SUEZ Recycling and Recovery Pty Ltd

Mill Creek Stream Rehabilitation, Stabilisation and Vegetation Management Plan

April 2021

Table of contents

Table index

Figure index

Appendices

1. Introduction

The following activities are proposed at the Lucas Height Resource Recovery Park (LHRRP) and were approved on 23 January 2017 under SSD 6835:

- Reprofiling of existing landfill areas to provide up to 8.3 million cubic metres of additional landfill airspace capacity.
- Relocation and expansion of the existing garden organics (GO) facility. The existing GO facility will be relocated to the western side of the site adjacent to Heathcote Road.
- Construction and operation of a fully enclosed advanced resource recovery technology (ARRT) facility. The ARRT will be located on the western side of the site adjacent to the GO facility. Establishment of the ARRT facility will be dependent upon SUEZ securing a guaranteed, long-term waste supply to ensure that the substantial upfront investment is able to be recouped.
- Community parkland. Landfilling will cease in 2037 after which time the site will be rehabilitated and converted to community parkland, with capping and landscaping to be completed and the site made available for community use in 2039.

SSD 6835 approved consent condition C34 states:

"The Applicant shall prepare a Mill Creek Stream Rehabilitation, Stabilisation and Vegetation Management Plan. The plan shall:

a) be prepared by a suitably qualified and experienced person in consultation with DPI Water

b) be submitted to the Secretary prior to the construction of the GO and ARRT facilities

c) be prepared in accordance with DPI Water Guidelines for Controlled Activities on Waterfront Land

d) detail proposed stream realignment works including details of the measures to minimise water quality impacts

e) detail proposed rehabilitation and stabilisation of the stream including methods and staging of the works

f) detail opportunities to maximise the width of riparian zones, particularly in the final landform design, and detail the vegetation types, maintenance, monitoring and performance criteria for the rehabilitation works; and

g) be updated to include any changes to the rehabilitation objectives and staging approved in the Post Closure Plan for the site, required under condition C40. "

The implementation of current approved works would be carried out in stages. The construction of the GO facility would be part of the initial works, only requiring an initial re-alignment of Mill Creek. In the event that the ARRT facility is constructed, then adjustments to the management plan and further re-alignment of Mill Creek would occur. The water management works required are proposed to be staged in consideration of the staged implementation of the ARRT and GO to minimise the disturbance activities associated with the facilities.

The Aquatic Habitat Monitoring Plan and Mill Creek Stream Rehabilitation, Stabilisation and Vegetation Management Plan were provided to the Natural Resources Access Regulator (NRAR) for comment. NRAR confirmed that the plans are to be reviewed by the Department of Planning, Industry and Environment (DPIE). Comments were issued by DPIE on 9 March 2020. The comments and their associated responses are included in Appendix A.

1.1 Purpose of the plan

The purpose of this plan is to address the requirements of Condition C34 with respect to the construction of the GO facility and the initial realignment proposed. In the event of future works to construct the ARRT facility, this plan would be updated accordingly to reflect the further realignment of Mill Creek.

This plan presents the proposed initial realignment works, as well as the methodology and results of the corresponding assessment that was undertaken to enhance the rehabilitation, stabilisation and vegetation management for Mill Creek.

The plan is structured as follows:

- Section 2 provides background with relation to the proposed works and in particular the need to realign and rehabilitate Mill Creek.
- Section 3 outlines the assessment methodology that was undertaken to develop the diversion concept as well as rehabilitation and revegetation measures. This provides background and support to the proposed works subsequently described in Section 4.
- Section 4 presents the proposed realignment, rehabilitation and revegetation measures.
- Section 5 reviews the proposed works to confirm compliance with respect to Condition C34 of the conditions of consent.
- Section 6 concludes the plan.

This plan has been prepared by Rod Towner, a Senior Water Resources Engineer with over 10 years of experience at numerous sites with relation to waterway realignment and rehabilitation works. This includes experience in hydrologic, hydraulic and water quality assessment. Input was also received from appropriately experienced landscaping and ecology specialists.

1.2 Scope and limitations

This report: has been prepared by GHD for SUEZ Recycling and Recovery Pty Ltd and may only be used and relied on by SUEZ Recycling and Recovery Pty Ltd for the purpose agreed between GHD and the SUEZ Recycling and Recovery Pty Ltd as set out in this report.

GHD otherwise disclaims responsibility to any person other than SUEZ Recycling and Recovery Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described throughout this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by SUEZ Recycling and Recovery Pty Ltd and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Background

The LHRRP is located to the north of the intersection of New Illawarra Road and Heathcote Road in Lucas Heights, New South Wales. The headwaters of Mill Creek run along the western boundary of the LHRRP, and the creek ultimately discharges into the Georges River. The locations of the LHRRP and Mill Creek are shown in Figure 1.

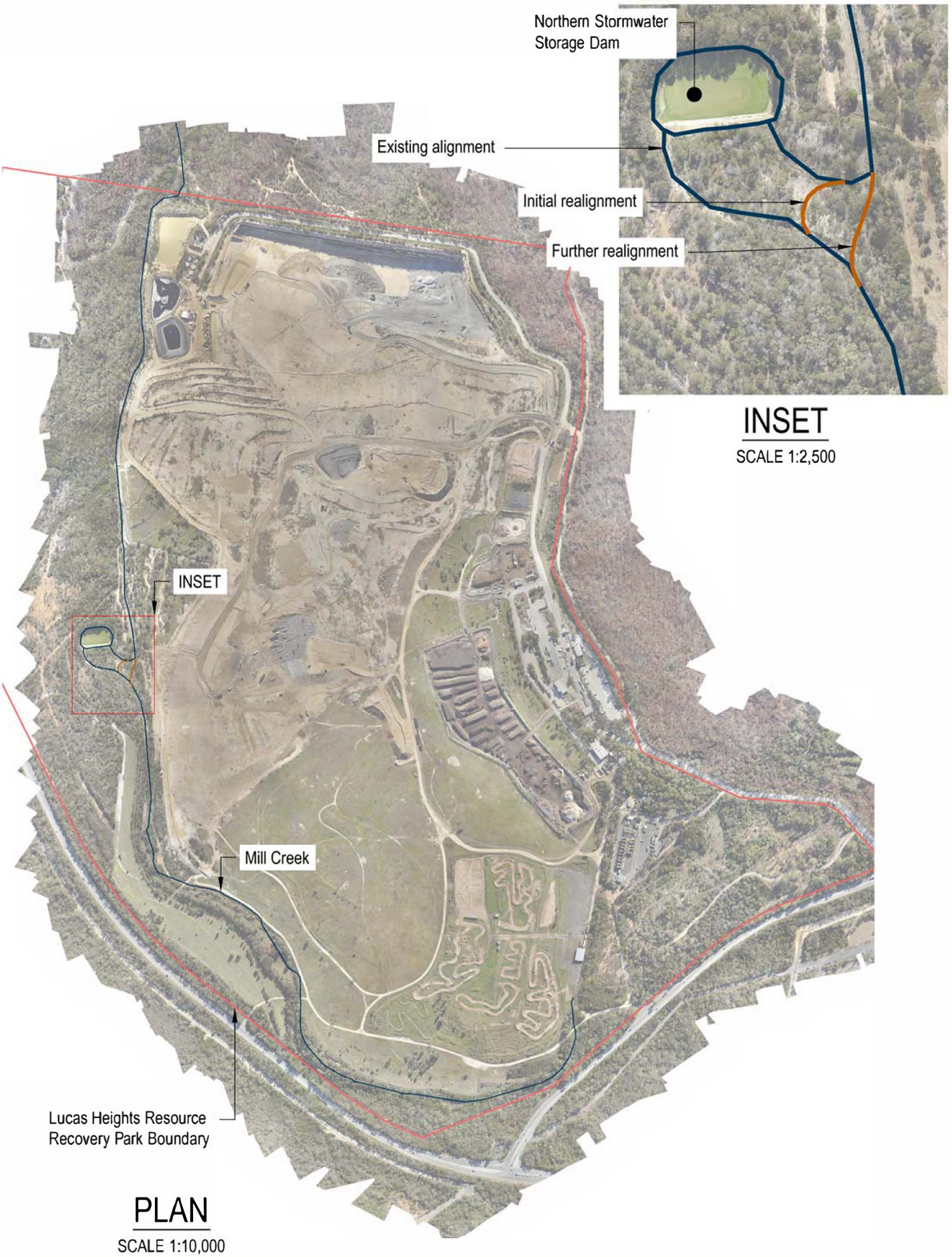
Clean stormwater runoff from the LHRRP flows towards the perimeter of the site and into Mill Creek. Surface water in contact with daily and intermediate cover is diverted to sediment and erosion control measures (not including Mill Creek) before being released from the site. Water drains from the site into the northerly flowing local watercourses of Mill Creek and Bardens Creek, both of which ultimately drain into the Georges River.

An EIS was prepared by GHD which subsequently informed the approval of SSD 6835. The EIS proposed and assessed the realignment of Mill Creek at the location of the proposed ARRT/GO footprint. The dam located on-line to Mill Creek in this location was proposed for removal. The realignment was required as the footprint of the proposed ARRT facility overlapped both the creek and the dam.

As discussed in Section 1 only an initial realignment of Mill Creek is proposed at this stage, with further realignments to be considered at a later stage in the event of the construction of the ARRT facility. This is on the basis of a staged implementation of the current approval which aims to minimise the impacts by only undertaking disturbance activities at the point in time that they are required. This initial realignment retains the western dam, although it is approved for removal and lessens the extent of disturbance to Mill Creek. These initial works are considered optimal for the construction of the GO facility, without the ARRT facility at this stage, on the basis of the following:

- The western dam can be retained at this stage, including the environmental value within and surrounding the dam.
- The dam is still taken offline from Mill Creek allowing it to be most flexibly and appropriately used for management of pumped stormwater from the GO facility.
- The disturbance to Mill Creek is minimised through shortening the length of the proposed realigned section by retaining some length of the additional channel
- The initial realignment results in a longer overall flow path length than the further realignment (though the disturbance length is less) which better mimics natural conditions and is anticipated to reduce channel velocities and scour, relative to the further realignment.

The proposed initial and further re-alignment routes are indicated on Figure 1 as well as the location of Mill Creek in the vicinity of the site.



INSET

SCALE 1:2,500

PLAN

SCALE 1:10,000

0 25 50 75m

SCALE 1:2500 AT ORIGINAL SIZE

0 100 200 300m

SCALE 1:10,000 AT ORIGINAL SIZE

N

GHD

SUEZ Recycling and Recovery
Lucas Heights Resource Recovery Park

Mill Creek Stream Rehabilitation, Stabilisation and Vegetation Management Plan

Job Number 12510188
Revision A
Date Oct 2019

Figure 1

230 Harbour Drive Coffs Harbour NSW 2450 Australia T 61 2 6650 5600 F 61 2 6650 5601 E cfsmail@ghd.com W www.ghd.com

Plot Date: 24 October 2019 - 10:42 AM Plotted by: Rod Towner

Cad File No: \\ghdnet\ghd\AU\Sydney\Projects\21\12510188\CADD\Drawings\12510188-F2-1_MillCkMgmtPlan.dwg

3. Assessment methodology

This section outlines the assessment methodology undertaken to develop the proposed works documented in Section 4.

3.1 Review of guidelines and requirements

As a first step a review of relevant guidelines was undertaken. In particular, this was informed by Condition 34 with the requirement to consider *DPI Water Guidelines for Controlled Activities on Waterfront Land*. These guidelines set out a number of requirements to minimise the impacts of works located on waterfront land and are directly applicable to a number of aspects of the proposed works. Key principles of the guidelines relevant to the works include:

- Considering the full width of the riparian corridor and minimising the construction footprint and disturbance extent.
- Maintaining hydrologic, hydraulic and geomorphic regimes as far as practicable, with this particularly considered for waterway crossings
- Protecting against scour
- Stabilising and revegetating disturbed areas
- Monitoring and maintaining in-stream works until stabilised

In addition to the requirements of the DPI Water Guidelines, key additional requirements were identified based on the proposed site operations and basis of the environmental assessment undertaken for the EIS.

- The proposed Mill Creek culvert crossing to the GO facility should remain flood free during the 100-year ARI event
- The GO facility footprint and landfilling activities should remain flood-free from external floodwaters during the 100-year ARI event, including consideration of the proposed culvert crossing over Mill Creek to the GO facility. Earthen diversion bunding should be provided where required
- The existing Northern Stormwater Storage Dam should be taken offline from Mill Creek with no flows entering for the 1-year ARI event and (volumetrically) minimal flows entering for the 10-year ARI event

3.2 Hydrologic assessment

In order to inform the proposed works with relation to satisfying the requirements identified in Section 3.1 the hydraulic/flooding conditions in Mill Creek in the vicinity of the GO facility required quantification. This in turn required assessment of the hydrologic conditions and flow rates from runoff in the upstream catchment.

The hydrology model for the site developed in XP-RAFTS as part of the site's EIS was updated to reflect the finalised cap drainage design and in accordance with Australian Rainfall and Runoff 2016 ensemble methodologies. Runoff loss and model parameters adopted during the EIS works were selected for this study. The XP-RAFTS model was simulated to estimated peak flow of Mill Creek through the area of interest, with key results indicated on Table 1.

Table 1 Design storm flows

Annual Recurrence Interval	Median peak flow (m^3/s)	Critical Duration Storm
100 year	13.74	20 min
10 year	8.78	25 min
1 year	4.37	25 min

3.3 Hydraulic assessment

Based on the flow rates estimated by the Hydrologic Assessment, a hydraulic assessment was undertaken by developing a HECRAS 1-dimensional hydraulic model. The model utilised field survey collected for the modelling, as well as interpretation of historical survey previously undertaken. The model extracted cross sectional geometry from the survey then applied hydraulic calculations to the creek, represented by a number of cross sections along the creek realignment.

The extent of the model including the location of the proposed re-alignment as well as the creek as it flows adjacent to the GO facility. The proposed culvert crossing, creek re-alignment and bunds to protect the GO facility were input into the model and iterated until the design storm events specified in Section 3.1 were achieved. This then informed the sizing of the proposed works identified in Section 4, with the works shown through the modelling to satisfy these requirements.

The change in hydraulic conditions, particularly shear stress, due to the proposed works was assessed and compared to the existing creek conditions (located predominately in bedrock) to assess potential impacts with relation to scour.

3.4 Vegetation assessment

A detailed assessment of the existing environment at the site was undertaken in association with the Biodiversity Assessment Report (BAR) (GHD 2015 – *Lucas Heights Resource Recovery Park Project – Biodiversity Assessment Report*) prepared to support the EIS. The BAR includes details regarding the geology, soils and geomorphology, surface water features, plant community types, noxious and environmental weeds, flora, fauna and threatened biota at and surrounding the site. Vegetation plot survey undertaken at the site provides a record of native plant species naturally occurring within different PCTs at the site.

The BAR identifies that vegetation within and surrounding the initial realignment of Mill Creek comprises a mix of naturally occurring and regenerating/planted Red Bloodwood – Scribbly Gum heathy woodland. A total of 5 vegetation plots were surveyed within this PCT for the BAR. This plot data, as well as descriptions of the subject PCT derived from the BAR and online databases, were used to inform the composition of native vegetation proposed in association with the stabilisation and revegetation of the Mill Creek realignment described under this plan.

3.5 Consultation

This plan was submitted to the NSW Natural Resources Access Regulator for consultation. It was submitted to this agency on the basis that the Aquatic Habitat Monitoring Plan developed for the proposed works was previously submitted to DPI Water, as per the conditions of consent, with this agency referring the report onto the Natural Resources Access Register.

The Aquatic Habitat Monitoring Plan and Mill Creek Stream Rehabilitation, Stabilisation and Vegetation Management Plan were provided to the Natural Resources Access Regulator

(NRAR) for comment. NRAR confirmed that the plans are to be reviewed by the Department of Planning, Industry and Environment (DPIE). Comments were issued by DPIE on 9 March 2020. The comments and their associated responses are included in Appendix A.

4. Proposed Works

The proposed works are presented on the sketch attached as Figure 2, with the elements of the work detailed in the following sections.

All works are to be undertaken in accordance (where applicable) with the most current version Lucas Heights Resource Recovery Park OEMP, including procedures with relation to weed management, stormwater runoff and erosion and sediment control.

4.1 Mill Creek realignment

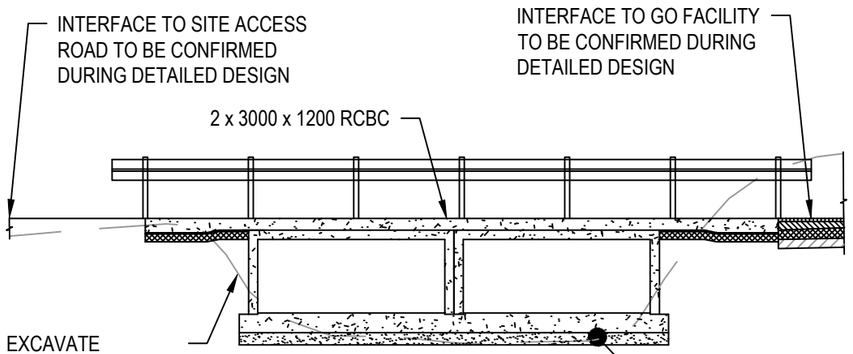
The proposed realignment amends existing flow conditions to enable stream flow to bypass the existing Northern Stormwater Storage Dam by constructing a new reach of Mill Creek and augmenting the existing drainage pathway. The creek realignment would be formed by excavation works around the existing surface over a reach of 40 m before connecting to the existing channel downstream.

During the operation of the garden organics, the storage of water in the Northern Stormwater Storage Dam is a component to surface water management opportunistically utilised as removal of the dam is not required initially as the ARRT facility would not be provided at this stage. This would provide water for the composting process at the site. During these operations, water that is not able to be stored in the onsite tanks would be pumped to the dam for later re-use. A permanent pumping station wouldbe established to pump clean water back to the GO facility for reuse on site.

The alignment of the realignment was selected to minimise the extent of disturbance whilst also allowing for a “curved” alignment to minimise bed slope as far as practicable, reducing modifications to flow hydraulics and geomorphic conditions. The realignment of Mill Creek would occur in a staged approach. The initial realignment proposed would allow for the construction only of the GO facility and then a further realignment would occur upon construction of the ARRT facility..

Site inspection and available geotechnical information confirmed that the realignment excavations are anticipated to be effectively fully located in cut bedrock with smaller shallow areas of residual soil. This is consistent with the existing conditions of the creek in the adjacent upstream areas and provides resistance to erosion through the presence of the exposed in-situ rock. Erosion and sediment controls, such as rock armouring of the channel bed and slopes are not required for the exposed rock.

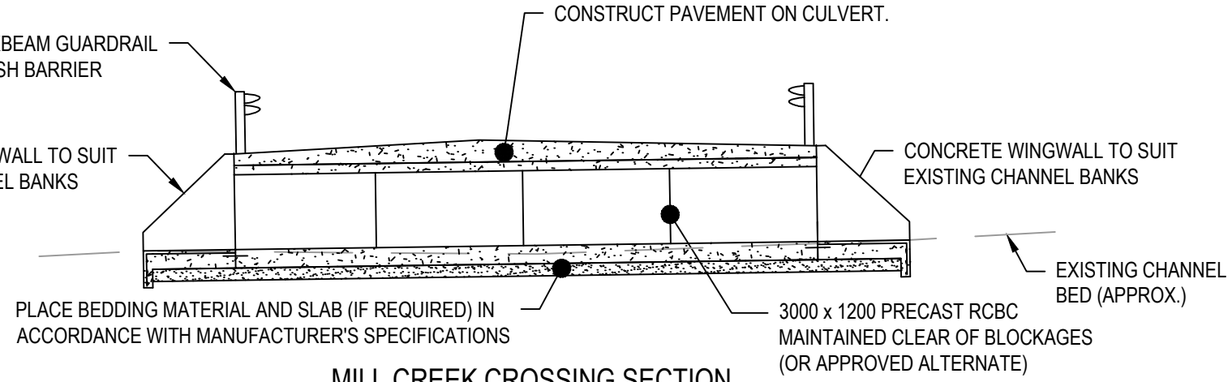
Removal of an existing culvert and crossing is proposed to increase the capacity of the channel and therefore reduce risks associated with overflow of water from the channel into the dam. The culvert could be retained subject to engineering assessment including consideration of risks with relation to the Northern Stormwater Storage Dam.



TYPICAL CULVERT SECTION

B - SECTION

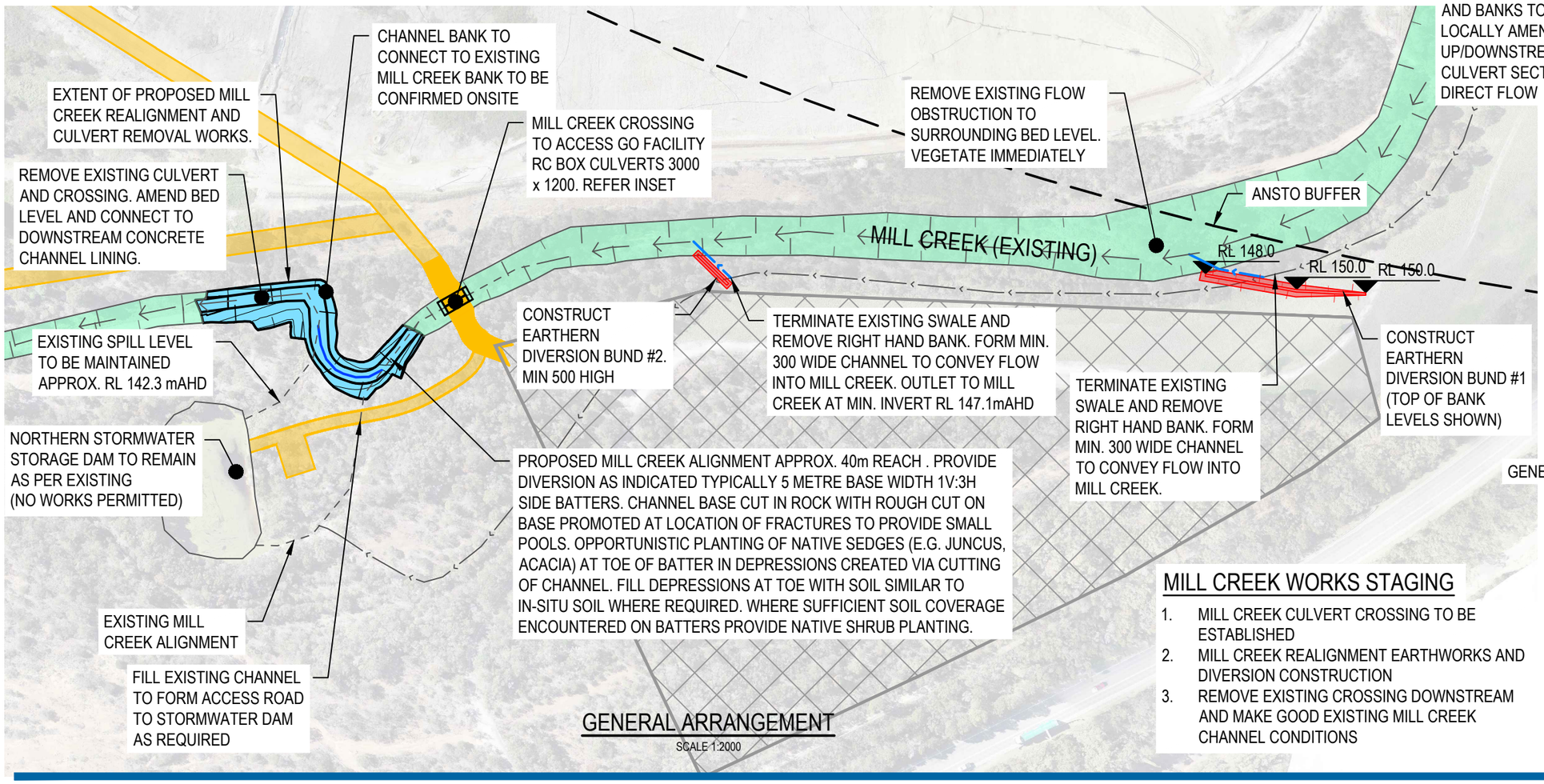
SCALE 1 : 100



MILL CREEK CROSSING SECTION

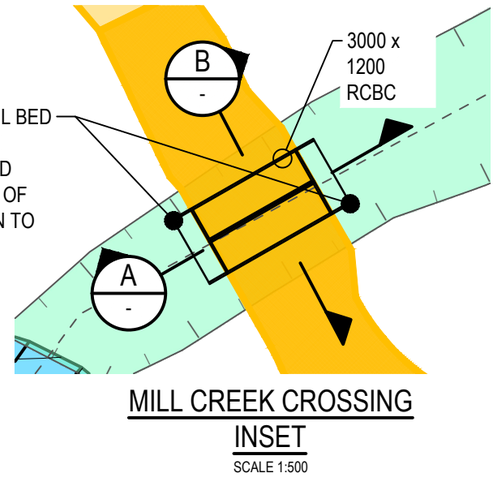
A - SECTION

SCALE 1 : 100



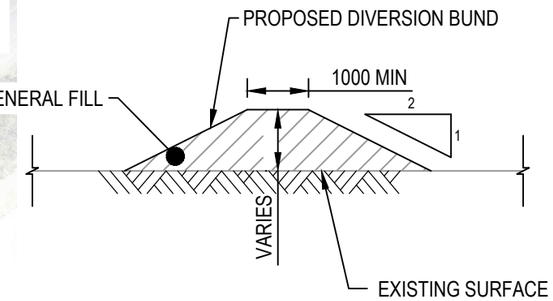
GENERAL ARRANGEMENT

SCALE 1:2000



MILL CREEK CROSSING INSET

SCALE 1:500



TYPICAL DIVERSION BUND CROSS SECTION

MILL CREEK WORKS STAGING

1. MILL CREEK CULVERT CROSSING TO BE ESTABLISHED
2. MILL CREEK REALIGNMENT EARTHWORKS AND DIVERSION CONSTRUCTION
3. REMOVE EXISTING CROSSING DOWNSTREAM AND MAKE GOOD EXISTING MILL CREEK CHANNEL CONDITIONS

N

0 5 10 15 20 25m

SCALE 1:500 AT ORIGINAL SIZE

0 10 20 30 40 50m

SCALE 1:1000 AT ORIGINAL SIZE

0 500 1000 1500 2000 2500mm

SCALE 1:50 AT ORIGINAL SIZE

GHD

Suez Recycling and Recovery
Lucas Heights Resource Recovery Park

Proposed Mill Creek Works

Job Number 12510188
Revision A
Date Sep 2019

Figure 02

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 27 September 2019 - 10:05 AM Plotted by: Tom Darley
Cad File No: G:\21\12510188\CADD\Drawings\12510188_Figure2.dwg

4.2 Connection of the western swale

In the process of forming the current Mill Creek alignment and providing sufficient flow conveyance, an embankment was previously constructed on the western bank of the creek. This resulted in the formation of a drainage swale behind the embankment conveying a smaller catchment to the west of Mill Creek. Currently this swale flows through the GO facility and joins the main Mill Creek alignment downstream of the proposed re-alignment before flowing into the existing Northern Stormwater Storage Dam.

With the installation of the GO facility this swale requires diversion into Mill Creek to minimise the risk of water flowing into the facility where the facility footprint intercepts the current alignment of the swale.

The western swale would therefore be connected in two locations into Mill Creek. The connection of the western swale would typically involve cutting a new channel from the swale into the left-hand bank of Mill Creek. Diversion berms on the left-hand bank of the new channel would be constructed with a top level above the 1 in 100 year flood level to protect the GO facility from flooding potential associated with cutting the bank of Mill Creek.

4.3 Mill Creek crossing and access requirements

To provide access to the proposed GO facility, an inline structure would be constructed to convey the 100 year design event with no overtopping of the road deck. The inline structure would comprise of two reinforced concrete rectangular box culverts. The box culvert spans approximately 10 m with the flow direction and spans Mill Creek. Training walls at the inlet and outlet would promote flow into the box culvert and returning into the creek.

The cross-sectional area and culvert geometry was selected to convey the required 100-year ARI event and also to minimise modifications to flow hydraulics and geomorphic conditions, assessed through hydraulic modelling.

The interface of the crossing with the bed and batters of Mill Creek is proposed based on consideration of the existing conditions of the channel being located in bedrock. A headwall apron is proposed to match-in with the existing channel levels to minimise potential flow restrictions around the culvert and to promote the existing flow regimes as far as practicable. Provision of placed rock at the bed level of the interface is not proposed on the basis that it is not required due to the resistance to scour of the bedrock, and that it would also interrupt the transition in bed levels between the structure and the existing channel. However, rip-rap is proposed around the headwalls to entrain flow through the culverts without affecting the geotechnical stability of the structure.

4.4 Native vegetation rehabilitation

4.4.1 Approach to works / project preparation

Revegetation with native plant species characteristic of the surrounding plant community types is proposed at all locations disturbed by the Mill Creek realignment.

For the extent of the realignment the modified surface would consist of a channel cut in bedrock with smaller shallow areas of *in situ* soils. This would provide a similar environment to the existing upstream channel, which is vegetated with native species. The proposed revegetation strategy is consistent with the anticipated modified surface type with the aim of promoting a vegetated natural environment similar to the upstream reaches, and includes:

- A channel base cut in rock with rough cut promoted at location of existing fractures to establish small pools.

- Wherever practical, packing of depressions at the channel bank toe with local soils, to be planted with macrophytes.
- Where sufficient soil coverage is present on the batters, planting of native shrub species.

For any channel and batter areas disturbed by the installation of the culvert crossing, a similar approach to that described above would be adopted.

The proposed diversion bunds would be revegetated with native grasses.

Hygiene protocols

Actions are to be taken to prevent introduction or spread of soil borne pathogens in association with bulk earthworks and revegetation works. All contractors are to follow hygiene protocols specified within the Sydney Botanic Gardens Trust *Best Practice Management Guidelines for Phytophthora cinnamomi within the Sydney Metropolitan Catchment Management Authority Area* (Suddaby & Liew, 2008). No foreign soil should be imported into or along the fringes of bushland within or surrounding the site.

Weed control

Prior to the commencement of the Mill Creek realignment, all exotic vegetation currently growing within the impact area should be treated in order to minimise the spread of invasive species during excavation and creek realignment works. In particular, any noxious and invasive environmental weed species present, such as *Chrysanthemoides monilifera (*Bitou Bush), *Lantana camara* (Lantana), *Ludwigia peruviana* (Peruvian Primrose), *Cortaderia selloana* (Pampas Grass), *Juncus acutus* (Sharp Rush) and *Eragrostis curvula* (African Love Grass), should be targeted and destroyed. The seed of any noxious or environmental weed species should be bagged and removed from site for disposal at a registered green waste facility.

In addition, following completion of the creek alignment excavation and stabilisation works, and prior to native plant revegetation, any emerging exotic species should be controlled as required in order to prevent weed seed set. As far as is practical, weed control works should avoid use of herbicides within the channel / waterway. All weed control works should be undertaken by an appropriately qualified and experienced bush regeneration contractor (see below).

Seed collection / plant supply

Allowing appropriate lead-times for seed collection and propagation works would be critical to achieving timely and optimal native vegetation restoration outcomes. A preferable 24-month lead time should be allowed for the collection, propagation and establishment of provenance tube stock.

All native seed collection is to be of provenance stock in accordance with *Florabank Guidelines & Code of Practice* (www.florabank.org.au):

- seed sourcing should prioritise collection of high quality and genetically diverse seed in order to maximise the adaptive potential of restoration efforts to current and future environmental change;
- seed should be collected as locally as possible, however, the matching of environmental conditions at the planting site with those of the collection location should be the most important consideration in establishing the collection range;
- collection of ‘local’ material, defined by the application of an arbitrary distance, should not form the principal priority that guides seed collection.

At a minimum, all seed collection works would adhere to the following guidelines:

- target species ranges have been well defined prior to commencement of collection;

- site environmental conditions including soils, geology, topography, climate and vegetation type are matched as closely as possible with collection sites;
- seed is collected from the largest, healthiest and most genetically diverse populations available;
- seed is only collected within pre-defined target ranges for each plant species;
- seed is never over-collected from individual sites (<20% available seed);
- seed is collected from as many different individual parents as is practicably possible;
- seed is not collected from previous plantings unless this is absolutely certainty of the provenance of the stock;
- seed is processed and stored immediately to ensure that viability is maximised;
- landholder permission is acquired prior to seed collection.

All seed collection is to be undertaken by specialist experienced and licenced native seed collection contractors. Native seed collection contractors must hold a valid seed collection licence under Part 2 of the *Biodiversity Conservation Act 2016*.

All plant propagation is to be undertaken by a specialist native plant nursery, qualified and experienced in provenance plant propagation. All grasses and macrophytes are to be supplied in hiko trays. Shrubs are to be supplied in forestry tubes of minimum 50 x 50 x 125mm size. Upon supply, all plants to be in the following condition:

- appropriately hardened-off;
- fully developed root system;
- not root bound or over-mature;
- in a healthy and robust condition;
- free of pests, disease and weed infestation;
- free of malformations and other defects.

Bush regeneration contractor

Initial weed control, revegetation and ongoing maintenance works are to be implemented by an appropriately qualified and experienced bush regeneration contractor. In order to ensure delivery of high quality vegetation management services, the bush regeneration contractor should:

- Provide a statutory declaration stating their compliance with provisions of the National Gardening & Landscape Services Award 2010.
- Demonstrate implementation of safe workplace and appropriate environmental management practices and procedures (e.g. appropriate transport and management of herbicides).
- Have previous experience undertaking bushland restoration works within western/greater Sydney. Contractor references should be contacted.
- Provide site supervisor(s) with minimum qualifications and experience including Certificate III Conservation & Land Management and one year full-time equivalent experience as a trained bush regenerator.
- Provide a minimum of one trained bush regenerator (plus supervisor) per team of four.

- Schedule appropriately resourced regular site visits for the duration of the contract period, as appropriate.
- All herbicide usage, including storage and transport, to be in accordance with the *NSW Pesticides Act 1999*, WorkCover NSW (2006) and all other relevant legislation. The use of a herbicide in or around the creek shall be approved before use.
- All bush regeneration crew members undertaking herbicide spray applications must hold a current chemicals application training certificate to AQF Level III.

4.4.2 Mill Creek realignment revegetation

A proposed list of native species and recommended planting densities, to be planted in the areas described above, is provided in Table 2. The number of plants required is to be determined by multiplying the treatment area (i.e. channel / batter / diversion bund) by the recommended planting density. As diverse a selection of the listed species as practicable should be utilised.

Table 2 Proposed native plant species revegetation list

Species (scientific name)	Species (common name)
Sedges	
Schoenus brevifolius	Zig-zag Bog-rush
Juncus continuus	
Cyperus polystachyos	
Shrubs	
Acacia linifolia	White Wattle
Acacia myrtifolia	Myrtle Wattle
Acacia obtusifolia	Blunt Leaf Wattle
Acacia rubida	Red-stemmed Wattle
Acacia suaveolens	Sweet Wattle
Allocasuarina littoralis	Black She-oak
Baumea rubiginosa	
Callistemon citrinus	Crimson Bottlebrush
Hakea dactyloides	Broad-leaved Hakea
Hakea gibbosa	Needlebush
Hakea sericea	Needlebush
Kunzea ambigua	Tickbush
Leptospermum polygalifolium	Tantoon
Grasses	
Anisopogon avenaceus	Oat Speargrass
Entolasia stricta	Wiry Panic
Poa affinis	
Microlaena stipoides	Weeping Grass
Recommended planting densities	

Sedges	4 plants / m^2
Shrubs	1 plant / 5 m^2
Grasses	5 plants / m^2

All plant installations should:

- Ensure that plant root ball is in a moist condition immediately prior to installation.
- Include addition of Gypsum as well as an appropriate soil conditioner (water crystals, wetting agent, nutrient, growth promoter) such as Terraform® Plant Establisher or equivalent to each plant hole prior to plant installation.
- Install plant directly and fully into soil.
- Install the top of the root ball below the level of surrounding soil in order to produce a small 'well' at the base of the plant.
- Firm the soil around the root ball following installation.
- Thoroughly water the plant immediately following installation.

4.4.3 Revegetation maintenance

All revegetation works are to be subject to a minimum 24 month maintenance program to ensure plant establishment and prevent establishment of weed species. A survival rate of 80% for revegetated native plants should be targeted. The maintenance program would include water maintenance as required, noxious/environmental weed control and plant replacements where required.

Watering

All installed plants are to be thoroughly watered in upon installation. Following-up watering should be applied as required, and depending upon prevailing weather conditions, for a period of approximately 1 month following plant installation.

Weed control

Weed control, particularly during the establishment phase of revegetation works, would be important to the success of restoring vegetation cover within the site.

Maintenance weed control is to be undertaken by an appropriately qualified and experienced bush regeneration contractor (see above). Maintenance weed control works would aim to maintain noxious and major environmental weed species to very low levels, with an overall aim of establishing a dominant cover of those species revegetated at the site. Appropriately resourced regular site visits should be scheduled in order to meet the performance targets (see section

Contingency planting

A plant allocation of 20% in addition to total number of plants installed at the site should be allowed for to replace unsuccessful / dead plants. Assessment for the requirement for an additional plant order should be made approximately 6 months following initial plant installations. The additional plant order should aim to directly replace dead planted individuals.

4.4.4 Performance targets

It is anticipated that the establishment, revegetation and maintenance works would achieve the following targets:

- Minimum 80% survival rate of original density of manually installed plants at the end of the 24 month contract period. Replacement plantings would be required should this survival rate not be achieved.
- No noxious or invasive environmental weed species present throughout the Mill Creek realignment site.
- Environmental weed species not impacting upon growth and survival of target revegetation species.
- Site visit frequency agreed upon the engagement of a bush regeneration contractor fulfilled and fully resourced.

4.5 Staging

The works would be staged as far as practicable such that the extent of disturbance at any one time is minimised. This would include firstly installation of the culvert crossing followed secondly by installation of the creek realignment. This would allow access to the realignment works with a minimised disturbance due to site access. The culvert crossing construction would be accessed via the route of the proposed access roads such that no additional disturbance is required. The realignment would be accessed via the proposed access route to the Northern Stormwater Storage Dam and then accessed up and down along the proposed extent of the re-alignment itself. Therefore, the disturbed extent is to be generally limited to the extent of the proposed works. The realignment of Mill Creek would also occur in a staged approach. The initial realignment proposed would allow for the construction only of the GO facility and then a further realignment would occur upon construction of the ARRT facility.

The risk associated with the generation of sediment during construction is significantly reduced through the location of the works in cut bedrock, as there would not be large areas of exposed soil subject to rainfall. Notwithstanding this, cut material would be removed from the channel, including finer particles generated, on the same day that they are exposed, or before rainfall should it be forecast. In-stream works would not be commenced where more than 5 mm per day of rainfall is forecast by the Bureau of Meteorology during the projected construction timeframe.

After completion of landfilling at the site the final rehabilitation landform would include consideration of maximising vegetated riparian widths. This would be undertaken with particular reference to providing a minimum vegetated width outside the top of bank of 10 metres, where not already achieved. This would be provided unless the presence of waste requires capping for which provision of riparian vegetation could compromise the capping. Provision of riparian vegetation in these areas would have greater detrimental environmental impacts than benefits due to the potential increase in leachate generation. The full available width from the toe of the cap to the GO facility would be utilised as a riparian zone.

4.6 Ongoing monitoring and maintenance

4.6.1 Construction monitoring

During construction regular monitoring would be undertaken. This would include continuous monitoring of weather conditions and forecasts with work ceasing if more than 5 mm per day occurs or is forecast. At the end of each day the entire work area would be inspected and any excavated material removed from the creek channel.

After construction, weekly monitoring would be undertaken to confirm no significant scour or change in geomorphic conditions is occurring, though the risk of this is lowered due to the location of the channel in cut rock. This monitoring is to continue for 6 months or until the vegetation is fully established.

After this period monitoring would continue throughout the life of the GO project at a rate of once every 6 months.

Monitoring is to consist of photographs and a consistent log noting the status and condition of all the rehabilitated areas. It would also include inspection of the culverts for any damage and unblocking of the culverts, if required.

4.6.2 Native vegetation rehabilitation monitoring

Photo points

At least three formal photo points are to be established at the Mill Creek realignment site prior to the commencement of revegetation works. Photos should be taken by digital camera and recorded in the project file by date and discrete photo-point number. Photo-point locations should be clearly marked on site and mapped by a surveyor or by GPS.

Works reporting

A brief report summarising the following aspects or works is to be produced for every month within which works are undertaken:

- Summary of works undertaken.
- Work methods.
- Weed species treated.
- Plant species and quantity installed
- Herbicide application records.
- Site progress towards management goals / performance indicators.
- Management issues / recommendations.

Annual reporting

Annual vegetation management reports are to be produced at the 12th and 24th month of the maintenance period. The annual report is to include:

- Summary of annual revegetation and maintenance works.
- Site assessment based on performance targets.
- Presentation of photo points to illustrate site changes.
- Any management issues / recommendations required to meet performance targets.
- Update work specification as required to meet performance targets.
- Management / maintenance requirements or recommendations to inform any subsequent management of the subject site (beyond the 24 month maintenance period).

5. Condition 34 review

As outlined in Section 1 SSD 6835 approved consent condition C34 requires consideration of a number of items with relation to the Mill Creek rehabilitation works. This plan has assessed these requirements and incorporated them into the proposed works as outlined in Table 3 and Table 4

Table 3 Condition 34 Requirement

Condition 34 Requirement	Response
The Applicant shall prepare a Mill Creek Stream Rehabilitation, Stabilisation and Vegetation Management Plan. The plan shall:	
be prepared by a suitably qualified and experienced person in consultation with DPI Water	This plan was prepared by Rod Towner, a Senior Water Resources Engineer with over 10 years experience working on related projects including hydrologic, hydraulic, geomorphological and creek rehabilitation works. He was supported by specialist ecological input where required. The plan was submitted to the Natural Resources Access Regulator based on previous advice from DPI Water
be submitted to the Secretary prior to the construction of the GO and ARRT facilities	This plan would be submitted to the Secretary as required
be prepared in accordance with DPI Water Guidelines for Controlled Activities on Waterfront Land	Refer Table 4
detail proposed stream realignment works including details of the measures to minimise water quality impacts	These are detailed in Section 4
detail proposed rehabilitation and stabilisation of the stream including methods and staging of the works	These are detailed in Section 4 and in particular Section 4.5
detail opportunities to maximise the width of riparian zones, particularly in the final landform design, and detail the vegetation types, maintenance, monitoring and performance criteria for the rehabilitation works; and	These are detailed in Section 4.5 and 4.6
be updated to include any changes to the rehabilitation objectives and staging approved in the Post Closure Plan for the site, required under condition C40	This plan would be updated in accordance with this requirement as required.

Table 4 DPI Water Guidelines Key Requirements

Key Requirement	Response
Considering the full width of the riparian corridor and minimising the construction footprint and disturbance extent.	As outlined in Section 4.5 the staging and construction methodology would maintain disturbance to the minimum area required to install the works. With disturbance minimised through the entire riparian width and this width maximised in the rehabilitation of the overall site.
Maintaining hydrologic, hydraulic and geomorphic regimes as far as practicable, with this particularly considered for waterway crossings	As outlined in Sections 3.2 and 3.3 a hydrologic and hydraulic assessment was undertaken, including analysis of regimes after installation of the proposed works. These were then assessed against the resistance of the proposed works against scour, noting they are located in bedrock.
Protecting against scour	Refer above. The hydraulic assessment included the minimisation of scour and ongoing monitoring and maintenance is proposed to assess ongoing scour risks
Stabilising and revegetating disturbed areas	As outlined in Section 4.4 all disturbed areas are to be revegetated, considering the exposed bedrock nature of the channel and revegetating consistently with surrounding vegetation types.
Monitoring and maintaining in-stream works until stabilised	Section 4.6 details proposed monitoring including during construction, immediately after construction, and in the long term after vegetation has established.

6. Conclusions

This plan was prepared in response to SSD 6835 approved consent condition C34 which required the preparation of a Mill Creek Stream Rehabilitation, Stabilisation and Vegetation Management Plan.

This plan presents the methodology undertaken to develop the proposed works, monitoring and maintenance, and then subsequently describes the proposed works which include the realignment of Mill Creek, installation of a crossing over Mill Creek and diversion of an adjacent drainage swale into Mill Creek at two locations.

The proposed works were then assessed against the requirements of the consent condition including requirements of the relevant DPI water guidelines, which included development of hydraulic and hydrologic modelling. It is anticipated that the proposed works can be provided in accordance with these requirements and in a manner, which minimises in-stream and riparian impacts, and provides opportunity for future expansion of the riparian zone.

Appendices

Appendix A - DPIE Comments and Response

Table A-1 - DPIE Comments and Associated Responses

Item No	Comment	Provided in plan to NRAR	Response
		Aquatic Habitat Monitoring Plan	
1	More frequent sampling of macroinvertebrates and water quality parameters is required. Macroinvertebrate sampling should be undertaken at six-monthly intervals at a minimum.	Monitoring once every three years.	The AHMP would be changed to include biannual monitoring in autumn and spring for the first two years after approval of the plan. Subsequent to this monitoring once every three years would be undertaken.
2	The use of a modified BACI design with multiple local control sites to enable the linking of any impacts to the garden organics facility should be incorporated.	Monitoring of one upstream site and one downstream site, with commencement of monitoring prior to the construction of the GO facility.	An additional control site would be included in the plan. To increase statistical power, an additional site downstream of the GO facility would also be added to the AHMP.
3	The use of quantitative macroinvertebrate sampling techniques, identification to genus taxonomic level and more robust statistical techniques should be incorporated.	Non quantitative sampling. Identification to family taxonomic level. Univariate data analysis only.	GHD believes that the proposed monitoring program is sufficient in terms of the ability to detect impact to macroinvertebrate communities. The proposed monitoring is consistent with the existing NSW guidelines (Turak et al. 2004). The SIGNAL-SG biotic index exists for interpreting genus level macroinvertebrate data, however SIGNAL-SG was developed for use in assessing the impacts of sewage treatment plant discharges, so may not be relevant for assessing the potential impacts of the GO facility on aquatic communities in Mill Creek. The use of SIGNAL-SG is not included in the relevant

			guidelines (Turak et al. 2004), so further justification of quantitative macroinvertebrate sampling techniques and genus level identification would be required before inclusion in the AHMP. Multivariate statistical techniques, such as SIMPER, PERMANOVA and MDS would be included in the AHMP.
4	Water quality sampling after rainfall events which produce runoff from the facility grounds is required.	Responsive sampling not proposed.	Responsive water quality sampling during the construction phase would be detailed in information accompanying the detailed design, as required under consent condition C32c, as well as in ongoing EPL compliance monitoring
Mill Creek Stream Rehabilitation, Stabilisation and Vegetation Management Plan			
5	The management plan outlines the following: a) Two small sections of Mill Creek to be realigned; b) Existing channel to be filled to form access road; c) Culverts to be installed for the access road across Mill Creek and existing culvert and crossing is to be removed; d) Two existing swales to be terminated and removal of right hand bank; e) Construction of an earthen diversion bund; 2 f) The plan outlines suitable vegetation species and densities for revegetation of the site with a 24 month maintenance period;		No response required
6	The plan has not committed to the minimum requirements for a 1st order vegetated riparian zone (VRZ). The project is to review the potential areas where the impacted VRZ can be offset should	After completion of landfilling at the site a minimum vegetated width of 10 metres outside the top of bank would be provided where not already achieved, other than over waste capping where	In the vicinity of the proposed realignment the 10 m VRZ requirement is generally achieved. In localised areas where not achieved much greater

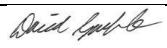
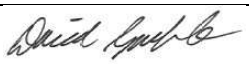
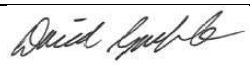
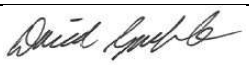
	a minimum VRZ not be achieved	provision of riparian vegetation would provide a net negative environmental outcome.	than the VRZ width is achieved on the other side of the realignment. The realignment does not reduce VRZ widths with these maximised to their fullest extent by maintaining and providing a riparian zone up to the edge of waste capping.

GHD

Level 15
133 Castlereagh Street
T: 61 2 9239 7100 F: 61 2 9239 7199 E: sydmail@ghd.com

12534605-66484-53/https://projectsportal.ghd.com/sites/pp15_01/lucasheights2develop/ProjectDocs/REP-Mill Creek Stream Rehabilitation Stabilitation and Vegetation Management Plan.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	R Towner D Whaite	T Darley D Gamble		D Gamble		19.11.19
1	R Towner	D Gamble		D Gamble		04.11.20
2	F.Li	R. Towner		D. Gamble		01.04.21

www.ghd.com