010).

Construction activities associated with the pipeline construction could create unintended wild fires in the vicinity of construction works. Fires have the potential to spread rapidly and well beyond the intended project footprint. Wild fires could also be started by vegetation maintenance activities in the proposed pipeline easement throughout the operational phase of the proposed project. Conversely, the proposed pipeline easement may act as a fire break and retard wild fire in some areas.

During the field survey undertaken in 2008, there were no signs of fire having recently affected the area.

Fire management during construction and operation has been addressed in this TSMP and will also be incorporated into a Construction Environmental Management Plan (CEMP) and an Operations Environmental Management Plan (OEMP). Fire management will require consultation and coordination with the managers of the powerline easement and Wallaroo National Park (TransGrid and DECCW respectively).

4.3 Habitat Fragmentation

Isolation of populations is likely to result in reduced gene flow and low genetic diversity, which may affect the long-term viability of Small-flower Grevillea. Activities that can increase the isolation of some populations are mowing, the dumping of fill and grazing by domestic animals. These can prevent the plants from maturing and setting seed, change the relative abundance of species and increase weed colonisation (DSEWPC, 2010).

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Construction of the pipeline will create temporary fragmentation; however, this will be rehabilitated upon completion of construction. The pipeline corridor will lie entirely within the existing 25 m cleared powerline corridor. The Small-flower Grevillea population at KP 59.8 appears to be thriving in the disturbed powerline easement, so current management practices (including regular slashing) may be promoting the population.

4.4 Weed Invasion

Weedy species such as Blady Grass (*Imperata cylindrica*) and the Tick Bush (*Kunzea ambigua*) can reduce available habitat and create barriers for Small-flower Grevillea. Tick Bush is known to be an aggressive early coloniser of bare sites and has large seedling recruitment in disturbed areas. It is considered a threat at several sites populated by Small-flower Grevillea (DSEWPC, 2010).

Several noxious weeds and numerous environmental weeds are present along the proposed pipeline route. The only noxious weed recorded in the Wallaroo National Park section was *Lantana camara* (Lantana), while other introduced species included *Verbena bonariensis* (Purpletop) and *Gomphocarpus physocarpus* (Cotton Balloon Bush). No Blady Grass or Tick Bush was observed in or adjacent to the Small-flower Grevillea population during the field survey.

Environmental weeds have many severe impacts on Australian environments, including smothering of native vegetation, competition with native vegetation, prevention of seedling recruitment and alteration of fire regimes. There is potential to spread weeds and increase their areas of infestation during the construction phase of the proposed development, during ongoing maintenance activities, and through modified drainage patterns. Schedule 3 of the TSC Act lists four Key Threatening Processes related to weed invasion:

- "invasion and establishment of exotic vines and scramblers"
- "invasion of native plant communities by bitou bush and boneseed"
- "invasion of native plant communities by exotic perennial grasses"
- "invasion, establishment and spread of lantana".

Lantana and exotic perennial grasses are present in nearby areas, so a detailed weed management plan will be developed to control existing infestations and avoid establishment and spread of these and other weed species during the construction and operation phases of the pipeline.

4.5 Maintenance of Easement

The actions associated with easement maintenance are recognised as threats to some listed flora species in NSW. In particular, road maintenance (which is a type of easement maintenance) is recognised as a threat to the Small-flower Grevillea. Maintenance activities which can cause negative impacts include slashing, clearing of regrowth, spraying of weeds, fire, and trampling by vehicles and machinery. Priority action statements to address these potential impacts generally require that, where threatened species or their potential habitats occur, planning and maintenance staff are to be made aware of threatened species before road, trail, or easement maintenance activities commence and processes are in place to avoid impacting upon them.

Impacts potentially arising from maintenance of the easement have particular relevance to the population of Small-flower Grevillea. The NPWS Threatened Species Information Sheet for Small-flower Grevillea (NPWS, 2002) identifies that the species often occurs in slightly disturbed areas such as easements. However, certain types of easement maintenance and vehicular use are recognised threats to populations. As such, it is important to identify the relationship between certain types of disturbance and maintenance activities and the health of the Small-flower Grevillea population.

4.6 Low Levels of Seedling Recruitment

Known populations of Small-flower Grevillea appear to have low levels of seedling recruitment. Germination from the seedbank does occur after fire but field observations suggest it is uncommon. Although most populations are relatively large as a result of suckering, the health and long-term viability of populations is likely to be dependent on adequate seedling recruitment. This is important for maintaining genetic diversity within populations. DSEWPC (2010) states that populations of Small-flower Grevillea may have low genetic diversity despite their size.

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4.7 Excavation Works

Small-flower Grevillea relies on underground rhizomes for regeneration following fire. Excavation of the trench during pipeline construction has the potential to inadvertently remove and destroy these rhizomes.

It is proposed that plants within the construction footprint will be transplanted into adjacent locations within the powerline easement. This will minimise impacts on the population at KP 59.8, while avoiding the risk of spreading soil pathogens and diseases into other areas. Cuttings may also be taken from these plants for propagation purposes. As cutting material can be disinfected and planted into sterile potting mix, resulting plants can be introduced into an offset site without risk of spreading soil pathogens.

4.8 Soil Compaction

Small-flower Grevillea relies on underground rhizomes for regeneration following fire. Soil compaction from construction machinery and easement maintenance vehicles has the potential to inadvertently destroy these rhizomes. Soil compaction may also impair regeneration of vegetation following construction and result in increased erosion and sediment loss. A detailed soil management plan will be developed to address compaction, erosion and sediment loss during construction and operation phases.

4.9 Erosion, Sedimentation and Dust Emissions

Earthworks, vegetation clearing, vehicle movements on unformed tracks and other machinery operations have the potential to cause erosion and dust emissions. Potential impacts arising from dust emissions would likely be short-term and reversible, but could affect vegetation communities and flora species through smothering. Erosion and sedimentation could continue after construction is completed and the impacts of sedimentation could persist after erosion has ceased. A detailed soil management plan will be developed to address compaction, erosion and sediment loss during construction and operation phases.

4.10 Spread of the plant pathogen *Phytophthora cinnamomi*

Phytophthora cinnamomi (root rot fungus) is a microscopic, soil-borne plant pathogen that infects and destroys the root systems of susceptible plant species. Root rot has been responsible for significant mortality of native plants and threatens native ecosystems, forestry and agricultural industries (DECC, 2008).

Phytophthora cinnamomi occurs worldwide and infects a wide range of plant species. It has been identified in several natural areas in New South Wales and coastal Queensland, although the extent of the spread in these areas is unclear. *Phytophthora* induced die-back has been identified in forest, woodland and heath communities in the Hunter-Central catchment within the proposed development area. *Phytophthora* is usually restricted to moister habitats along drainage lines, in gullies and depressions and in areas of surface seepage along ridge tops (DECC, 2008).

The fungus lives within the soil on the roots and stems of living plants. It produces zoospores which are transported between areas in contaminated soil and on footwear, tools, equipment and vehicles. The spores are also transported large distances in surface and sub-surface water supplies. They are attracted to the root systems of plants and quickly infect susceptible plant species (DECC, 2008).

Thousands of Australian native plant species are potentially susceptible to *Phytophthora*, although some plant species are more susceptible than others. This disease has the potential to significantly influence biodiversity and species composition, particularly in dry open woodlands, woodlands and heath, where the disease has been most destructive.

'Infection of native plants by *Phytophthora cinnamomi*' has been listed as a key threatening process in Schedule 3 of the TSC Act and 'Dieback caused by the root rot fungus (*Phytophthora cinnamomi*)' is listed as a key threatening process under the EPBC Act. Several threatened plants that could potentially be found along the proposed pipeline route, including *Grevillea guthrieana* and *Tetratheca juncea*, are susceptible to the *Phytophthora* pathogen (DECC, 2008). The susceptibility of Small-flower Grevillea is unknown, but is likely as other Grevillea species are known to be affected by this plant pathogen.

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Small-flower Grevillea plants containing root material that may be infected with *Phytophthora cinnamomi* will only be transplanted into adjacent sites within the powerline easement to avoid spreading this disease. Propagation of seeds and cuttings will be undertaken using strict hygiene protocols to ensure plants are free of *Phytophthora*. A hygiene strategy will be developed and implemented to minimise the risk of spreading this pathogen, including the establishment of quarantine zones.

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5.0 Management Plan

Management of the Small-flower Grevillea population at KP 59.8 will require consultation with the powerline easement operators (TransGrid). The management actions for the Small-flower Grevillea include:

- Mitigation measures to protect the plants that occur in and in the vicinity of the development footprint.
- An offset strategy.
- A monitoring program.

The management actions apply during the construction phase, the post construction phase and during the operations phase of the Project and are detailed in the sections below.

5.1 Mitigation Measures

Table 1: Mitigation Measures

Threat	Mitigation Measures
Prior to finalisation of this TSMP	
Land Clearing Habitat Fragmentation	Detailed Survey • Targeted surveys will be undertaken in November and will comprise random meanders on areas of sandy clay soils in woodland habitat, especially along existing cleared easements. The surveys will determine population characteristics (including precise distribution, extent and abundance).
Pre-construction	
Land Clearing Low Levels of Seedling Recruitment	Collection of Seeds and Cuttings • Seed should be collected from the plants to be removed and grown by a suitably experienced organisation, which must obtain a Scientific Licence from DECCW prior to seed collection. • Cuttings from the plants to be removed should be collected, disinfected and propagated by a suitably experienced organisation.
Construction Phase	
Land Clearing Habitat Fragmentation	Minimise Construction Width • Restrict the construction width to a maximum of 15 m wherever the Small-flower Grevillea occurs.
Fire Control Activities Excavation Works Soil Compaction Erosion, Sedimentation and Dust Emissions	Raise Awareness of Construction Staff • Ensure construction staff are made aware of the Small-flower Grevillea, particularly its appearance and location of the known population. • Ensure construction staff are aware of their responsibilities with regard to protection of the species.
Soil Compaction	Access Tracks Alignment • Select the alignment of access tracks for vehicle and construction machinery along the powerline easement to minimise compaction of soil around the underground rhizomes of the Grevillea.
Land Clearing Habitat Fragmentation	Fencing • Provide fencing around the Small-flower Grevillea population adjacent to the development to avoid accidental damage to these plants.
Erosion,	Sediment and Erosion Control

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Threat	Mitigation Measures
Sedimentation and Dust Emissions	• Install standard sediment and erosion control systems to ensure there is no increase in erosion or movement of runoff and sediments into the areas in which Small-flower Grevillea occurs adjacent to the development. • Develop strategies and facilities to contain contaminants such as gross pollutants, weed seeds, fuels and oils, chemicals, etc. • Stabilise exposed soil surfaces (e.g. through sterile grass seeding, erosion control meshing, progressive stabilisation and revegetation of finished soil surfaces and / or mulching using vegetative material removed from the project area). • Vegetation and soil stockpiles should be separated where possible to maximise use of vegetation for sediment erosion control. • Topsoil and subsoil stockpiles should be separated where possible to maximise retention of seedbanks of Small-flower Grevillea. • Dispose of waste materials and / or contaminants appropriately and away from adjacent native vegetation and waterways. • Develop a strategy and facilities for the suppression of dust (e.g. dust trigger levels, air quality monitoring and water trucks). • Rehabilitate access tracks not required after construction, to minimise the potential for erosion and inappropriate vehicular access.
Fire Control Activities	Fire Management • Fit spark-arrestors to all machinery and equipment operating in the powerline easement. • Ensure fire fighting equipment is available when works are being undertaken (especially hot works). • Prohibit open flames on work sites wherever possible.
Land Clearing Habitat Fragmentation	Transplantation • Transplant Small-flower Grevillea plants that occur within the construction footprint into adjacent sites within powerline easement, where possible. • Undertake in accordance with <i>Guidelines for the Translocation of Threatened Plants in Australia</i> 2nd edition (Vallee et al., 2004). • Transplantation will be supervised by suitably qualified and experienced practitioners. • Trim plants before transplantation to reduce moisture loss and provide cutting material for propagation. • Smaller plants will be salvaged using hand tools (shovels, mattocks, crowbars) where substrates allow. Larger plants, or smaller plants on hard substrates, will be excavated by backhoe or excavator. • Obtain sufficient quantities of soil to cover the roots of each plant while it is out of the ground. • Each plant will be placed in a separate container and transported to retention areas. • Replanting should occur as soon as possible. • Transplanted plants will be established in retention areas by excavating a small void, placing the plant in this void, and filling with soil from the excavated void. Each plant will be given a deep watering at planting. 2-3 times in the first week; 2-3 times in the following month; and then monthly until first substantial rain.
Low levels of Seedling Recruitment	Propagation • Stockpile topsoil containing seeds of the species and respread it in the rehabilitation area following construction.
Spread of Plant	Reduce risk of spread of <i>Phytophthora cinnamomi</i>

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Threat	Mitigation Measures
Pathogen <i>Phytophthora cinnamomi</i>	- Assess all operations for the likelihood of introducing or spreading <i>P. cinnamomi</i>, modify operations and apply hygiene measures to reduce the risks: - Schedule construction activity for periods when soil is dry, wherever possible. - Educate staff and contractors on the threat of <i>P. cinnamomi</i>, management objectives and mitigation measures. - Supervise staff to ensure compliance with the mitigation measures. - Use existing roads and tracks wherever possible. - Minimise the amount of water used on the site. - Wash down vehicles, tools and equipment prior to entry into the section of line passing through KP59.8. - Implement a certification process to ensure vehicles and equipment are soil-free when entering or leaving the site and when moving between quarantine zones. - Minimise the potential for the transport of infected soil by transporting excavated soil no further than the nearest stockpile locations. - Use sediment control fencing to prevent dispersion of soil infected with <i>P. cinnamomi</i>. - Where possible, ensure vegetation cleared from the ROW is not removed from the development site. - Only revegetate with plants and seeds from a nursery that can guarantee potting medium and plants that are free of <i>P. cinnamomi</i>. - Ensure seeds and cuttings of Small-flower Grevillea are disinfected before propagation.
Weed Invasion	Weed Management - Remove existing noxious weeds within the development footprint. - Destroy weed material removed from construction sites. - Develop weed quarantine zones along the proposed pipeline route based on weed distribution and sub-catchments, for application of weed hygiene activities. - Wash down vehicles, machinery and equipment prior to entering the section of line that passes through KP59.8. - Implement a certification process to ensure that all vehicles and plant are weed-free whenever entering or leaving the section of line that passes through KP59.8 - Minimise the potential for the transport of weeds in soil, by not transporting excavated soil further than the nearest stockpile locations. - Use shredded native plant material (uncontaminated by weeds) removed from the site as a mulch and groundcover on disturbed soil surfaces to reduce the potential for weed establishment. - Use sediment control fencing to prevent dispersion of soil contaminated with weed seeds.
Post Construction Phase	
Land Clearing Habitat Fragmentation	Revegetation Revegetate with native species as soon as possible following construction.
Weed Invasion	Weed Management Develop and implement weed management protocols (for at least two years following construction).
Operation Phase	
Maintenance of Easement	Raise awareness of planning and maintenance staff Ensure planning and maintenance staff are made aware of the Small-flower

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Threat	Mitigation Measures
	Grevillea, particularly its appearance and location of the known population. • Ensure planning and maintenance staff are aware of their responsibilities with regard to protection of the species.
Maintenance of Easement	ROW Maintenance • Develop and implement appropriate maintenance strategies to minimise ongoing impacts on the existing population. • Assess potential impacts of any change to the current management regime of the easement. • Consider the appropriateness of minor changes to the current management regime that may be beneficial, such as raising the height of slashing.
Fire Control Activities	Fire Management • Avoid causing any significant changes to current fire regime. Coordinate fire management with the <i>Walleroo National Park Fire Management Strategy 2005</i> and any fire management plans prepared for the area by TransGrid. • Fit spark-arrestors to all machinery and equipment operating in the powerline easement during dry periods in summer. • Ensure fire fighting equipment is available when works are being undertaken. • Undertake fuel load control around assets.
Weed Invasion	Weed Management • Wash down vehicles, machinery and equipment prior to entering the section of line that passes through KP59.8. • Implement a certification process to ensure that all vehicles and plant are weed-free whenever entering or leaving the section of line that passes through Wallaroo National Park. • Undertake regular weed monitoring and conduct weed management works as required.

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5.2 Biodiversity Offset Strategy

An offset strategy is currently being developed by AH Ecology. The strategy will use the NSW Department of Environment, Climate Change and Water's (DECCW) Biobanking Assessment Methodology. The offset strategy is being undertaken in consultation with DECCW and will include the following:

- Assessment of the extent and number of Small-flower Grevillea plants that would be impacted and calculation of the biodiversity credits required to offset the impact. The calculation will use the DECCW Biobanking Credit Calculator. Targeted surveys along the proposed pipeline route will be undertaken for the Small-flower Grevillea in November. The surveys will comprise random meanders on areas of sandy clay soils in woodland habitat, especially along cleared pipeline easements. The random meanders will be undertaken in accordance with DECC (2004) and Biobanking (Seidel and Briggs, 2008) methodology (AH Ecology, 2010).
- Identify and procure an appropriate offset area nearby where a population of Small-flower Grevillea can be established, preferably adjacent to an existing conservation area. A site near Seaham, approximately 10 km from the population of Small-flower Grevillea, is currently being considered by AGL as a potential offset site. Preliminary ecological investigations by AH Ecology at the site have identified nine vegetation associations and potential habitat for four threatened flora species previously recorded within 10 km of the property, which includes Small-flower Grevillea. Surveys in accordance with the Biobanking Assessment Methodology will be undertaken at the site in November by AH Ecology.
- Investigate and develop appropriate propagation and cultivation techniques. Olde and Marriott (1995) note that Small-flower Grevillea adapts readily to cultivation and can be grown from seeds and cuttings of half-hardened new growth in early Spring.
- Seed collection and propagation would be undertaken by a suitably experienced organisation and would be in accordance with currently accepted Australian guidelines, including:
 - Germplasm Conservation Guidelines for Australia (ANPC, 1997)
 - Floradata: A guide to the collection, storage and propagation of Australian native plant seed (Mortlock and Lloyd, 2001)
 - Growing Australian Native Plants from Seed - for revegetation, tree planting and direct seeding (Murray, 2003).
- Propagate sufficient plants to offset the number impacted by the proposed development.
- Plant and maintain propagated plants in the offset area for at least 2 years. Maintenance will include watering once every month for six months.
- Manage weeds in the offset area for at least 2 years following planting.
- Register the offset property under the appropriate legislation to ensure its protection in perpetuity.

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5.3 Monitoring

5.3.1 Monitoring of Small-flower Grevillea Population at KP 59.8

The Small-flower Grevillea population at KP 59.8 will be monitored twice a year for a period of 2 years. The monitoring will include observations of all the Small-flower Grevillea that have been transplanted and also a control site amongst the plants that are not disturbed during construction works i.e. the plants that occur within the 25 m powerline easement and outside the 15 m corridor that will be cleared for the pipeline. Monitoring will include observations of:

- Number of living and dead Small-flower Grevillea plants.
- Condition and reproductive status of Small-flower Grevillea plants (presence of new growth, fruit, green leaves).
- Presence of factors that are having a detrimental effect on the Small-flower Grevillea plants (herbivory, yellowing or wilting leaves).
- Presence and abundance of weeds.

5.3.2 Management of Easement

As the Small-flower Grevillea plants at KP 59.8 appear to have benefited from the existing management regime of the powerline easement, monitoring will be undertaken to understand which actions are contributing to this. The monitoring will include:

- Documentation of the pre-construction (baseline) management regime of the powerline easement.
- Monitoring and recording the future annual management regime of the powerline and pipeline easement to allow any modifications in management practices to be related to observed changes in the Small-flower Grevillea population.

5.3.3 Weed Monitoring

Weed monitoring will be undertaken as part of a Weed Management Plan for the entire project. Weed monitoring will be undertaken as a component of weed management works for at least 2 years after completion of construction. Regular monitoring will also be undertaken along the established easement during the operational phase of the project.

5.3.4 Monitoring of Protection Measures

Sediment and erosion control systems and fencing should be regularly checked throughout the construction phase to ensure it continues to function properly. This task will be included in the Construction Environmental Management Plan (CEMP).

5.3.5 Monitoring at Offset Site

Monitoring to evaluate the success of the offset program will be included as part of the Biodiversity Offset Strategy, and may be incorporated into this TSMP as part of future revisions of the plan. However it is envisaged that monitoring of offset sites would be undertaken for at least 2 years to identify requirements for further remedial actions. Monitoring would likely include:

- Number of living and dead Small-flower Grevillea plants.
- Condition and reproductive status of Small-flower Grevillea plants.
- Presence and abundance of weeds.
- Records of site maintenance works (e.g. weed control, watering, fire management).

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6.0 References

AECOM (2009). *Gloucester Gas Project: Gloucester to Hexham*, report prepared for the Gloucester Gas Project Environmental Assessment (November 2009) by AECOM Australia Pty Ltd on behalf of AGL. Available online: http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=3194

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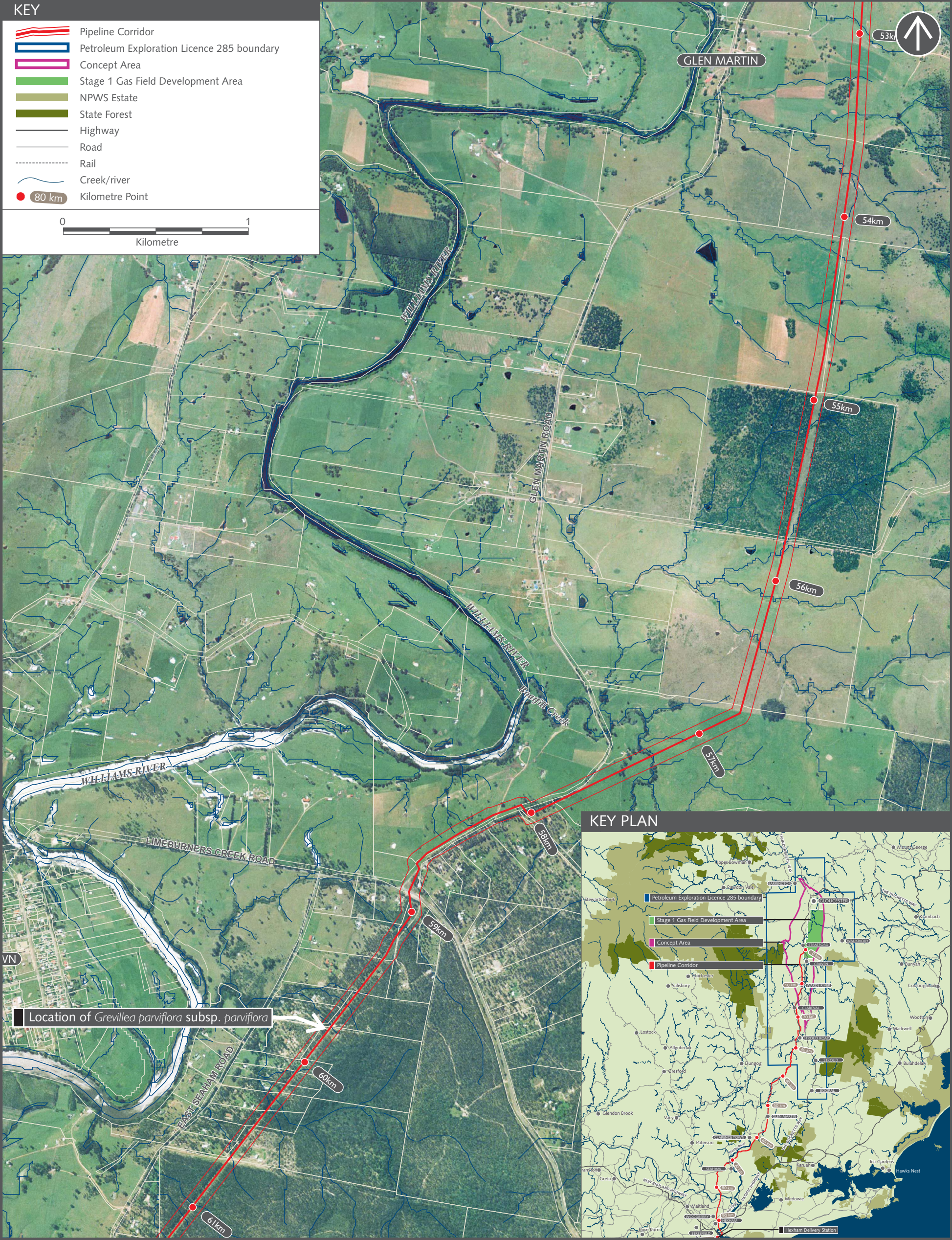
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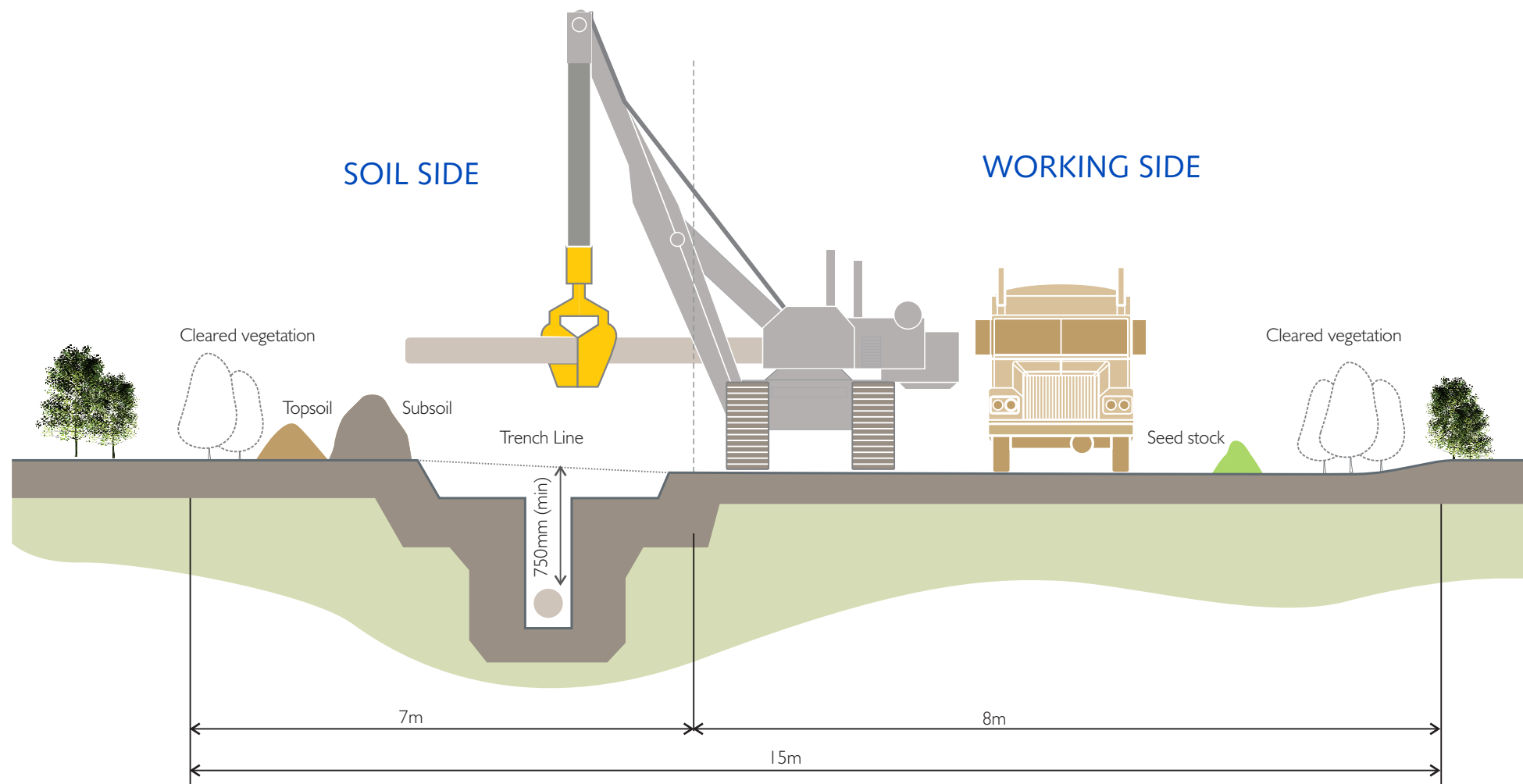
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Appendix A

Figures





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Reduced Right of Way Schematic Diagram

AGL Gloucester L E Pty Ltd
Draft Threatened Species Management Plan for Grevillia parviflora subsp. parviflora Gloucester Gas Project

Figure F2