

Fish Creek Restoration Management Plan

2019



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1. Introduction

Fish Creek is an ephemeral waterway located in The Gap in the western suburbs of Brisbane. It starts at Wittonga Park, The Gap, and flows east joining Enoggera Creek then Breakfast Creek (one of the major tributaries) before entering the Brisbane River.

Fish Creek forms part of the Moreton Bay catchment, and waters from the upper catchment flow through the channel before eventually reaching the Coral Sea. Moreton Bay is a national marine park and forms part of the internationally significant Ramsar wetland in Moreton Bay. As such, the health and condition of the tributaries and waterways that contribute water to the protected bay are important in regulating the health and condition of the Ramsar wetland and marine park. Numerous stormwater drains and natural drainage lines are connected to Fish Creek, giving it an important role in managing sediment and pollutant transfer between the upper catchment and Moreton Bay.

Fish Creek passes along the property boundary of Hilder Road State School (HRSS). Approximately 500 metres of the northern bank and associated riparian vegetation forms the southern property boundary of HRSS. Over the past five years, HRSS has conducted weed clearing, management and restoration along the western half of the creek where it borders the property. This work has been done as part of the Fish Creek 4061 education program that provides HRSS with educational tools to teach and connect both students and the community with the ecology, history and culture of Fish Creek. In 2014, HRSS was awarded an 'Everyone's Environment' grant from the state government to assist in the restoration and management of the creek.

1.1. Purpose

The purpose of this Fish Creek Management Plan (the Plan) is to provide a framework for conserving, managing and restoring Fish Creek along the boundary of HRSS, as part of an outdoor primary education program that engages the local community and stakeholders.

The Plan focuses on management actions and activities that provide the School community and Fish Creek 4061 team with the basis to conduct strategic and structured programs to improve and maintain the creek environment. These include:

- Weed and pest management
- Erosion and sediment control
- Access and walkways
- Revegetation and restoration
- Signage
- Community involvement and integration

The Plan also provides structured monitoring of restored and maintained sections of the creek that can be incorporated into the Fish Creek 4061 education program, as well as reported to various grant or funding providers to demonstrate the impact of the activities and management. Reporting requirements have been set out to meet any grant or funding requirements, as well as to provide a

consistent format for reporting to the Habitat Brisbane program, and to inform future grant or funding applications.

1.2. Aims and Objectives

The overall aim of the Plan is to facilitate the restoration of Fish Creek so that it can be utilised by HRSS and the community as an outdoor educational resource.

This will be achieved through the following objectives:

- Removal and management of pest and weed species from the creek corridor.
- Management and mitigation of sediment loss, run-off and erosion of the creek banks and surrounding area.
- Installation and maintenance of clear, safe pathways and access points for children and the community to access the creek corridor and the creek banks.
- Restoration of riparian vegetation in the creek corridor using native species that enhance the character of the creek, and improve ecosystem and habitat connectivity and condition.
- Installation and maintenance of interpretive and informative signage for users, and safety information to protect both users and the environment.

The management and improvement works at Fish Creek will be monitored and reported on as appropriate to the various grant and funding requirements, Habitat Brisbane scheme, and for the purposes of monitoring the health of the creek and success of restoration. Monitoring and reporting will be integrated into the educational aspect of the restoration program.

1.3. Scope

The scope of the Plan includes the northern bank of Fish Creek and the land immediately parallel and to the north of the creek, from the centreline of the creek itself. Vegetation and management works may include the southern banks where Brisbane City Council (BCC) approval and support is granted; however, the primary goal is to provide access and improve the habitat of the side of Fish Creek that forms the HRSS property boundary. This Plan details the management requirements pertaining specifically to the physical and environmental aspects of the Fish Creek program, and excludes the educational and academic perspective, which is included in another document.



Figure 1 Location of Hilder Road State School and Fish Creek, The Gap, Brisbane



Figure 2 Aerial image of Fish Creek forming the southern boundary of the Hilder Road State School property boundary

2. Site Description

2.1. Physical Characteristics

Fish Creek is a first order stream with a steep but relatively narrow channel densely vegetated with a mixture of native and introduced riparian vegetation species. The creek enters the HRSS property in the south west via a culvert under Hilder Road. The channel is relatively steep with mostly native vegetation at this point as a result of a comprehensive weed management program previously

conducted by HRSS. The top of the northern bank has a relatively clear dirt path with access to the school grounds via a gate adjacent to the culvert. Currently, access from the school to the creek at this point is down a relatively steep slope to the area of path that has been cleared at the top of the bank. The path along the top of the northern bank extend along the creek to approximately halfway, where it becomes overgrown and impassable (the extent of the first stage of weed and vegetation clearing and restoration conducted by the school). The path is bounded on the northern side by a wire fence that has been damaged in a few places. The path itself has not been graded, but is cleared of vegetation, although there are numerous tree roots crossing the path. Approximately halfway along the creek, in the area that has not been cleared, a storm water culvert connects from under the school grounds to the creek. It is understood that the storm water from this drain originates in the residential area north of the school. Vegetation along this last section of the creek on the school property is dense and impassable, and comprised of a mixture of native riparian vegetation and weeds.

The creek is ephemeral, meaning it only tends to flow during and immediately following periods of medium to heavy precipitation. During dry periods, small pools of water remain in the creek that have the potential to support macroinvertebrates; however, the creek will only support other species during times of regular flow.

2.2. Key Issues

2.2.1. Land Tenure

Fish Creek forms the southern boundary of HRSS and is mapped by the Queensland Department of Natural Resources, Mines and Energy (DNRME) as “Unallocated State Land” under the trusteeship of BCC (Figure 3). As such, the tenure is regulated by BCC on behalf of the Queensland Government, and any development occurring within the Creek is subject to local and state approvals.



Figure 3 DNRME mapping of Land Tenure (2016) showing HRSS (Lot 95 Plan SL9656) with Fish Creek at the southern boundary

Discussion as to whether the boundary of HRSS was the top of the bank, or the centreline of the Creek concluded with the decision to involve BCC in the project to ensure all necessary approvals were obtained and appropriate advice was given. Dependent on the extent of works, Owner's Content may be required from BCC to conduct any modifications in the Creek footprint. BCC will provide ongoing advice and assistance on this through the Habitat Brisbane program.

2.2.2. Flooding

Fish Creek is mapped on BCC's Flood Awareness Map (2019) as having a 'high likelihood' (5%) of annual flooding, with much of the HRSS grounds included in the mapped overland flow (Figure 4). As such, there will be significant limitations on the extent of work that can occur within the Creek footprint. This will include no permanent structures (such as constructed pathways, boardwalks or platforms).

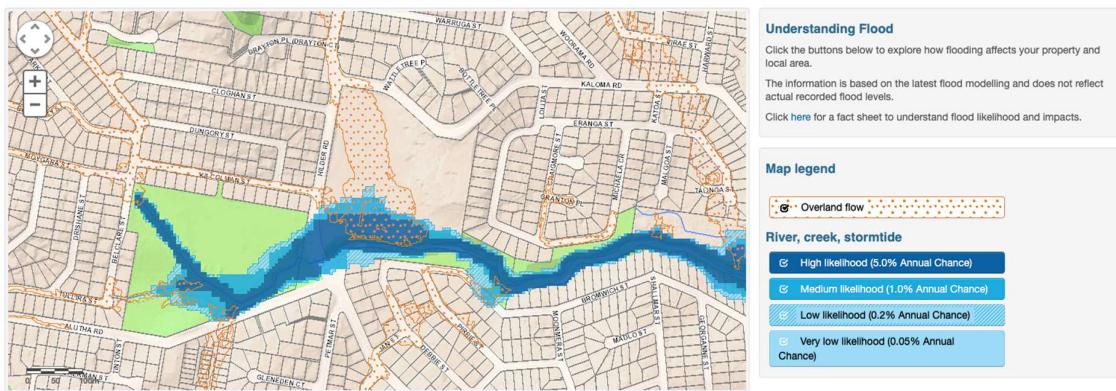


Figure 4 BCC mapping of likelihood of flooding at the HRSS and Fish Creek (BCC, 2019)

2.2.3. Access and Safety

Currently limited access to the creek corridor - there are currently two entrances/exits accessing the creek corridor from the school grounds, which are via steel gates in the fencing. The westerly access currently consists of a relatively steep gradient slope down to the cleared access pathway, which presents a potential trip and fall hazard and limits access for disabled persons.

Currently only half of the creek corridor has a cleared access pathway along the top of the northern creek bank. The remainder of the creek corridor parallel to the school grounds is inaccessible. There is currently no safe access to the creek bed from the top of the bank.

Education Queensland has processes and procedures relating to safe access to outdoor areas as part of education programs. This includes approvals required and risk assessment protocols.

Education Queensland will be consulted as required throughout the project.

2.2.4. Permits and Approvals

BCC will be the primary agency from whom HRSS will obtain any required approvals from. In the event that State approvals are required, the Department of Environment and Science (DES) and/or DNRME will be the main agencies requiring consultation.

With the exception of Owners Consent (as discussed in Section 2.1.2), it is unlikely that any approvals will be required for the project. This is determined by the following assumptions:

- No permanent structures will be constructed that require Development Application for Operational Works (e.g. buildings, boardwalks, etc.)
- No native vegetation will be cleared or damaged as part of the project. Vegetation clearing will be limited to weed removal and treatment only.
- No barriers will be placed in the Creek channel that would be considered Waterway Barrier Works. The flow of the Creek will remain unobstructed by both temporary (construction) works and permanent (operational) works.

2.2.5. Volunteers and Human Resources

The Plan will require a certain level of commitment, resulting in the need for a workforce available to volunteer their time to basic maintenance, weeding, and planting. To date, it has been a challenge to recruit volunteers consistently. In response to this issue, the Hilder Road State School Bushcare Group was established in March 2019 under the BCC Habitat Brisbane program. The HRSS Bushcare Group provides best practice technical advice, guidance, support and training to complement the work of Fish Creek 4061 and will become a vital mechanism for engaging a volunteer workforce.

The HRSS P&C is the driving force of this project and other programs recruiting volunteer services from parents and members of the community associated with the school. However, it is necessary to maintain the independence of the Fish Creek 4061 project, particularly for funding and resourcing.

As such, the project will be delivered under the existing Fish Creek 4061 program with the Hilder Road State School Bushcare Group as a mechanism for coordinating working bees, and engaging community volunteers beyond the immediate school community.

3. Management Program

3.1. Management Zones

For ease of programming the Project, and to enable the work to be delivered in smaller, easier to manage packages, Fish Creek has been divided into six management zones (Figure 5).

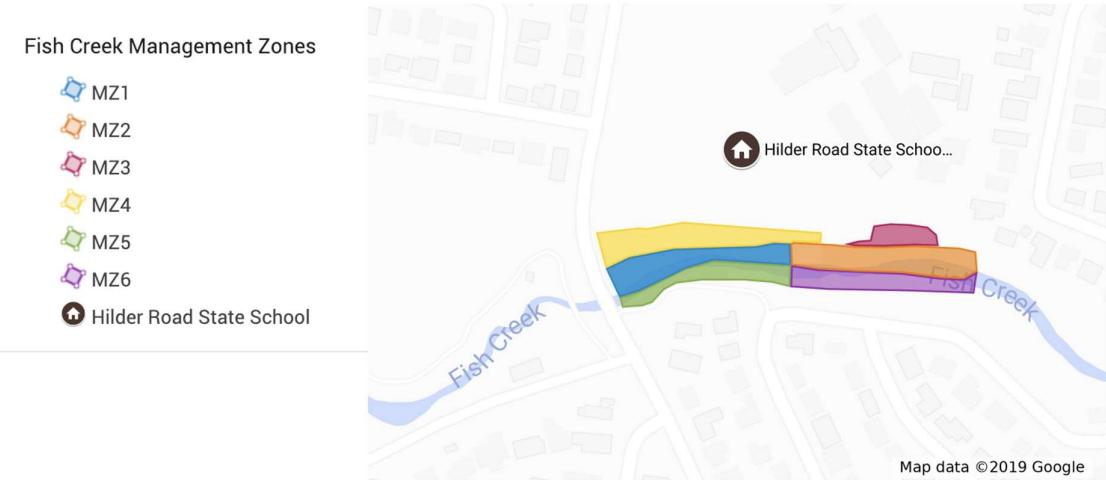


Figure 5 Management zone map of the Fish Creek restoration project

Each management zone is described below:

Management Zone 1 (MZ1): West Fish Creek - North Bank

MZ1 comprises the area subject of previous grants that has been cleared of weeds. The area has been under a weed management program for approximately two years and a pathway has been cleared to the mid-point of the Creek. The area boundary includes the fence line that separates the creek from the school grounds to the northern bank of Fish Creek to the centre line of the channel. The western boundary is Hilder Road and the culvert, and the eastern boundary is the mid-point of the Creek as it sits on the school property. This is marked by the netball courts and west of the storm water drain.

Management Zone 2 (MZ2): East Fish Creek - North Bank

MZ2 comprises the area east of MZ1, from the centre point of the creek as it occurs on the school boundary, to the east of the school where the school boundary finishes. It includes the north bank of the creek to the centreline of the creek channel. The area has not had any management treatments applied previously and is currently not accessible due to dense weed cover. The area includes a storm water drain, a spoil pile from previous construction activities near the creek (likely the netball courts), and is bounded in the north by the fence line.

Management Zone 3 (MZ3): Outdoor Classroom

MZ3 includes the area currently designated for development as an outdoor classroom, which is located to the east of the netball courts within the HRSS property boundary. MZ3 is being developed separately to the Fish Creek restoration project and, as such, is not included in the scope of this management plan.

Management Zone 4 (MZ4): Car Parking Area

MZ4 is the area north of Fish Creek within the HRSS property boundary. It is bounded to the south by the perimeter fence that separates the school from the creek and extends as far as the netball courts to the east. The area is currently being used as informal parking during events. A site survey indicated that run-off from this area is likely to be causing erosion of sections of the northern bank of Fish Creek.

Management Zone 5 (MZ5): West Fish Creek - South Bank

MZ5 is the southern bank of the western area of the creek. It follows the creek centreline as its northern boundary, Hilder Road and the culvert to the west, and the fenceline to the south of the creek. This area extends east to the mid-point of the creek as it occurs on the HRSS property.

Management Zone 6 (MZ6): East Fish Creek - South Bank

MZ6 is the southern bank of the eastern area of the creek. It follows the creek centreline as its northern boundary and the fenceline to the south of the creek. This area extends east to the end of the HRSS property boundary, and starts west of the storm water drain in the centre of the school property.

3.2. Weed and Pest Management

3.2.1. Management Mechanisms

Weeds

Weeds are invasive plants that have the potential to cause harm to environmental, economic and/or social values. Weeds are most commonly exotic (introduced) species, but in some cases they can be native species that are occurring outside of their usual, natural range.

Weed management is important to stop the spread of invasive and introduced species to other areas. It is important that weeds are properly identified and managed in a way that is appropriate to the type of weed. For example, some weeds can only be effectively controlled by pesticide spraying, while others must be physically removed.

Initial weed management is most effective when conducted by a qualified weed contractor, who can identify the weeds and treat them appropriately. Once the weeds have been identified and treated, ongoing weed management can then be implemented as part of volunteer drives or education programs where school students and/or community volunteers can be educated on weed identification, removal and treatment while assisting in ongoing weed management.

Weeds should be cleared and managed prior to any revegetation works to enable new plantings to have the best chance of establishment without unnecessary competition. As such, the weed program should be implemented first, prior to any other ground works or planting.

Once initial areas have been cleared of weeds, ongoing maintenance should be relatively straightforward and easy to manage with a relatively small volunteer group. Weed inspections and maintenance should be completed at least twice a year. It is most effective to complete a weed survey and maintenance activities immediately after the summer (when the majority of wet weather has

passed), as weeds will grow more rapidly and become more prolific with hot, wet weather. A second weed survey and maintenance program should be completed prior to summer in case weeds have emerged during the winter months, particularly if there has been rainfall over this period. As such, weed surveys and clearing activities are recommended to occur in May/June and October/November each year. If only one weed clearing activity can occur each year, then May/June would be the preferred period.

BCC has a useful Weed Identification Tool (<https://weeds.brisbane.qld.gov.au/>) that can be used to identify and control weeds.

Pests

Pests are species of animal or insect that are overabundant and have the potential to cause damage environmental, economic and/or social values. Pest species often occur in areas that provide favourable conditions, such as dense vegetation, standing water (e.g. mosquitoes), or poorly maintained areas impacted by human wastes (e.g. rats and cockroaches).

It is advisable for a licenced pest management contractor to conduct initial pest identification, treatment and removal. Pests are best managed by maintaining areas so that pollution and weeds are avoided and environments favourable to their existence are controlled. The HRSS should monitor for pest species and, where sightings are reported, engage a specialist pest management contract to investigate and treat areas of the Creek and surrounds as required.

3.2.2. Site Specific Requirements

The following table provides site specific requirements for each management zone relating to managing weeds and pests.

Management Zone	Activities	Resources	Time Frames
MZ1	<ul style="list-style-type: none"> → Monitor for weeds and pests → Ongoing weed management 	<ul style="list-style-type: none"> ● Volunteers for weed management activities ● Pest/weed contractor when required ● Equipment for weed removal (trowels, garden bags, wheelbarrows, gloves) ● Monitoring worksheet (to record species and amount removed) 	Twice yearly - October/November and May/June
MZ2	<ul style="list-style-type: none"> → Initial weed clearing → Monitor for weeds and pests → Ongoing weed management 	<ul style="list-style-type: none"> ● Pest/weed contractor for initial clearing activities ● Volunteers for ongoing weed management activities ● Equipment for weed removal (trowels, garden bags, wheelbarrows, gloves) ● Monitoring worksheet (to record species and amount removed) 	Initial weed clearing - May/June Ongoing maintenance - twice yearly (October/November and May/June)

MZ4	→ Monitor for weeds and pests	<ul style="list-style-type: none"> • Volunteers for ongoing weed management activities • Equipment for weed removal (trowels, garden bags, wheelbarrows, gloves) • Monitoring worksheet (to record species and amount removed) 	<p>Throughout the year (monitoring) in passing</p> <p>Ongoing maintenance - twice yearly (October/November and May/June)</p>
MZ5	→ Initial weed clearing → Monitor for weeds and pests → Ongoing weed management	<ul style="list-style-type: none"> • Pest/weed contractor for initial clearing activities • Volunteers for ongoing weed management activities • Equipment for weed removal (trowels, garden bags, wheelbarrows, gloves) • Monitoring worksheet (to record species and amount removed) 	<p>Initial weed clearing - May/June</p> <p>Ongoing maintenance - twice yearly (October/November and May/June)</p>
MZ6	→ Initial weed clearing → Monitor for weeds and pests → Ongoing weed management	<ul style="list-style-type: none"> • Pest/weed contractor for initial clearing activities • Volunteers for ongoing weed management activities • Equipment for weed removal (trowels, garden bags, wheelbarrows, gloves) • Monitoring worksheet (to record species and amount removed) 	<p>Initial weed clearing - May/June</p> <p>Ongoing maintenance - twice yearly (October/November and May/June)</p>

3.3. Erosion and Sediment Control

3.3.1. Management Mechanisms

Erosion and sediment control is important to protect the stability of the Creek and surrounding landscapes, and also to prevent excessive volumes of sediment from entering the waterways. While rivers, estuaries and their associated habitats require some sediments to survive, large volumes caused by erosion further upstream can cause pollution and damage the health of ecosystems and the waterway itself.

Measures to prevent erosion and control sediments have been prioritised below according to effectiveness:

1. Multistorey Vegetation
2. Surface Water Control
3. Sediment Entrapment
4. Repairs and Maintenance

Multistorey Vegetation

The most effective way to prevent erosion and control sediment loss is through vegetation at multiple levels - i.e. a mix of groundcovers, shrubs and trees. Plants hold soil together with their roots, providing soils with the nutrients and biological matter that help stabilise the land. Stems and trunks help to slow down the flow of surface water over the land during rainfall events, meaning that the friction between the water and the surface of the land is reduced, subsequently reducing the risk of erosion. Foliage, particularly from groundcover plants and decaying matter from trees and shrubs, help to trap any sediment and soil that may have been lifted by water during heavy rain, reducing the amount of sediment entering the waterways.

Reinstating vegetation where plants have been removed or cleared (particularly where understorey vegetation has been removed) should be the first line of defence in terms of erosion and sediment control. Revegetation for the project is covered in Section 4.5 in more detail.

Surface Water Control

Controlling the flow and velocity of surface water from rainfall events is key in reducing erosion and the transportation of sediments to waterways. There are numerous measures that can be put in place to control surface water:

- Grading hard surface areas - areas that cannot be vegetated because of their use (such as a car park) should be graded so that the flow of water is directed across the area to one specific point where it can then be controlled properly.
- Installing drainage - V-drains are an effective and cheap way to control water and prevent erosion. By direction water to a purpose-built drain, the area impacted by flowing water is reduced, and the water is controlled through a constructed channel that is properly maintained. V-drains can be installed cheaply by simple digging a small V-shaped trench on the edges of the area that needs to be drained and cannot be vegetated. Small rock structures or morphology within the V-drain can then be added to slow the flow of water down, so that the friction between the water and the soil is reduced and less erosion occurs.
- Rock structures - these can be used to slow down water where it enters a drainage channel or nears the creek. The rocks should be of varying size to trap sediment and debris while allowing the water to flow through. They should not completely restrict water flow, otherwise ponding and flooding behind the structure can happen. They also need to be regularly maintained, particularly after heavy rainfall
- Bunding and bunds are structures made from soil, rocks or semi-natural structures (such as sand bags) that create a barrier to water and direct it to a designated flow/discharge point. These should be temporary measures only and utilised in times of extreme rainfall and flooding.

Sediment Entrapment

Trapping sediment from areas where there is no vegetation and excessive erosion is important to protect the health and values of waterways. When vegetation cannot be reinstated as a means to trap

sediments, there are a number of mechanisms that can be used that consist of natural and manmade materials.

- Coir logs
- Sand bags
- Rock chutes
- Sediment fencing



Figure 6 Examples of erosion and sediment controls. Top left: coir logs; top right: sand bags; bottom left: sediment fencing; bottom right: rock chute

These methods should be considered temporary and require maintenance to ensure they remain effective while in use.

Repairs and Maintenance

Where erosion occurs under extreme events or has been previously uncontrolled, repair work may be required. Rock armouring is usually the most effective way to control further erosion where revegetation cannot be used as a more permanent measure. In such cases, the measures discussed previously should be implemented as appropriate. Note that most of the mechanical measures discussed in this section will require ongoing maintenance and replacement over time.

Areas should be monitored for emerging erosion or sediment loss at least yearly. It is recommended to conduct inspections prior to and following the wet/summer season (October/November and May/June) so that impacts from erosion and sediment loss can be reduced as much as possible.

3.3.2. Site Specific Requirements

The following table provides site specific requirements for each management zone relating to managing erosion and controlling sediment.

Management Zone	Activities	Resources	Time Frames
MZ1	→ Revegetation (see Section 4.5) → Ongoing monitoring	• Volunteers - monitoring worksheet to record instances and severity of erosion or sediment loss	Twice yearly monitoring (October/November and May/June)
MZ2	→ Revegetation (see Section 4.5) → Ongoing monitoring	• Volunteers - monitoring worksheet to record instances and severity of erosion or sediment loss	Twice yearly monitoring (October/November and May/June)
MZ4	→ Construction activities (grading, installation of V-drains) → Preventative measures (coir logs, rock chutes) → Ongoing monitoring	• Contractor to level car park (with single drainage point) and install V-drain • Materials - coir logs and rocks (various sizes) • Volunteers - installation of coir logs and annual/biannual monitoring (monitoring worksheet to record instances and severity of erosion or sediment loss)	Construction works to be completed May - August (prior to next wet season) Coir logs and rock to be installed before October Twice yearly monitoring (October/November and May/June)
MZ5	→ Revegetation (see Section 4.5) → Ongoing monitoring	• Volunteers - monitoring worksheet to record instances and severity of erosion or sediment loss	Twice yearly monitoring (October/November and May/June)
MZ6	→ Revegetation (see Section 4.5) → Ongoing monitoring	• Volunteers - monitoring worksheet to record instances and severity of erosion or sediment loss	Twice yearly monitoring (October/November and May/June)

3.4. Access and Walkways

3.4.1. Management Mechanisms

Access to the Creek areas and providing walkways is important for the project to enable students and the community to access the creek safely. Currently, there is only one formal access point - a gate located at the eastern end of the property boundary. Informal access points through the perimeter fence exist as gaps in the fence, or areas where the fence wire has become slack.

There is a cleared footpath along a short section of the northern bank of the creek on the western side. Aside from this, there is no other access along the creek bank.

Access to the creek currently involves stepping up and down the steep bank. There is no formal access into the creek channel or to the already cleared walkway.

Walkways should be cleared to enable safe passage along the top of the creek bank for the length designated for the project (from Hilder Road to the Outdoor Classroom). To protect vegetation and tree roots from trampling and erosion, it is recommended that the path is edged with simple timber edging, then backfilled where necessary with locally sourced soil or gravel. This will both prevent further erosion and provide safe passage for visitors.

Steps should be installed at two locations along the creek:

1. The north west end of the creek as it occurs on the property - current main access for the creek area
2. The north east section of the creek that borders the proposed outdoor classroom

3.4.2. Site Specific Requirements

The following table provides site specific requirements for each management zone relating to installing and managing access and walkways.

Management Zone	Activities	Resources	Time Frames
MZ1	<ul style="list-style-type: none">→ Install steps→ Install path edging and backfill→ Monitor	<ul style="list-style-type: none">• Habitat Brisbane - contractors to install steps, edging along already cleared path, and backfill• Soil/backfill - locally sourced soil (pool contractors) or gravel to backfill path• Volunteers - monitoring worksheet to identify any spot repair or maintenance needs	May to July construction works Twice yearly monitoring (October/November and May/June)
MZ2	<ul style="list-style-type: none">→ Install steps→ Clear pathway (avoid trees and shrubs - chose natural line if possible)→ Install path edging and backfill	<ul style="list-style-type: none">• Habitat Brisbane - contractors to install steps, edging along already cleared path, and backfill• Soil/backfill - locally sourced soil (pool contractors) or gravel to backfill path	May to July construction works Twice yearly monitoring (October/November and May/June)

	→ Monitor	<ul style="list-style-type: none"> Volunteers - monitoring worksheet to identify any spot repair or maintenance needs 	
MZ4	Not applicable		
MZ5	<ul style="list-style-type: none"> Clear pathway (avoid trees and shrubs - chose natural line if possible) Install path edging and backfill Monitor 	<ul style="list-style-type: none"> Habitat Brisbane - contractors to install steps, edging along cleared path, and backfill Soil/backfill - locally sourced soil (pool contractors) or gravel to backfill path Volunteers - monitoring worksheet to identify any spot repair or maintenance needs 	May to July construction works Twice yearly monitoring (October/November and May/June)
MZ6	<ul style="list-style-type: none"> Clear pathway (avoid trees and shrubs - chose natural line if possible) Install path edging and backfill Monitor 	<ul style="list-style-type: none"> Habitat Brisbane - contractors to install steps, edging along cleared path, and backfill Soil/backfill - locally sourced soil (pool contractors) or gravel to backfill path Volunteers - monitoring worksheet to identify any spot repair or maintenance needs 	May to July construction works Twice yearly monitoring (October/November and May/June)

3.5. Revegetation

3.5.1. Rationale

Revegetation may be required to replace areas of native vegetation that have been lost as a result of excessive disturbance - e.g. by erosion or clearing. Once weeds have been cleared from the project area, the extent of disturbance should be assessed to determine the extent of revegetation that needs to occur. It is preferable to allow areas of vegetation to regenerate naturally - i.e. self-propagate and seed - as this form of revegetation (natural) is the most successful in terms of establishment and habitat. However, it may be necessary to conduct assisted revegetation (where additional plants are planted in addition to natural regenerations). Cases where this may be required include:

- Areas that have been impacted by erosion
- Large spaces between native vegetation following weed removal
- Areas where a monoculture (one dominant species) is a risk
- Areas that have been previously cleared or disturbed by construction

3.5.2. Species Selection

Where assisted revegetation is required, a vegetation and habitat survey should be conducted to determine the most suitable species to be used in revegetation. Species selection should be based on the species already growing in the creek riparian zone, be native, and provide habitat complexity (i.e. a mixture of trees, shrubs and groundcovers).

A list of suggested species has been provided below:

- *Elaeocarpus grandis* (blue quandong)
- *Brachychiton discolor* (lacebark tree)
- *Eucalyptus tereticornis* (Queensland blue gum)
- *Casuarina cunninghamiana* (river she-oak)
- *Acacia concurrens* (black wattle)
- *Pipturus argenteus* (native mulberry)
- *Diospyros geminata* (Queensland ebony)
- *Callistemon viminalis* (river bottlebrush)
- *Christella dentata* (Binung fern)
- *Dianella caerulea* (blue flax lily)
- *Crinum pedunculatum* (Brisbane lily)
- *Lomandra longifolia* (long-leaved matrush)
- *Doodia aspera* (prickly rasp fern)
- *Goodenia rotundifolia* (star goodenia)

3.5.3. Methods

Replanting

Plants should be selected based on the native species surrounding the area within which they will be planted. Prior to planting, the area should be prepared by scouring the surface and turning over the top layer of soil to create a soft medium in which to plant, provide the new plant with looser soil within which it can set roots, and provide a pathway for water to enable the new plant to survive.

The general rule of thumb for diversity should be 20% upper-storey species (trees), 30% mid-storey plants (shrubs) and 50% lower-storey (groundcovers). Base the species to be planted in each area on what exists naturally. Some species co-exist with others as they provide flowers for reproduction or control pests.

The density of plants (i.e. the spacing between each plant) should be based on both recommended spacing (provided by the nursery) and the density of existing vegetation of the same species in the area. Where this is not clear, the following general rules can be followed:

- Trees: 4 to 5 metres apart
- Shrubs: 2 to 4 metres apart
- Groundcovers: 0.5 to 1 metre apart

Where planting is in response to erosion, a higher density of groundcovers should be selected to provide immediate cover and protection, and to further stabilise the soil where it is exposed.

If plants are being planted in the creek channel where water flow is likely to occur, plants with longer stems that enable water to pass between plants without causing major damage should be used.

Plants should be planted at the very end of summer/wet season to give the plants time to establish before the next wet seasons, but enough change of some rain so that they do not require additional watering. April to June is generally the best time to plant. Watering is likely to be needed regardless, and planting should take this into consideration.

Where possible, detritus, such as fallen branches, twigs and leaf litter, should be maintained during planting, or reinstated following, to continue to provide fauna with safe passage while the area is reestablishing.

Habitat Development

One of the main goals of revegetation should be to develop a diverse and supportive habitat for native fauna. Maintaining features that already exist in the creek area, such as tree hollows, is important to enabling fauna to continue to thrive in the area. Habitat can be created to encourage other fauna species to the area and should be included in the revegetation program. These include:

- Roosting boxes for birds and possums
- Perches for owls, nightjars, and bats
- Piles of logs, branches and sticks for small mammals and reptiles
- Leaf litter for frogs
- Rocks of varying sizes for amphibians and reptiles

These features should be included during revegetation and considered when clearing and preparing the site.

3.5.4. Maintenance

Once established, planted areas will require ongoing maintenance and monitoring to ensure they are growing and surviving. Weed control, thinning out of competing species, and removal of dead or diseased specimens may be required and should be included as part of the monitoring activities.

The idea of assisted revegetation is that it eventually becomes self-sustaining and requires very minimal maintenance. If revegetated areas are continuously requiring maintenance they cannot be considered sustainable.

3.5.5. Site Specific Requirements

The following table provides site specific requirements for each management zone relating to revegetation.

Management Zone	Activities	Resources	Time Frames
MZ1	<ul style="list-style-type: none">→ Prepare areas for replanting→ Select suitable species for each	<ul style="list-style-type: none">• Plants - from nursery / Habitat Brisbane / Queensland Government native trees programs	<p>April to July planting works</p> <p>Twice yearly</p>

	<p>area to be planted</p> <ul style="list-style-type: none"> → Install plants → Install habitat features → Maintain and monitor 	<ul style="list-style-type: none"> • Bird boxes, branches and sticks (collected locally) • Tools - rakes, spades, trowels • Watering equipment • Volunteers - planting and pre-work • Volunteers - monitoring worksheet to check progress of plants 	<p>monitoring till established</p> <p>Yearly monitoring once established</p>
MZ2	<ul style="list-style-type: none"> → Prepare areas for replanting → Select suitable species for each area to be planted → Install plants → Install habitat features → Maintain and monitor 	<ul style="list-style-type: none"> • Plants - from nursery / Habitat Brisbane / Queensland Government native trees programs • Bird boxes, branches and sticks (collected locally) • Tools - rakes, spades, trowels • Watering equipment • Volunteers - planting and pre-work • Volunteers - monitoring worksheet to check progress of plants 	<p>April to July planting works</p> <p>Twice yearly monitoring till established</p> <p>Yearly monitoring once established</p>
MZ4	<ul style="list-style-type: none"> → Prepare areas for replanting → Select suitable species for each area to be planted → Install plants → Maintain and monitor 	<ul style="list-style-type: none"> • Plants - from nursery / Habitat Brisbane / Queensland Government native trees programs • Tools - rakes, spades, trowels • Watering equipment • Volunteers - planting and pre-work • Volunteers - monitoring worksheet to check progress of plants 	<p>April to July planting works</p> <p>Twice yearly monitoring till established</p> <p>Yearly monitoring once established</p>
MZ5	<ul style="list-style-type: none"> → Prepare areas for replanting → Select suitable species for each area to be planted → Install plants → Install habitat features → Maintain and monitor 	<ul style="list-style-type: none"> • Plants - from nursery / Habitat Brisbane / Queensland Government native trees programs • Bird boxes, branches and sticks (collected locally) • Tools - rakes, spades, trowels • Watering equipment • Volunteers - planting and pre-work • Volunteers - monitoring worksheet to check progress of plants 	<p>April to July planting works</p> <p>Twice yearly monitoring till established</p> <p>Yearly monitoring once established</p>
MZ6	<ul style="list-style-type: none"> → Prepare areas for replanting → Select suitable species for each area to be planted → Install plants → Install habitat features → Maintain and 	<ul style="list-style-type: none"> • Plants - from nursery / Habitat Brisbane / Queensland Government native trees programs • Bird boxes, branches and sticks (collected locally) • Tools - rakes, spades, trowels • Watering equipment • Volunteers - planting and pre- 	<p>April to July planting works</p> <p>Twice yearly monitoring till established</p> <p>Yearly monitoring once established</p>

	monitor	<ul style="list-style-type: none"> • work • Volunteers - monitoring worksheet to check progress of plants 	
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3.6. Signage

Fixed signage will be placed along the edge of the walkway that provide information about the ecology, history and culture of the creek. The aim is to create an interactive and informative eco-walkway for students and the community to use. Rationale

The signage is to be informative and interactive. The physical signs will provide information on the ecology, history and culture of the creek. QR codes will provide an interactive component so users can link directly to the www.fishcreek4061.com.au website using their mobile technology. The users are primarily students at HRSS so they can access information pertinent to their Australian curriculum studies while in the creek environment. Teachers and staff at HRSS will be part of the process in deciding what material is important for each sign.

The signs will be placed adjacent to the pathway, initially from the Western gate to the midpoint gate and then in a future project, from the midpoint gate to the outdoor classroom at the Eastern end.

Between 6 and 12 signs will be placed along the entire planned pathway (from Western gate to outdoor classroom). Vandalism is an area of concern so when deciding on the construction of the signs and placement, this will need to be considered carefully.

3.6.1. Site Specific Requirements

The following table provides site specific requirements for each management zone relating to installing signage.

Management Zone	Activities	Resources	Time Frames
MZ1	<ul style="list-style-type: none"> → Install 4 x informative/interactive signs → Install 1 x explanation / welcome sign at midpoint gate 	<ul style="list-style-type: none"> • Metal/wooden vandal proof sign • Post • Material to secure post to sign and post to ground • Volunteers to put posts in • Spades • Attachment for sign on gate 	Completed by end of 2019
MZ2	<ul style="list-style-type: none"> → Install 4 x informative / interactive signs 	<ul style="list-style-type: none"> • Metal/wooden vandal proof sign • Post • Material to secure post to sign and post to ground • Volunteers to put posts in • Spades 	Completed after pathway has been created from midpoint to outdoor classroom.
MZ3	<ul style="list-style-type: none"> → Install 1 sign at outdoor classroom 	<ul style="list-style-type: none"> • Metal/wooden vandal proof sign 	Completed by end of 2019.

	- explanation / welcome to eco-walkway	<ul style="list-style-type: none"> ● Post ● Material to secure post to sign and post to ground. ● Volunteers to put posts in ● Spades 	
MZ4	→ Install 1 sign outside Western gate - explanation / welcome to eco walkway	<ul style="list-style-type: none"> ● Metal/wooden vandal proof sign ● Post ● Material to secure post to sign and post to ground ● Volunteers to put posts in ● Spades 	Completed by end of 2019.

3.7. Monitoring

3.7.1. Vegetation and Habitat Monitoring

Monitoring activities are to be carried out during pre-planned works or as part of routine inspections of the creek. Monitoring shall include the following:

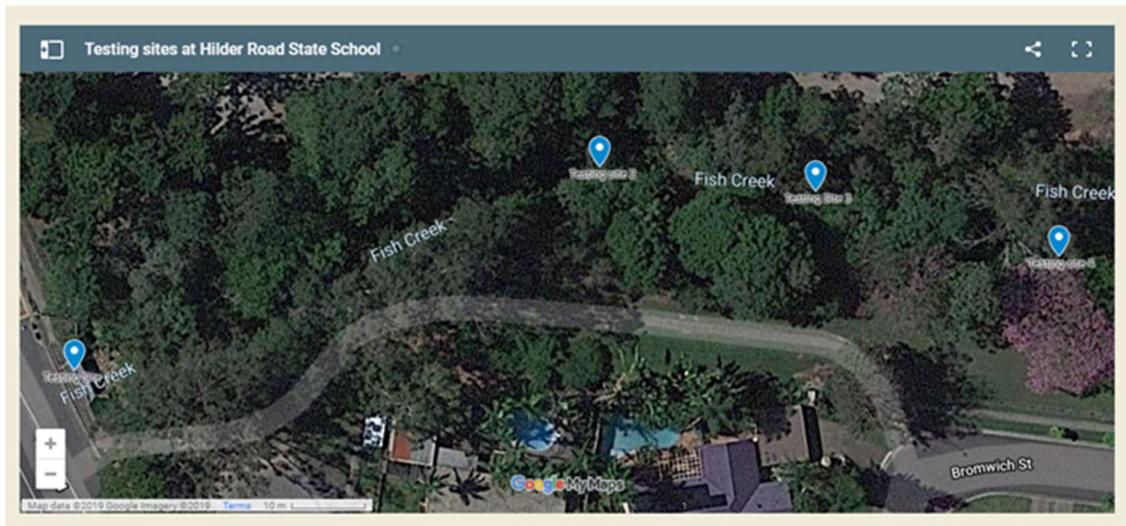
- Identifying any areas where planted vegetation is not successful (i.e. areas of die-back, failed plantings) and where revegetation is successful (plants are growing and established).
- Monitoring weeds - increases/decreases in weed presence, new species, recurrences of weeds where treatment has been previously applied.
- Monitoring growth - including the development of understorey (groundcovers), shrubs and trees. Noting any species that are not growing (being outcompeted) or are growing excessively (invading).
- Opportunistic fauna sightings - during inspections, note any fauna species (including reptiles and birds) that are seen in the area surrounding the creek.
- Habitat - note any nests, burrows, hollows, and other habitat features that are sighted while conducting the inspection. Make a note of their location so that they can be revisited in follow up inspections.

The information collected from the monitoring inspections should be used to inform future planting, species selection, and ongoing maintenance. Simple inspection checklists that include the above monitoring activities, as well as the date and location of features noted, should be developed to enable comparison and assessment of success.

3.7.2. Water Quality Monitoring

Water Quality testing has been completed since November 2016 at four data collection points along Fish Creek (see image below). The water quality data has been recorded on the www.fishcreek4061.com.au website for the HRSS parents and community to use for educational and scientific monitoring purposes. This will continue on an annual basis as long as the school continues to teach the amended Year 5 HASS (Geography) Unit 1 (see <http://fishcreek4061.com.au/2018/04/year-5-hass-geography/>) for more details.. The water quality

testing is an excursion that aligns with this unit of work and provides a meaningful way for students to understand the health of the creek and how to take action to look after it.



4. Schedule and Resources

4.1. Staging of Works

In order of priority:

- 1: Design and build a pathway**, including paths to access the creek for student observation and water quality testing. **Location:** MZ 1. **Timing:** By end of 2019.
- 2: Design and install a pedestrian gate.** **Location:** Interface between MZ1 - MZ2 **Timing:** By end of 2019.
- 3. Install v-drain and coir logs to reduce sedimentation.** **Location:** MZ1. **Timing:** Jun-Oct 2019.
- 4. Weed removal and planting** to reduce erosion in rehabilitated area. **Location:** MZ1 **Timing:** May/June and Oct/Nov annually.
- 5. Weed removal and rehabilitation.** **Location:** MZ2 **Timing:** May/June 2020.
- 6. Design and build a pathway**, connecting MZ1 to outdoor education classroom. **Location:** MZ2 **Timing:** By end of 2021 (Term 1 = design; Term 2 = weed; Term 3 = build; Term 4 = weed)
- 7: Consult with and support BCC** to rehabilitate southern side of Fish Creek. **Location:** MZ 5 & MZ6 **Timing:** From 2021

4.2. Resources

The following resources are available:

Resource	Provider
WH&S Risk Assessment	HRSS Bushcare Group Leader
Public Liability & Personal Accident Insurance	HRSS Bushcare Group - Mandatory completion of Working Bee Record Form
Tools & Equipment	HRSS Bushcare Group Leader
Rubbish Removal	Habitat Brisbane Officer
Seed collection & propagation	Habitat Brisbane Officer
Ongoing technical advice & training	Habitat Brisbane Officer
Trees/plants, stakes, mulch & other resources	Habitat Brisbane Officer (min 2 wks notice)
Bushcare books, guides & library resources	HRSS Bushcare Group (donated to HRSS library)

4.2.1. Equipment

An allocation of tools and equipment has been made to the Hilder Road State School Bushcare Group. This equipment will be managed and stored off-site by Jo Duncan - HRSS Bushcare Group Leader. Where applicable, suitable training will be arranged through HRSS Bushcare Group.

4.2.2. Financial

Fish Creek 4061 as a sub-committee of the Hilder Road P&C has the potential to receive investment from the Hilder Road P&C via school fundraising activities. Any request of funds must be supported by a quote, proposed at a P&C Committee meeting and formally approved by the P&C Executive prior to expenditure.

Fish Creek 4061 in its own right was successful at winning:

- Healthy Land and Water Award [category winner 2018]
- Ministers Grand Prize Winner [2015 & 2018]

The prize money must be used solely for supporting Fish Creek 4061 (i.e. is excluded from other Hilder Road P&C activities). The current balance of funds is \$24,047 (May 2019).

The Queensland Education Showcase Awards 2018 [category winner 2018] was awarded directly to Hilder Road State School. These funds (\$2,000) are allocated by the School Principal towards the Outdoor Classroom project.

Hilder Road State School Bushcare Group is eligible for up to \$5,000 per annum from Brisbane City Councils Habitat Brisbane Scheme.

4.2.3. Volunteers and Human Resources

Role	Nominated person	Contact
Fish Creek 4061 sub-committee member / education lead	Ollie Narbey	fishcreek4061@gmail.com
Fish Creek 4061 sub-committee member / Hilder Road State School Bushcare Group Leader	Ingrid S	fishcreek4061@gmail.com
Habitat Brisbane Officer	Jodi Rees	jodi.rees@brisbane.qld.gov.au
Hilder Road P&C Executive	P&C Secretary	hrsssecretary@gmail.com
Hilder Road P&C Members	N/A	
Parents & Friends of Hilder Road State School	N/A	
Hilder Road State School Bushcare Group Community Volunteers (age 5 - 90 yrs)	N/A	

5. Training and Guidance

Fish Creek 4061 in association with Hilder Road State School Bushcare Group welcome members to further develop their skills and meet others working in bushland around Brisbane. For more information and expressions of interest, contact HRSS Bushcare Group Leader

Habitat Brisbane Orientation Day: Annual event guides new and existing volunteers through the basics of bush regeneration, weed ecology and management. Contact: HRSS Bushcare Group Leader

Restoration celebration: Annual celebration by Brisbane City Council to thank community groups and individuals who undertake voluntary habitat restoration in Brisbane.

Technical training calendar: Ongoing through the year, including weed identification and control, seed collecting, plant propagation, working with wildlife etc.

First Aid Training: Open to members of HRSS Bushcare Group

Onsite training / volunteering: Induction and bushcare training, including site safety and the use of Personal Protective Equipment (PPE), bush regeneration techniques, basic weed and plant identification, use of small plant and equipment (brush cutter, motorised auger, water pump).

6. Health, Safety and Working with Children

To help manage risks on site and fulfill Workplace Health and Safety, all on-ground activity shall be considered a ‘working bee’ and conducted in accordance with Habitat Brisbane Workplace Health & Safety guidelines. There is no minimum number of participants constitute a ‘working bee’ and Working Bee Record Forms must be maintained for insurance purposes.

HRSS Bushcare Group has completed a Risk Assessment Worksheet (March 2019). This remains valid until March 2022.

Children 15 years and under must be supervised by a parent or guardian during all HRSS Bushcare Group activities.

Any activity involving children under 18 years on-site may require a blue card. Consultation with the Habitat Brisbane Officer must be undertaken prior to arranging any activities that involve children.

7. Budget FY19/20

Current funds available for the Fish Creek sub-committee is \$24,046.69.

Allocation of funds in order of priority:

Order number	Action	Estimated allocation of funds
ongoing	On-going website costs e.g. tiki toki timeline, url etc	\$300 / year
1	Digital signage located in MZ1 & MZ2	~\$8000
2	Creation and installation of gate at mid point between MZ1 and MZ2.	~\$2000
3	Maintenance of fence along HRSS school and creek boundary.	~\$500
4	Restoration of MZ2	~\$5000 - \$20000
5	Educational material for school	unknown ~\$500

These are approximate costs for all actions. Quotes and actual prices will be obtained and checked with P and C executive before actual expenditure of money.

Future funds may be acquired through yearly Habitat Bushcare group funding, application for environment grants, submission for awards.

8. Reporting

Fish Creek 4061 and HRSS Bushcare Group have several reporting obligations. There are currently no reporting obligations from recent awards or grants.

Reporting Requirement	Report to	Timing
Fish Creek 4061 sub-committee	Hilder Road P&C	1 week prior to monthly P&C meeting (during school term).
HRSS Bushcare Group	BCC	Annual
All injuries and near miss incurred by group members whilst working on site during a Working Bee	Habitat Brisbane Officer	By the end of the next working day
Missing or damaged equipment	Habitat Brisbane Officer	Within 5 working days
Herbicide application record sheet	Habitat Brisbane Officer	At each application.
Annual Works Plan	Habitat Brisbane Officer	Every 12 months - May
All Working Bee Records & Online survey	Habitat Brisbane Officer	Every 12 months - Jun/Jul