PARRAMATTA CITY COUNCIL

VINEYARD CREEK WATERWAYS MAINTENANCE AND REHABILITATION MASTERPLAN

VOLUME 1- MASTERPLAN

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1 VINEYARD CREEK

1.1 Introduction

Vineyard Creek drains a five km^2 catchment within the eastern section of the City of Parramatta. The catchment is generally bounded by Pennant Hills Road to the northwest, James Ruse Drive to the southwest, Carlingford railway line to the east and shoreline of Parramatta river in the south (Sinclair Knight, 1992). The catchment has increased in size from 4.2 km^2 to 5.04 km^2 as a result of diverted flow from Burnside Creek Catchment (Duckmanton, 2001).

Parts of Vineyard Creek and its tributaries have been subjected to substantial modification in stream form through the period of European settlement, but particularly during the period of intense urbanisation since 1970. The catchment is almost fully developed and is composed of low-medium density urban precincts with a Golf Course adjacent to the creek line significant areas of parkland throughout and light to medium industrial zones in the southern part of the catchment (Sinclair Knight, 1992).

The Vineyard Creek catchment is shown in **figure 1.1**. For all detailed mapping refer to **Volume 2.**

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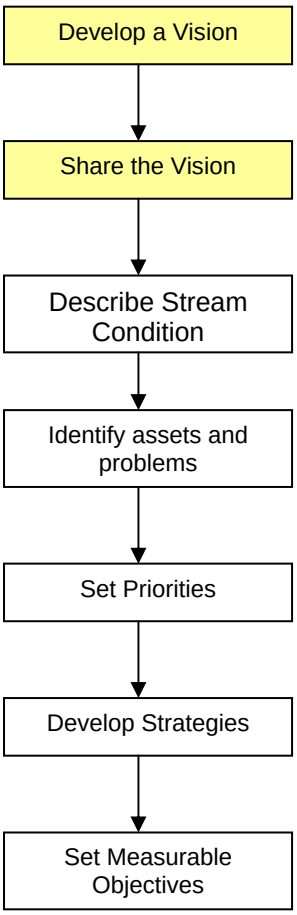
Vineyard Creek Waterways Maintenance and Rehabilitation Masterplan

Figure 1.1: Study area

1.2 A Vision for Vineyard Creek

Through consultation with the local residents the following vision was set:

> ***A Vision for Vineyard Creek***
>
> *"Ownership, education, partnership & community*:
> Council, land owners, everyone to re-instate natural values (including flora, fauna and base water flows), maintain passive recreation & walking access and address flooding."



1.2.1 What does it mean?

A community forum was held to assist in the development of a "*Vision*" for the waterway corridor. The vision outlined the most important aspects of the creek to preserve and the most critical issues to be addressed.

The community focus group identified the major issues affecting the creek as lack of flows, weed infestation, erosion/flooding caused by stream blockages, and poor water quality. From this the following components of the vision were derived:

***Ownership, education, partnership & community*:**
These were considered to be the fundamental to the preservation of the creek.

Natural values (including flora, fauna and base water flows):
The community would like to see the reinstatement of natural values that support native flora and fauna. In particular the maintenance of natural water flows was seen as important for the creek.

Maintain passive recreation & walking access:
The value of the waterway corridor as an open space / natural reserve offering a diverse range of passive and recreational opportunities was supported. The focus was on passive recreation such as walking through informal network of paths.

Flooding:
It was recognised that due to the close proximity of development of the creek that the sustainable management of the creek included a balance with protecting properties from flooding.

With these issues at the forefront, and in consideration of best practice stream management methodologies, the following *Masterplan* for the future rehabilitation and maintenance of the waterway corridors has been developed.

1.3 Preparation of the Masterplan

1.3.1 Vineyard Creek: Then and Now

The Maintenance and Rehabilitation Masterplan was prepared following the principles of best practice in waterway corridor rehabilitation as described in Council's supplementary report: **STREAMCARE – Waterways Management Guidelines.**

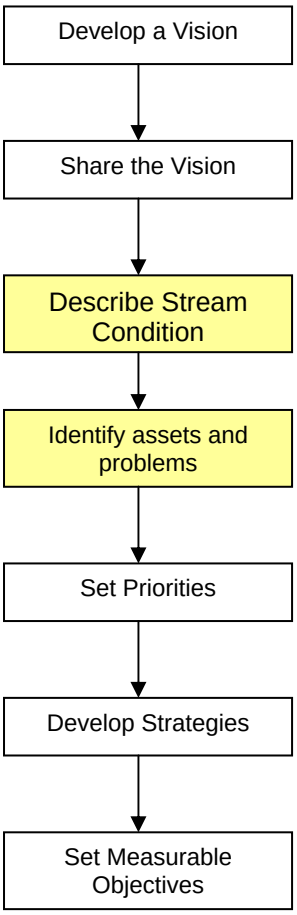
In the preparation of the Masterplan an assessment of the pre-European condition of Vineyard Creek including vegetation structure and stream dynamics was undertaken. This included a review of impacts over time as a result of urbanisation and a history of reconstruction and restoration activities.

A mapping exercise was prepared detailing the present condition of the waterway corridor and specific features such as infrastructure, vegetation, fauna, flow regime and water quality within Vineyard Creek. A further detailed mapping exercise was then prepared for waterway corridor producing 5 separate maps of the existing condition and issues.

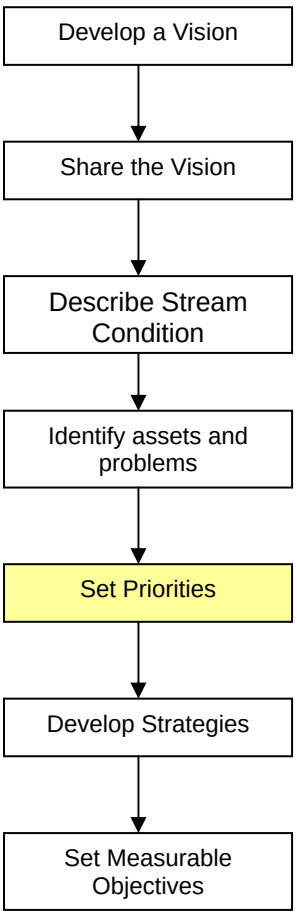
An opportunities and constraints analysis was prepared to determine the possible future improvements that were feasible. This explored the issues of:

- Quality of remnant vegetation;
- Diverse and naturally functioning stream;
- Bank stability;
- Flood behaviour;
- Access and recreation;
- Land ownership constraints; and
- Existence of volunteer bush regeneration or other community groups in the area.

Due to the occurrence of flooding within the Vineyard Creek catchment a technical assessment of the hydraulic behaviour within Vineyard Creek was undertaken to assess the current status and implications of any recommended waterways management activities on flooding.



For details on this process refer to **Volume 2**.



1.3.2 Objectives and Priorities

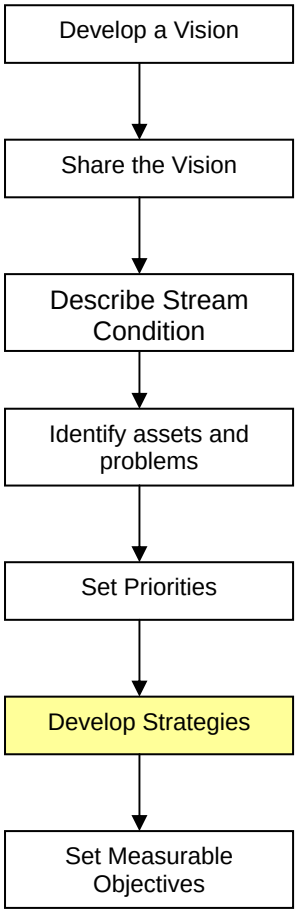
Based on this history and current status, specific actions were prepared which responded to the desired Vision for Vineyard Creek that was determined through a consultation and focus group process. The proposed actions were assessed and prioritised based on the criteria in **Table 1.1.**

Table 1.1 Prioritisation methodology

Criteria	Value Judgement	Description
COMMUNITY BENEFIT	High	Significant participation in project by community, engaging in all aspects of project Significant improvements to access to waterway corridor for whole community
	Medium	Moderate participation in project by community, through a process of general consultation Moderate improvements to access to waterway corridor
	Low	Involvement in partnerships with special interest stakeholders only, limited general consultation Little improvement in access to waterway corridor
RISK MANAGEMENT (risk of environmental degradation)	High	Remove or reduce a significant risk
	Medium	Remove or reduce a moderate risk
	Low	Reduce a moderate risk
ENVIRONMENTAL BENEFIT	High	Significant species and/or habitat improvement or rehabilitation Significant contribution to creek stability
	Medium	Moderate species and/or habitat improvement or rehabilitation Moderate contribution to creek stability
	Low	Little species and/or habitat improvement or rehabilitation Little contribution to creek stability
EFFECTIVENESS Number of Waterway "Target Conditions" and "*Vision*" Elements Addressed	High	Significant number of elements addressed
	Medium	Moderate number of elements addressed
	Low	Some/few elements addressed
COST	High	< $20,000
	Medium	Between $20,000 & $50,000
	Low	> $50,000

For details on this process refer to **Volume 2**.

The result of this process is the development of a detailed Masterplan for Vineyard Creek that is based on 'best practice' and balances the environmental and social issues to achieve 'a sustainable, biologically diverse, stable, naturally functioning waterway corridor' that we can pass on to future generations.



1.4 MASTERPLAN MAPPING

Table 1.2: Costings and Priority Evaluation – Reaches 1 and 2 – HIGH rehabilitation priority

	Principal Masterplan Activity	Capital Cost Estimate *(One-off or annual)*	Priority Rank
1.1	**Management Maintenance** - Activity Type O – Monitoring and Investigation Assess hydraulic capacity of upstream drainage to identify extent of overland flow ie. Anecdotal evidence from golf course personnel indicates that the stormwater pipes upstream of the site may be operating under capacity and causing overland flow contributing to observed erosion. Liaise with SMEC to discuss the outcomes of their pipe/pit investigate and determine whether infrastructure replacement will assist erosion control. **Management Maintenance** - Activity Type P - Monitor/ maintain Inspection of drainage works after storm event	$27,072	5
	Stormwater works - Activity Type L – Minor works Collect overland flows and divert in an armoured channel to deliver flows to streambed. Eroded areas are shown on Figure 2.1 and are indicated by the legend.		
	Revegetation – Activity Types A, B, D and F Adopt a 'top-down' catchment management approach, incorporating tributaries to contain weed spread via water Consider using erosion control measures in association with revegetation works on the upper slopes eg. geofabric/geotextiles, coconut fibre. *Recommend – Contractor and Bushcare group strategy*	$50,000	
	Education – Activity type G - Edge impacts Consider forming a partnership with the Golf Course and community in the upper catchment to address stormwater pollution, nutrients, and the spread of weed propagules.	$15,000	
1.2	**Stormwater Management** - Activity Type N - Remove Snags/Blockages Hand remove snags and blockages and/or any other rubbish and debris. Investigate the need for mosquito control if required. Stabilise instream erosion points in association with revegetation. Consider the use of geotextiles or hand placing rocks to stabilise instream erosion points if required..	$4,000	18
1.3	**Revegetation** - Activity Types A and D Adopt a 'top-down' catchment management approach, incorporating tributaries to contain weed spread via water Work to reconnect bushland canopy Recommend – Contractor and Bushcare group strategy	$25,000(3)	12
1.5	**Management maintenance** - Activity Type O - Monitoring and investigation Investigate stormwater outlet near gabion structures. Investigate the need to protect steep slopes from erosion using a drop structure immediately downstream of outlet.	$25,000	24

For further information on 'Activity Types' refer to **Table 1.5**

	Principal Masterplan Activity	Capital Cost Estimate *(One-off or annual)*	Priority Rank
	Revegetation - Activity Types A and D Adopt a 'top-down' catchment management approach, incorporating tributaries to contain weed spread via water Work to reconnect bushland canopy Design revegetation works to address weed spread at stormwater outlets Use erosion control measures on the steep slopes in association with weed treatment (especially Madiera Vine treatment). Appropriate controls may include geotextile or jute mesh. Recommend – Contractor and Bushcare group strategy		
1.6	**Revegetation** - Activity Type F *Recommend – Contractor and Bushcare group strategy*	$25,000	20
1.7	**Stormwater Management** - Activity Type L – Minor works Use coir logs and hand placed rock to protect bank where severe instability is occurring. Retain existing large woody debris	$5,520	2
	Management maintenance - Activity Type P - Monitor/ maintain Inspect repair works after storm events and repair where necessary		
	Revegetation - Activity Type F *Recommend – Contractor and Bushcare group strategy*	$25,000	
	Management maintenance - Activity Type R – Prevention Signage Provide clear signage to inform residents that dumping materials, including green waste is not allowed. Inform public of the biodiversity value of native environment	$1,200	
	Education/ Recreation - Activity Type K – Enhance passive recreational potential Consider provision of seating adjacent tracks to take advantage of views / bushland character	$3,000	
1.9	**Stormwater Management** - Activity Type M – Major works Construct bed armouring on both arms in the vicinity of the sewer overflow to prevent further bed incision. Provide bank protection near sewer overflow	$29,760	13
	Management maintenance - Activity Type P - Monitor/ maintain Inspect repair works after storm events and repair where necessary		
1.10	**Management Maintenance** - Activity Type O – Monitoring and Investigation Investigate environmental flow requirements of Vineyard Creek (consider both the old and new weirs at this site) Approach and liaise with DLWC to assess the ecological/geomorphological requirements of Vineyard Creek (including seasonal flow variations essential for ecosystem health). Consider the implications of the Water Management Act 2000 which stipulates that water be provided specifically for environmental needs as a priority ie. consider whether environmental flow studies are required in the future through the implementation of this legislation Activity Type R - Signage Install clear signage notifying residents and visitors of the of the health and safety risks associated with swimming there (especially in relation to potential sewage overflows in the area)	$30,000	6
1.11	**Revegetation** - Activity Types A, B and F *Recommend – Contractor and Bushcare group strategy*	$50,000	14

For further information on 'Activity Types' refer to **Table 1.5**

	Principal Masterplan Activity	Capital Cost Estimate *(One-off or annual)*	Priority Rank
1.12	**Revegetation** - Activity Types B and F - Weed Infestation *Recommend – Contractor and Bushcare group strategy* Cull Pittosporum Treat weed infestation prior to any culling. Remove Pittosporum growing directly underneath large native canopy trees. Remove all juveniles (< 1m) and 1 in 3 adult plants in years 1-2 *Recommend – Contractor*	$50,000	15
1.13	**Revegetation** - Activity Type F *Recommend – Contractor*	$25,000	22
1.14	**Education/ recreation** - Activity type H – edge impacts Review edge situation in liaison with Golf Course to provide a formalised edge/ buffer between maintained grassed areas and native bushland, investigate need for control of runoff by catch drains/ swales, and investigate current practices in use of fertilisers/ other chemicals for maintained grass	($10,000 for Golf Course)	16
1.15	**Education/ Recreation** - Activity type I – reserve entry points Provide entry / identity signage at track junctions with public roads Provide paved thresholds (eg sandstone) at entry points	$13,550	10
1.16	**Education/ Recreation** - Activity type J – bush trails Confirm trail alignment to be removed (ie. where trails are surplus to access requirements or causing environmental degradation) Ameliorate trail alignment to provide suitable growing conditions for revegetation Undertake regeneration and stabilisation as required Provide temporary fencing	$8,380	7
1.17	**Revegetation** - Activity Types D and F - Weed Infestation Lack of Native Vegetation Continue rehabilitation by controlling keystone weeds (vines and woody weeds as a priority) Maintain vacant land and edge sites Gain public support for a long-term Bushcare program Progressively rehabilitate selected sites, adopting a 'top-down' catchment management approach Increase density / species diversity of previous plantings *Recommend – Contractor and Bushcare group strategy*	$50,000	11
1.18	**Revegetation** - Activity Types B and D Consider focussing initial revegetation on the quarry to enhance passive recreation potential, clearing privets and opening up the quarry for better viewing. *Recommend – Contractor and Bushcare group strategy*		
	Education/recreation - Activity Type K – Enhance passive recreational potential Consider installation of signage to provide information about the history of the quarry Activity type J – bush trails Upgrade existing walking track Undertake regeneration and stabilisation as required Upgrade fencing for safety	$25,000	23

For further information on 'Activity Types' refer to **Table 1.5**

	Principal Masterplan Activity	Capital Cost Estimate *(One-off or annual)*	Priority Rank
1.19	**Stormwater Management** - Activity Type L and M Construct minor bank stabilisation on left hand side Construct bed armouring to prevent movement of headcut Grind willow stumps to minimise flow disturbance	$14,060	17
	Management Maintenance - Activity Type P - Monitor/ maintain Assess bank protection works after storm events and determine if more heavy duty armouring is require		
	Revegetation - Activity Types C and E Recommend – Contractor	$50,000	
1.20	**Revegetation** - Activity Types B, D, E and F *Recommend – Contractor and Bushcare group strategy*	$50,000	8
1.21	**Revegetation** - Activity Types B, D, E and F Revegetate to support pool and riffle and flood channel features at this site. *Recommend – Contractor and Bushcare group strategy*	$50,000	9
	Management Maintenance - Activity Type R - Signage Install clear signage notifying residents that dumping of rubbish is prohibited	$1,200	
	Management Maintenance - Activity Type S – Review Setbacks Review all new development or redevelopment applications to determine riparian setback implications for Riparian Zone / Riparian Buffer Zone Liaise with landholders for implementation of Potential Planning Controls for the proposed Riparian Zone / Riparian Buffer Zone	$3,000	
1.22	**Stormwater Management** - Activity Type L – Minor works Removal of the dumped car by crane at this site is constrained by overhead wires, winching the car may cause significant disturbance/damage to creek banks and local ecology. Recommend leaving the car where it is, consider removing the roof of the car to address the lack of visual amenity. Stabilise erosion through replanting.	$6,000	19
	Management Maintenance - Activity Type P - Monitor/ maintain Regularly inspect stream and embankment for dumped materials		
	Revegetation - Activity Types C and F - Weed Infestations *Recommend – Contractor and Bushcare group strategy*	$25,000	
	Stormwater Management - Activity Type N - Remove Snags/Blockages Hand remove other snags and blockages and/or any other rubbish and debris. Investigate the need for mosquito control if required. Stabilise instream erosion points in association with revegetation. Consider the use of geotextiles or hand placing rocks to stabilise instream erosion points if required. *Recommend – Contractor and Bushcare group strategy*	$4,000	
	Management Maintenance - Activity Type R - Signage Install clear signage notifying residents that dumping of rubbish is prohibited	$1,200	
	Management Maintenance - Activity Type S – Review Setbacks Review all new development or redevelopment applications to determine riparian setback implications for Riparian Zone / Riparian Buffer Zone Liaise with landholders for implementation of Potential Planning Controls for the proposed Riparian Zone / Riparian Buffer Zone	$3,000	

For further information on 'Activity Types' refer to **Table 1.5**

	Principal Masterplan Activity	Capital Cost Estimate *(One-off or annual)*	Priority Rank
1.23	**Revegetation** - Activity Types B, C, D and F - Weed Infestations - Consider soil stability/slumping when removing woody weeds from creek banks, use bank stability measures such as geofabric, coir logs if required. *Recommend – Contractor and Bushcare group strategy* **Management of Threatened Species (TSC Act)** Re-route walking track if required to minimise pedestrian traffic and disturbance to this area. Care to be taken when undertaking weed control in vicinity of species. Inform regenerators as to presence of the threatened species and instruct on optimal management practices. Implement appropriate fire regime for this species. Note regenerative capacity of this species after fires is good. Apply for government assistance for management *Recommend – Contractor and Bushcare group strategy*	$50,000	1
	Education/ Recreation - Activity type I – bush trails Utilise existing bush trail network for education / recreation within the corridor: Erect interpretive signage based on the corridors natural / cultural heritage; and Select a focal point within each sub catchment for passive recreation improvements eg. small gathering area, seating, park information signage	$8,380	
2.1	**Revegetation** - Activity Types A, B, C, D and F - Weed Infestations - Stabilise sediment pulse through staged weeding and revegetation (consider using a patchwork revegetation technique). Use erosion controls where required. Focus on stabilising the sediment pulse as a priority then stabilise benches and creek banks (refer to **Volume 2 Figure 3.3** using the legend to identify these units). Consider soil stability/slumping when removing woody weeds from creek banks, use bank stability measures such as geofabric, coir logs if required. *Recommend – Contractor and Bushcare group strategy*	$50,000	4
	Education/ Recreation - Activity type G – edge impacts Consider placement of road barrier / edge to prevent parking / dumping access to road edge Consider placement of video surveillance camera as a deterrent if dumping recurs	$21,000 $10,950	
	Management Maintenance - Activity Type R - Signage Provide signage at park entries and prominent edges in forming visitors of efforts by Council / community to improve catchment condition. Signage content to include: vision for corridor; role of corridor; and minimisation of impacts on the corridor from adjoining developments and visitation	$1,200	
	Education/ Recreation - Activity type J – bush trails Confirm trail alignment to be removed – where surplus to access requirements or causing environmental degradation Ameliorate trail alignment to provide suitable growing conditions for revegetation Undertake regeneration and stabilisation as required Provide temporary fencing	$13,500	

For further information on 'Activity Types' refer to **Table 1.5**

	Principal Masterplan Activity	Capital Cost Estimate *(One-off or annual)*	Priority Rank
2.2	**Stormwater Management** - Activity Type L – Minor works Armour the stormwater outlet with rock and geotextile.	$3,840	3
	Management maintenance - Activity Type P - Monitor/ maintain Inspect drainage armouring works after storm events and replace where necessary		
	Revegetation - Activity Types A, B, C, D and F Opportunity to increase densities / spp diversity of previous plantings Re-instate canopy structure via planting of fast growing native shrubs (eg. Acacia, Kunzea, Dodonaea) @ 1 unit / 10 m^2 Remove silt islands – investigate the potential to re-instate wetland basin in conjunction with treatment of weed infestations by machine removal of silt islands (conditional on access and sediment disposal). Refer to Vineyard Creek flood studies to ensure this action does not impact on downstream flooding *Recommend – Contractor and Bushcare group strategy*	$50,000	
	Education/ Recreation - Activity type G – edge impacts Consider placement of road barrier / edge to prevent parking / dumping access to road edge Consider placement of temporary video surveillance camera if dumping recurs	$15,000	
	Education/ Recreation - Activity type J – bush trails Confirm trail alignment to be removed – where surplus to access requirements or causing environmental degradation Ameliorate trail alignment to provide suitable growing conditions for revegetation Undertake regeneration and stabilisation as required Provide temporary fencing	$18,600 $9,690	
	Management maintenance - Activity type R - Signage Provide clear signage informing public that dumping of any material, including green waste is illegal	$1,200	
2.1/ 2.2	**Education/ Recreation** - Activity type I – reserve entry points Provide entry / identity signage at track junctions with public roads Provide paved thresholds (eg sandstone) at entry points	$40,650	21

For further information on 'Activity Types' refer to **Table 1.5**

Table 1.3: Costings and Priority Evaluation – Reaches 3 and 5 – MODERATE rehabilitation priority

	Principal Masterplan Activity	Capital Cost Estimate *(One-off or annual)*	Priority Rank
3.1	**Revegetation** - Activity Types A, B, C, D and F *Recommend – Contractor and Bushcare group strategy*	$50,000	37
3.2	**Stormwater Management** - Activity Type M – Major Works Re-align stormwater outlets at this site into Vineyard Creek where feasible. Stabilise right hand bank of creek (refer to site sketch – Figure 3.3). Collect overland flows from right hand side of stream and transfer flows to Vineyard Creek using rock armouring to prevent gullying. Stabilise erosion around stormwater outlets and sewer overflows using rock armouring and geotextiles. Revegetate.	$54,576	25
	Management maintenance - Activity Type – P Monitor/Maintain Inspection of sewer overflow and sewer pipes in the area by suitably qualified personnel. Liaise with such personnel to either address or contribute to addressing the site erosion/water quality issues. Inspection of stabilisation works after storm events		
	Revegetation - Activity Types A, B, C, D and F Staged removal of woody weeds and vines that are holding creekbanks together Planting within approximately 3 m of Creek to include riparian species characteristic of local plant community (gully forest) *Recommend – Contractor and Bushcare group strategy*	$50,000	
	Activity type R - Signage Install signage informing public about sewer overflow and exfiltration issues	$1,200	
	Management maintenance - Activity Type O - Monitoring and investigation Carefully review recommendations of floodplain risk management plans. Revegetation works should be designed to provide an optimum roughness coefficient at this site as identified by the floodplain plan. Should works to increase channel width/depth be recommended at this site ensure that the creek channel is suitably stabilised to prevent erosion.	-	
3.3	**Revegetation** - Activity Type D Re-instate tree canopy via planting of fast growing native shrubs (eg. Acacia, Kunzea, Dodonaea) Planting within approximately 3 m of Creek to include riparian species characteristic of local plant community (gully forest) *Recommend – Contractor and Bushcare group strategy*	-	32
3.4	**Revegetation** - Activity Type C Recommend – Contractor	$50,000	38
3.5	**Revegetation** - Activity Types A, B, D and F Staged removal of woody weeds and vines that are holding creekbanks together Planting within approximately 3 m of Creek to include riparian species characteristic of local plant community (gully forest) *Recommend – Contractor and Bushcare group strategy*	$50,000	39

For further information on 'Activity Types' refer to **Table 1.5**

	Principal Masterplan Activity	Capital Cost Estimate *(One-off or annual)*	Priority Rank
3.7	**Revegetation** - Weed Infestation – Activity Types C and D Staged removal of weeds and replacement with native macrophytes Activity Type N - Remove Snags/Blockages Hand remove snags and blockages and/or any other rubbish and debris. Investigate the need for mosquito control if required. Stabilise instream erosion points in association with revegetation. Consider the use of geotextiles or hand placing rocks to stabilise instream erosion points if required. Recommend – Contractor	$25,000	33
3.8	**Revegetation** - Activity Type A Vines may be providing stability of creekbanks – staged removal may be required *Recommend – Contractor*	$25,000	34
	Management Maintenance - Activity Type S – Review Setbacks Review all new development or redevelopment applications to determine riparian setback implications for Riparian Zone / Riparian Buffer Zone. Liaise with landholders for implementation of Potential Planning Controls for the proposed Riparian Zone / Riparian Buffer Zone	$3,000	
3.9	**Education/ Recreation** - Activity type H – edge impacts Inspect resident boundaries to identify encroachment / garden escape problems Liaise with residents through consultation process for education and awareness of environmental objectives and preferred practises Undertake follow up inspections Potentially involve property owners in the rehabilitation and stabilisation of the stream in their back yards	$10,000	28
	Management Maintenance - Activity Type S – Review Setbacks Review all new development or redevelopment applications to determine riparian setback implications for Riparian Zone / Riparian Buffer Zone. Liaise with landholders for implementation of Potential Planning Controls for the proposed Riparian Zone / Riparian Buffer Zone	$3,000	
3.10	**Education/ Recreation** - Activity type H – edge impacts Inspect resident boundaries to identify encroachment / garden escape problems Liaise with residents through consultation process for education and awareness of environmental objectives and preferred practises Undertake follow up inspections	$1,200	31
3.11	**Education/ Recreation** - Activity type H – edge impacts Inspect resident boundaries to identify encroachment / garden escape problems Liaise with residents through consultation process for education and awareness of environmental objectives and preferred practises Undertake follow up inspections	$13,500	27
5.1	**Stormwater Management** - Activity Type L – Minor Works Stabilise erosion with revegetation techniques (refer to revegetation Activity Type F, specifically typha management)	$10,000	35

For further information on 'Activity Types' refer to **Table 1.5**

	Principal Masterplan Activity	Capital Cost Estimate *(One-off or annual)*	Priority Rank
	Stormwater Management - Activity Type N -Remove Snags/Blockages Hand remove snags and blockages and/or any other rubbish and debris. Investigate the need for mosquito control if required. Stabilise instream erosion points in association with revegetation. Consider using geotextiles or hand placing rocks to stabilise instream erosion points. *Recommend – Contractor*	$4,000	
	Revegetation - Activity Types A, C, D and F - Weed Infestation *Recommend – Contractor*	-	
5.2	**Revegetation** - Activity Types B, D and F Important to revegetate following weed removal to maintain visual buffer between university and industry Dense vegetation in this reach may be stabilising existing floodplain sediments. Any revegetation activities must be staged to protect these sediment stores. *Recommend – Contractor*	$50,000	29
5.3	**Revegetation** - Activity Types A, B, C, D and F Important to revegetate following weed removal to maintain visual buffer between university and industry Dense vegetation in this reach may be stabilising existing floodplain sediments. Any revegetation activities must be staged to protect these sediment stores. Recommend – Contractor	$50,000	30
5.4	**Stormwater Management** - Activity Type L – Minor Works Stabilise undercutting using revegetation techniques. Investigate appropriate plant species for this stabilisation of creek banks at this site. Investigate the use of rockwork or hard engineering structure in association with revegetation techniques to assist in stabilisation. Works need to be suitable to the tidal influences at this site. Liaise with department of transport/river transport agencies to discuss ways to minimise erosion at creek outlets due to boat-generated wave action	$25,000	36
5.5	**Stormwater Management** - Activity Type O - Remove Snags/Blockages Hand remove snags and blockages and/or any other rubbish and debris. Investigate the need for mosquito control if required. Stabilise instream erosion points in association with revegetation. Consider the use of geotextiles or hand placing rocks to stabilise instream erosion points if required.	$4,000	26
	Revegetation - Activity Type G - Mangroves On-going maintenance program – mangroves trap silt and litter. A clean-up/maintenance program is required at this site to ensure that litter is removed. The site should be maintained so that nutrients attached to silt particles do not lead to weed infestation and the degradation of mangrove health. *Recommend – Contractor*	-	
	Education/ Recreation - Activity type G – edge impacts Inspect resident boundaries to identify encroachment / garden escape problems Liaise with residents through consultation process for education and awareness of environmental objectives and preferred practises Undertake follow up inspections Involve property owners in the rehabilitation and stabilisation of the stream in their back yards	$7,000	

For further information on 'Activity Types' refer to **Table 1.5**

Principal Masterplan Activity	Capital Cost Estimate *(One-off or annual)*	Priority Rank
Management Maintenance - Activity Type S – Review Setbacks Review all new development or redevelopment applications to determine riparian setback implications for Riparian Zone / Riparian Buffer Liaise with landholders for implementation of Potential Planning Controls for the proposed Riparian Zone / Riparian Buffer Zone	$3,000	

For further information on 'Activity Types' refer to **Table 1.5**

Table 1.4: Costings and Priority Evaluation – Reach 4 – LOW rehabilitation priority

	Principal Masterplan Activity	Capital Cost Estimate *(One-off or annual)*	Priority Rank
4.1	**Stormwater Management** - Activity Type M – Major Works Construct bank protection to prevent bank erosion and movement of creek into property areas where machines are accessible to the site. Trial various soft engineering techniques such as coir logs, jute matting, and revegetation techniques such as long stem planting, and manually placed rock protection where access for machinery is difficult. Liaise with landowners regarding if and how they wish to be involved in the creek works. Landholder participation may range from removing structures from the floodplain to revegetation of creek banks.	$72,000	45
	Management Maintenance - Activity Type P -Monitor/Maintain Regularly assess the stormwater works trialed on site (ie. various bank stabilisation techniques) after storm events and report on preferred techniques and repair where necessary		
	Management Maintenance - Activity Type R - Signage Install signage for local residents regarding the bio diversity values of the stream and that dumping of any materials including green waste (lawn clippings) is prohibited	$1,200	
	Management Maintenance – Activity Type O - Monitoring and investigation Carefully review recommendations of the floodplain risk management plan. The large amount of sediment stored in this zone may be destabilised by channel widening or channel clearing activities potentially leading to widespread erosion. Any proposed reduction in vegetative roughness should also be investigated to ensure ongoing creek stability. A hard engineering solution may be required here and Council may need to consider the resulting loss of ecological values. Any proposed flood mitigation works in this reach will require further detailed investigation.	-	
4.2	**Stormwater Management** - Activity Type L – Minor Works Minor bank stabilisation using soft engineering techniques such as coir logs, jute matting and manually placed rock protection, revegetate the site.	$9,600	41
	Management Maintenance - Activity Type P -Monitor/Maintain Inspect any stabilisation works after storm events and repair where necessary		
4.3	**Revegetation** - Activity Types A, B, D and F Dense vegetation in this reach may be stabilising existing floodplain sediments. Any revegetation activities must be staged to protect these sediment stores. *Recommend – Contractor*	$50,000	43
	Management Maintenance - Activity Type S – Review Setbacks Review all new development or redevelopment applications to determine riparian setback implications for Riparian Zone / Riparian Buffer Zon. Liaise with landholders for implementation of Potential Planning Controls for the proposed Riparian Zone / Riparian Buffer Zone	$3,000	
4.4	**Revegetation** - Activity Type C, D and F Dense vegetation in this reach may be stabilising existing floodplain sediments. Any revegetation activities must be staged to protect these sediment stores. Recommend – Contractor	$50,000	42

For further information on 'Activity Types' refer to **Table 1.5**

	Principal Masterplan Activity	Capital Cost Estimate *(One-off or annual)*	Priority Rank
4.5	**Stormwater Management -** Activity Type L – Minor Works Armour around bridge abutments using rocks and geotextiles Eroded areas are shown in **Volume 2 Figure 2.4** and are indicated by the legend. Repair damaged pipe infrastructure and armour around stormwater outlets (refer to action 2.2 and associated sketch for guidance).	$31,200	
4.6	**Management Maintenance** - Activity Type S – Review Setbacks Review all new development or redevelopment applications to determine riparian setback implications for Riparian Zone / Riparian Buffer Zone. Liaise with landholders for implementation of Potential Planning Controls for the proposed Riparian Zone / Riparian Buffer Zone	$1,500	40
ALL	**Education/ Recreation -** Activity type G – edge impacts Inspect resident boundaries to identify encroachment / garden escape problems Liaise with residents through consultation process for education and awareness of environmental objectives and preferred practises Undertake follow up inspections Involve property owners in the rehabilitation and stabilisation of the stream in their back yards	$10,000	44

For further information on 'Activity Types' refer to **Table 1.5**

1.5.1 VINEYARD CREEK ACTIVITIES KEY

Table 1.5 - Activity Key

REVEGETATION ACTIVITIES	
Activity	Description
A	**Manage Introduced Vines (eg. Madeira Vine, Balloon Vine and Morning Glory)** • Remove vines from native canopy trees as a matter of priority • On steep slopes – poison and/or clear vines, and stabilise soil as required • Consider application of 'vine specific' herbicide (eg. Starane) to avoid impacting on native vegetation • Monitor weed regrowth and treat as required
B	**Manage Woody Weeds (eg. Lantana, Privet and Ochna)** • Cut stump or drill/poison woody weeds (Roundup, Glyphosate 340) *in-situ* • On steep slopes and creekbanks maintain soil stability by leaving roots *in-situ* (minimal soil disturbance) • Use stockpiled woody weed debris to provide fuel for regeneration burns in cleared areas • Control regrowth (hand weeding and/or spot spray) • Consider use of woody weed specific herbicide (eg. Grazon or Brushoff) to preserve native grasses • Monitor weed regrowth and treat as required
C	**Manage Aquatic Weeds** • Give priority to aquatic noxious weeds (eg. Water Hyacinth, Salvinia) • Note legal requirement to obtain EPA permit for herbicide application in aquatic environment. Recommend engage a specialist contractor • Monitor weed regrowth and treat as required • Typha may dominate the creek bed and cause erosion of outer channel, it may also trap gross pollutants. It is persistent and may require repeat treatments over a number of years to eradicate (and it may regenerate). Treat Typha initially - consider controlled burning* or chemical application* (eg. Roundup Biactive). If planning to spray, do so in late Autumn while still green. The channel may be deepened to discourage typha regrowth. Address erosion by grading back creek bank edges, stabilise using geofabric, jute matting or other erosion control measure and replant with fast growing species to out compete typha regeneration. Maintain grades and depths and remove emergent vegetation colonising the interior of the channel every 3-6 months. If litter is an issue, address at the source or by installing litter traps upstream. * A permit is required from the EPA under the Control of Burning Regulation, any herbicide use is subject to label specification under NSW legislation. The keeping of records of pesticide application may also be required.
D	**Revegetation** • Restore tree canopy and sub-canopy via plantings • Reinstate native understorey • In riparian zone use native macrophytes at toe of slope to reinforce creek banks and decrease sedimentation • Increase density / species diversity of any previous plantings
E	**Bushfire Management** • Clear and/or maintain appropriate firebreak behind properties (bushland/residential interface) • Encourage/educate residents to manage 'bushland/residence' interface beyond firebreak zone (eg. selectively hand clear (once every two years) to remove leaf litter and fallen timbers) • When planting in interface zone, use mesic/low flammable species • Create burn piles of woody debris as a short term hazard reduction in particular near residential boundaries
F	**General Weed Control** • Target noxious and environmental weeds • Maintain soil stability and revegetate as required • Maintain existing Bushcare/Contractor worksite • Develop cooperative works program with adjoining landowners to contain weed invasion from private property
G	**Mangrove management** • Liaise with Waterways Authority to confirm agreed management approach

RECREATION ACTIVITIES

Activity	Description
H - Edge impacts	**Community Education** • Raise community awareness about the importance of natural areas and the potential impacts from urban areas on the natural environment • Plan and implement a public education program aimed at improving community awareness of environmental values. Topics covered should include: - dumping; - encroachment; - appropriate use of pesticides, herbicides and other chemicals; - weed management; and - management of domestic animals.
	Edge Treatment • Provide a coordinated approach to Reserve edges whereby a consistency in elements (eg. barriers, signage, pathways) are used to promote user legibility and understanding.
I - Reserve entry points	**Entry Definition** • Provide entry points to Vineyard Creek Reserve through provision of consistent landscape treatment and signage • Formalise corridor entry points with landscape treatments aimed which reflect the regional role of the Reserve
	Materials and Treatments approach • Provide a consistent identity throughout the separate parcels that form Vineyard Creek Reserve – develop consistent approach
J - Bush trails	**Consider closure of some trails** • Consolidate path system by closing trails that impact on the environment, and to avoid duplication • For tracks to be closed - ameliorate soil along path alignment to provide suitable growing conditions, revegetate and provide temporary fencing
	Investigate liability implications • Provide consistent level of trail quality that conform to Australian Standards and demarcate primary access routes
	Provide signage to direct trail users • Develop coordinated signage strategy for Vineyard Creek to direct path users and install directional signage at park entry points and path junctions
	Provide connections to external trail systems when completed • Maximise potential for external trail connections with the surrounding urban environment and proposed regional walking / cycle connections
	Track upgrading • To tracks to be retained – provide upgrading as required of surfacing to address erosion or root exposure issues – crushed sandstone surfacing • Provide drainage underpasses as required to facilitate localised drainage • Localised retention of path edges as required through edging / low walling (eg sandstone)
K - Enhance passive recreational amenity	**Maximise potential for passive recreational experiences** • Enhance passive recreational opportunities for picnics and scenic rest points • Provide seat, and signage park furniture

STORMWATER MANAGEMENT

Activity	Description
L – Minor Works	Site specific minor construction or rectification activities to be carried out by Council
M – Major Works	Site specific major construction activities to be carried out by Council or contractor
N – Remove snags / blockage	• Council Natural Resource Officer to confirm action scope on site with field staff • Confirm with appropriately qualified personnel / specialist that removal will not adversely impact fauna habitat values or create erosion or adjacent and downstream banks • Liaise with NSW Fisheries to obtain a permit to remove snags/blockages and undertake works • Investigate the need for mosquito control following the removal of snags or blockages which may contribute to stagnant water pool formation. Address erosion to prevent stagnant pool formation. Ensure that items such as plastic containers which may collect warm stagnant water and therefore provide a potential mosquito breeding habitat be removed.

MONITORING MAINTENANCE

Activity	Description
O - Monitoring and investigation	• Identify testing and sampling scope • Undertake recurrent testing suitable for evaluation and determination of any required actions • Undertake required remedial actions
P - Monitor and maintain	• Monitoring of specific sites after storm events to confirm adequacy of remedial actions – or additional actions required
R - Warning and prevention signage	• Prepare information / prevention signage where required • Implement signage on site
S - Review setbacks	• Refer to **Volume 2** for more information regarding setback identification • Survey property boundaries and identify riparian zones to designated areas on site • Identify encroachments • Liaise with land owners for rectification of encroachments • Identify potential for acquisition to problem areas • Follow up acquisition

Potential Enhancements

Reserve entries - example

Consistent path materials - example

Interpretive information signage - example

Reach 1

Reach 2

Reach 3

Reach 4

Reach 5

KEY

- existing path / track to be retained
- existing path to be revegetated
- existing concrete path
- existing and proposed cycleway
- 1.16 location of itemised actions
- zone of itemised actions
- refer legend below for generic actions - refer to Actions Table for further detail
- study area

Revegetation	Education / Recreation	Stormwater Management Actions	Investigation / Maintenance / Management
a Treat introduced vines	h Edge impacts	l Minor works	o Monitoring / investigation
b Treat woody weeds	i Reserve entry points	m Major works	p Monitor / maintain
c Treat aquatic weeds and /or silt islands	j Bush trails	n Remove snags / blockages	q Water sensitive design of urban areas
d Revegetation	k Passive recreational amenity		r Information / warning signage
e Bushfire Management			s Review setbacks
f General weed control			
g Mangroves			

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Vineyard Creek Waterways Maintenance and Rehabilitation Masterplan

Action Masterplan

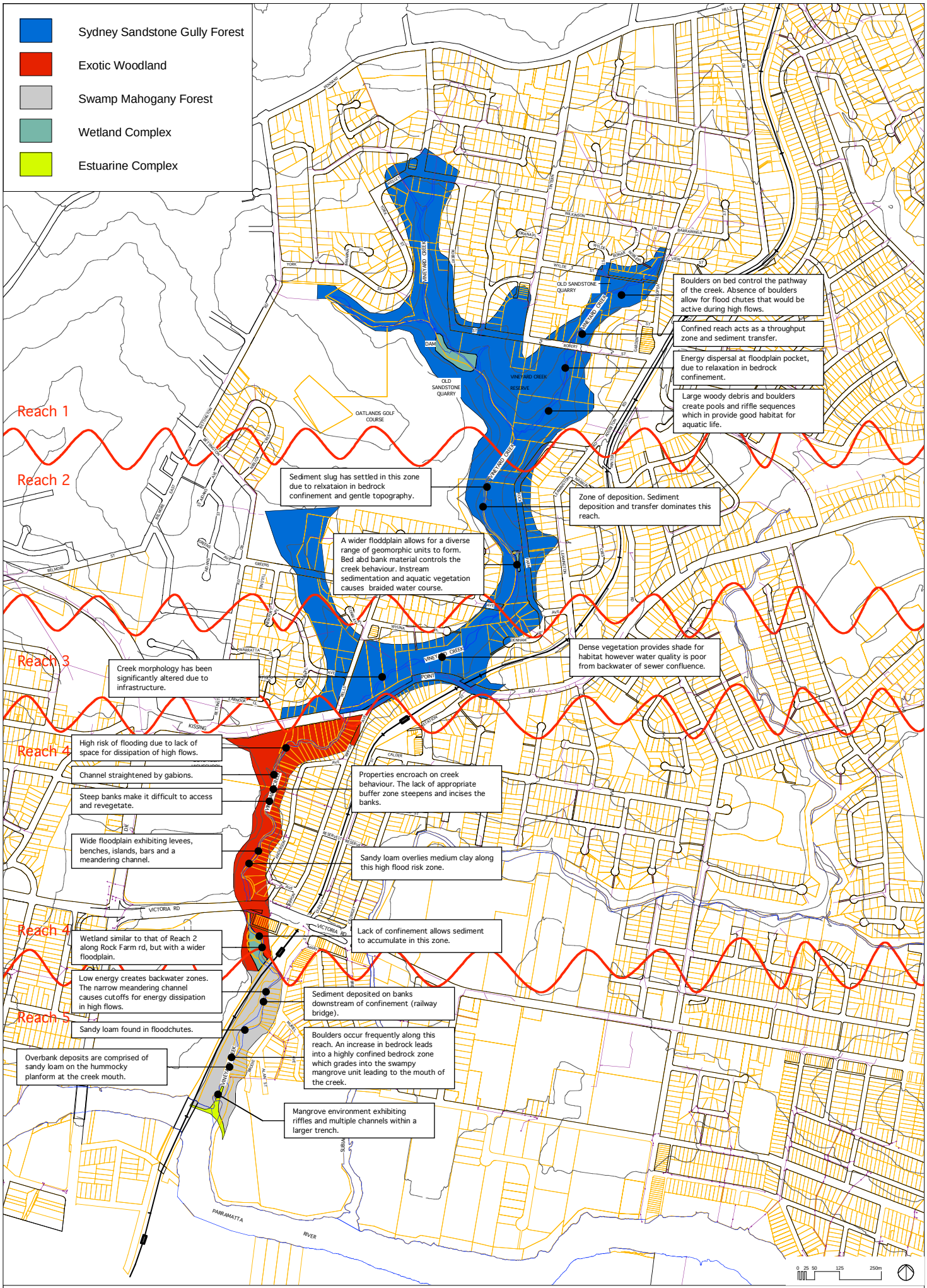

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Figure 1.3: Identified Creek reaches and vegetation communities

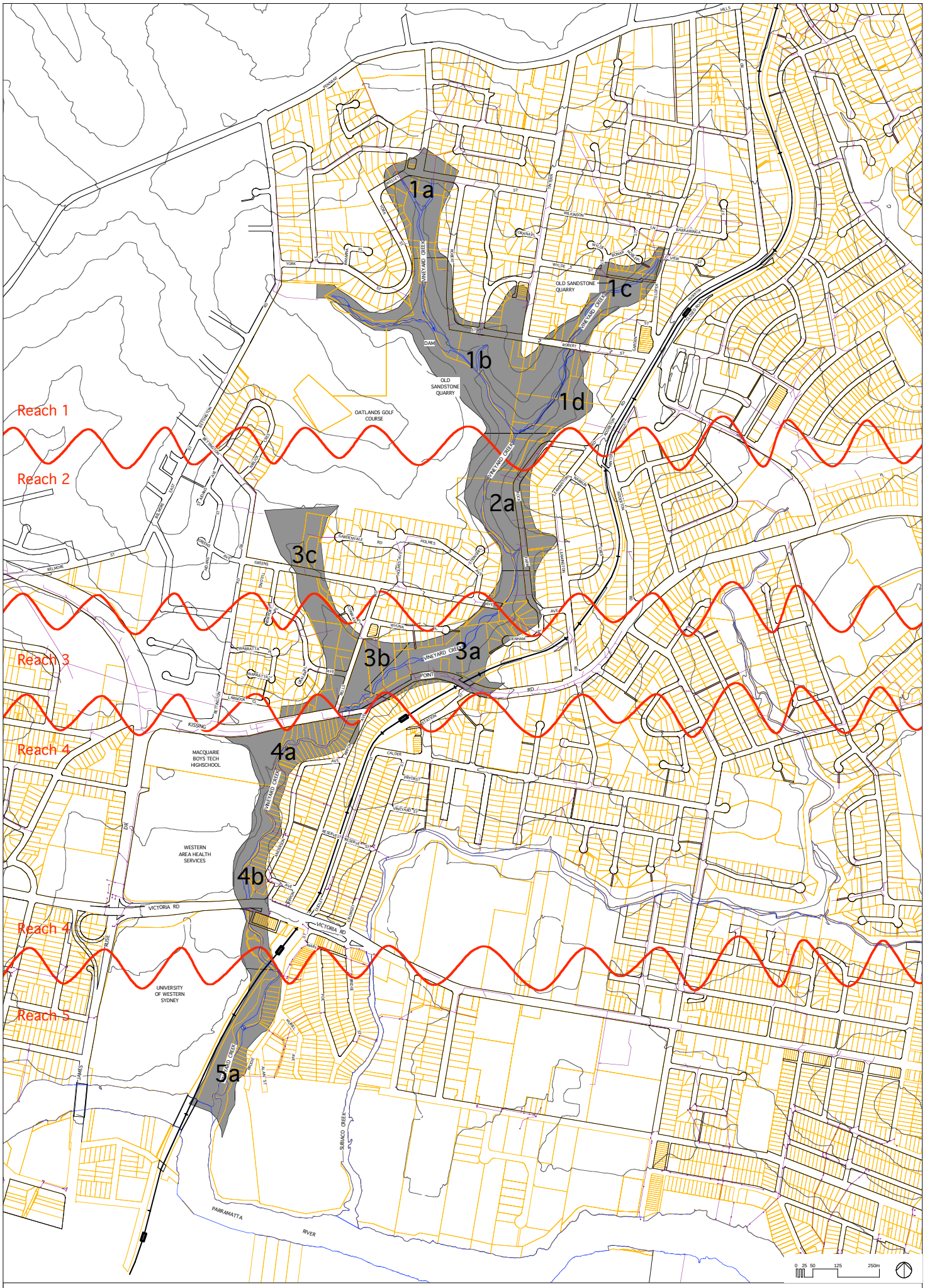

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Figure 1.4: Vegetation sub-reaches

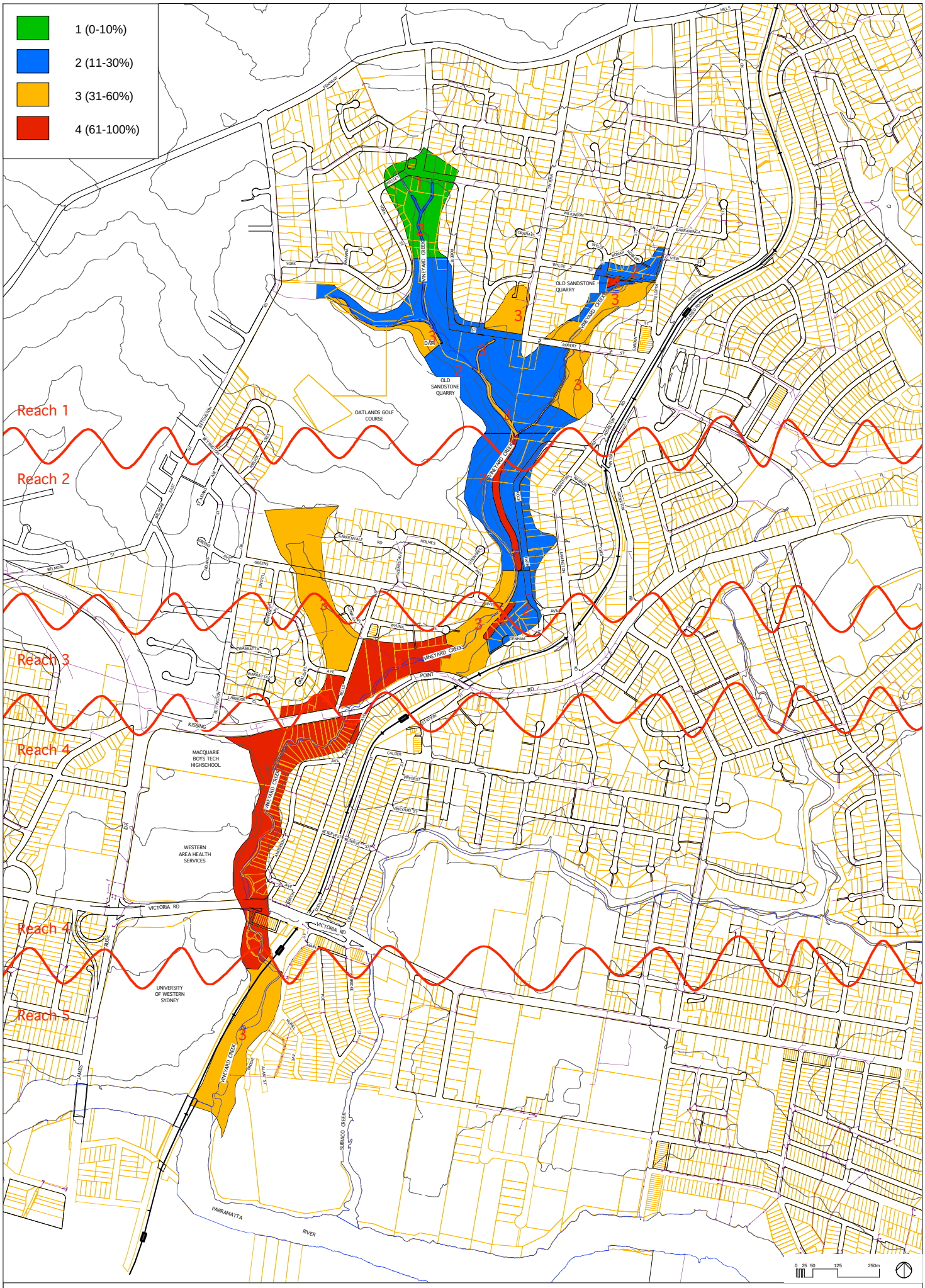

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Figure 1.5: Weeds

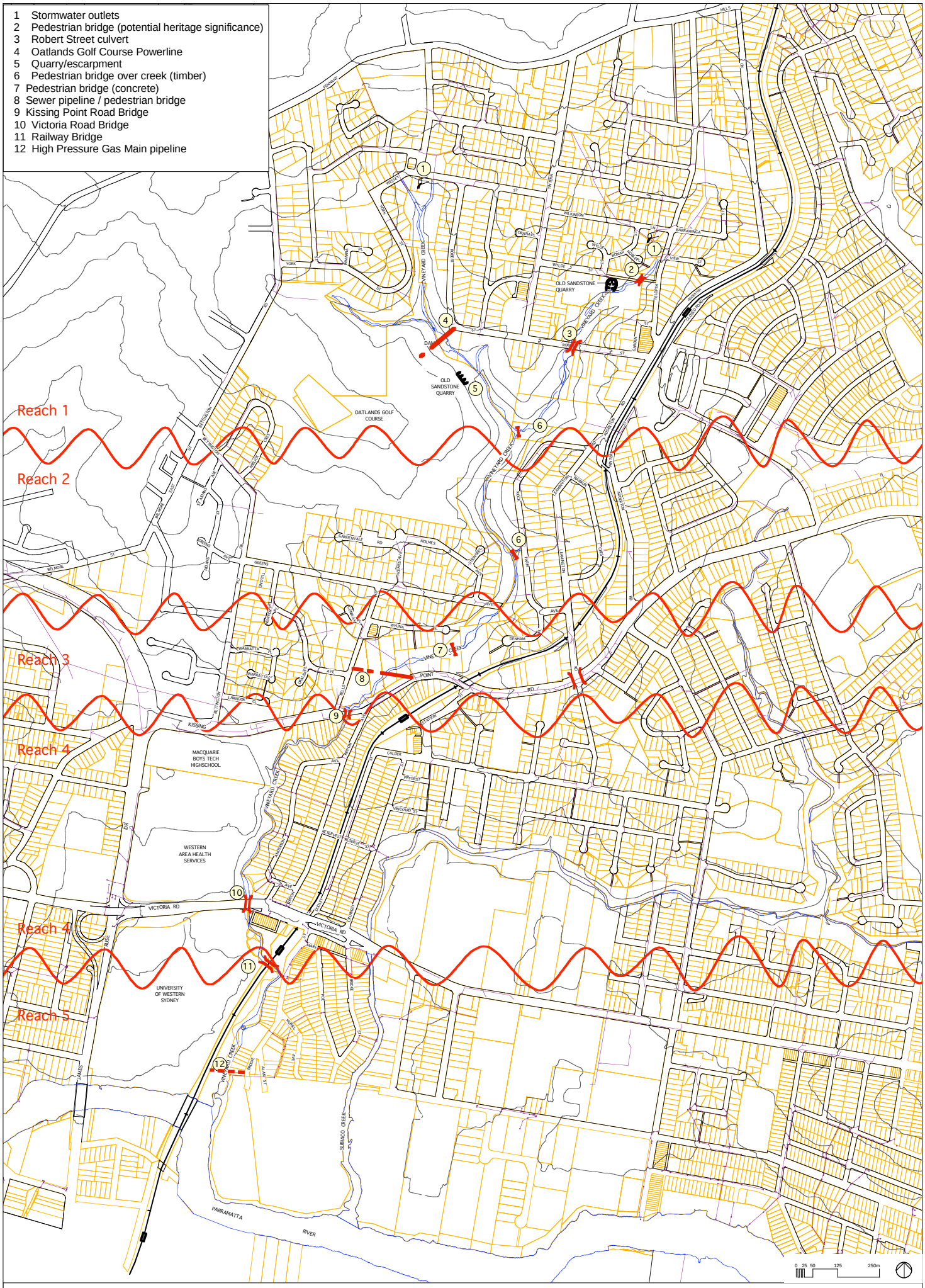

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Figure 1.6: Contemporary infrastructure

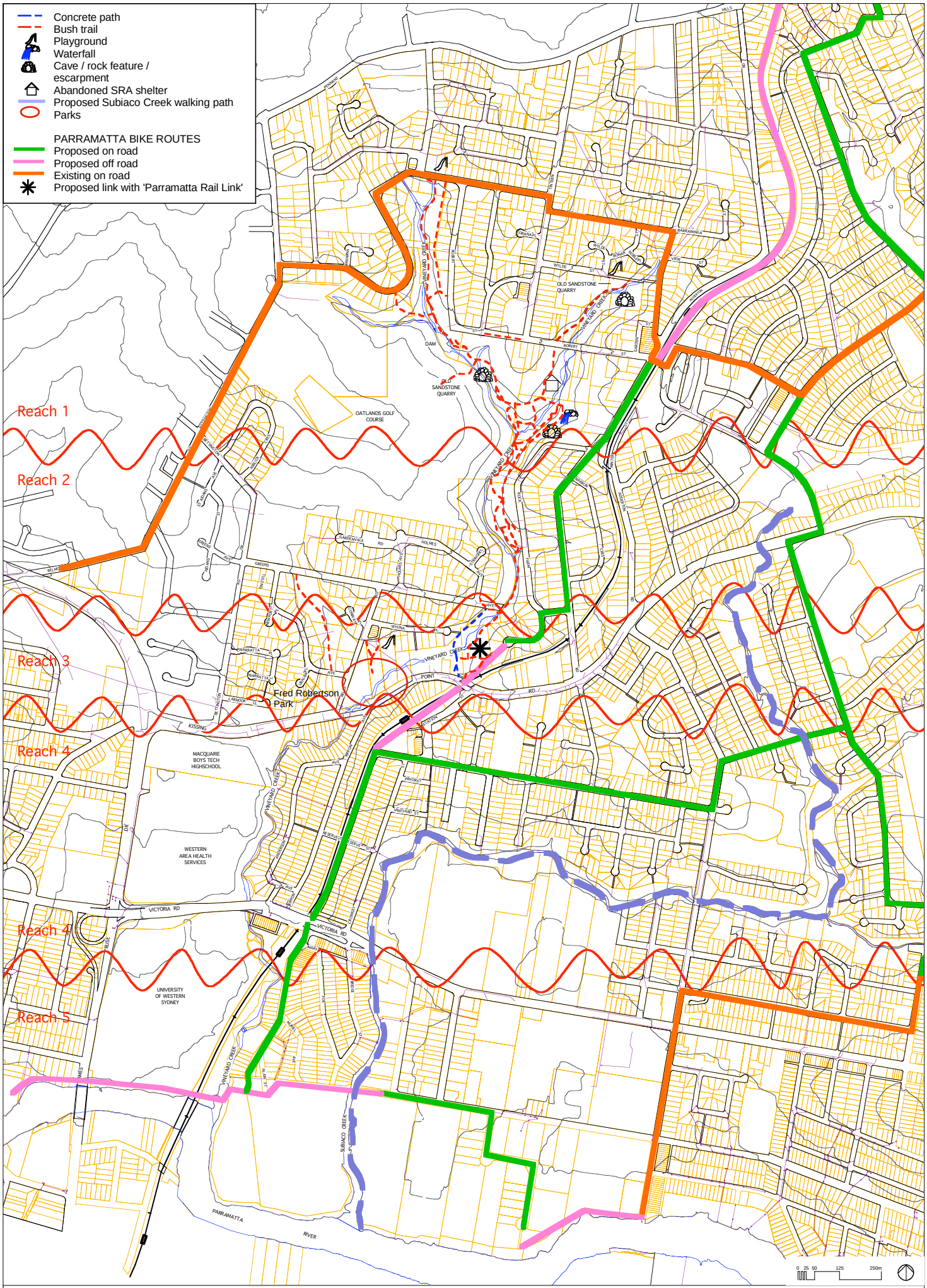

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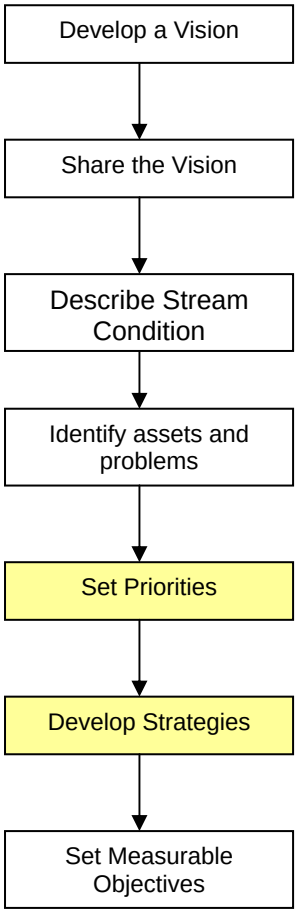
Figure 1.7: Recreation



1.5 Priorities

A ranked schedule of activities proposed for implementation in Vineyard Creek is found in **Table 1.6.** The tables include monitoring and investigation activities where appropriate. The actions are ranked and presented according to Reach rehabilitation priority groups. ie.

- HIGH priority (reaches 1 and 2);
- MODERATE priority (reaches 3 and 5); and
- LOW priority (reach 4).

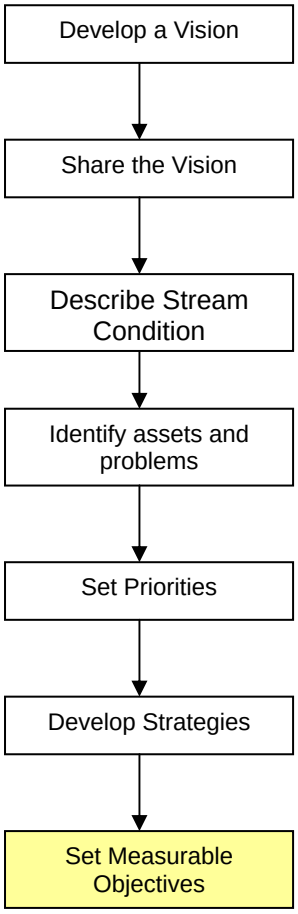
For additional details on the prioritisation, refer to **Volume 2**.

Table 1.6 –- Masterplan Activity Table

HIGH rehabilitation priority (reaches 1 and 2)		
Location	Principal Masterplan Activity	Priority Rank
1.23	❑ Revegetation - Activity Types B, C, D and F - Weed Infestations ❑ Education/ recreation - Activity type J – bush trails	1
1.7	❑ Stormwater Management - Activity Type L – Minor works ❑ Management maintenance - Activity Type P - Monitor/ maintain ❑ Management maintenance - Activity Type R – Prevention Signage ❑ Revegetation - Activity Type F ❑ Education/Recreation - Activity Type K – Enhance passive recreational potential	2
2.2	❑ Stormwater Management - Activity Type L – Minor works ❑ Management maintenance - Activity Type P - Monitor/ maintain ❑ Revegetation - Activity Types A, B, C, D and F ❑ Education/Recreation - Activity type G – edge impacts ❑ Activity type J – bush trails ❑ Management maintenance - Activity type R - Signage	3
2.1	❑ Revegetation - Activity Types A, B, C, D and F - Weed Infestations ❑ Education/recreation - Activity type G – edge impacts ❑ Education/recreation - Activity type J – bush trails ❑ Management maintenance - Activity Type R - Signage	4
1.1	❑ Management maintenance - Activity Type O – Monitoring and Investigation ❑ Management maintenance - Activity Type P - Monitor/ maintain ❑ Stormwater Management - Activity Type L – Minor works ❑ Revegetation - Activity Types A, B, D and F ❑ Education/ recreation - Activity type G - Edge impacts	5

MODERATE rehabilitation priority (reaches 3 and 5)		
Location	Principal Masterplan Activity	Priority Rank
3.2	❑ Stormwater Management - Activity Type M – Major Works ❑ Management Maintenance - Activity Type – P Monitor/Maintain ❑ Revegetation - Activity Types A, B, C, D and F ❑ Management maintenance - Activity Type O - Monitoring and investigation ❑ Management maintenance - Activity type R - Signage	1
3.5	❑ Revegetation - Activity Types A, B, D and F	2
3.11	❑ Education/Recreation - Activity type H – edge impacts	3
3.9	❑ Education/Recreation - Activity type H – edge impacts ❑ Management maintenance - Activity Type S – Review Setbacks	4
5.2	❑ Revegetation - Activity Types B, D and F	5

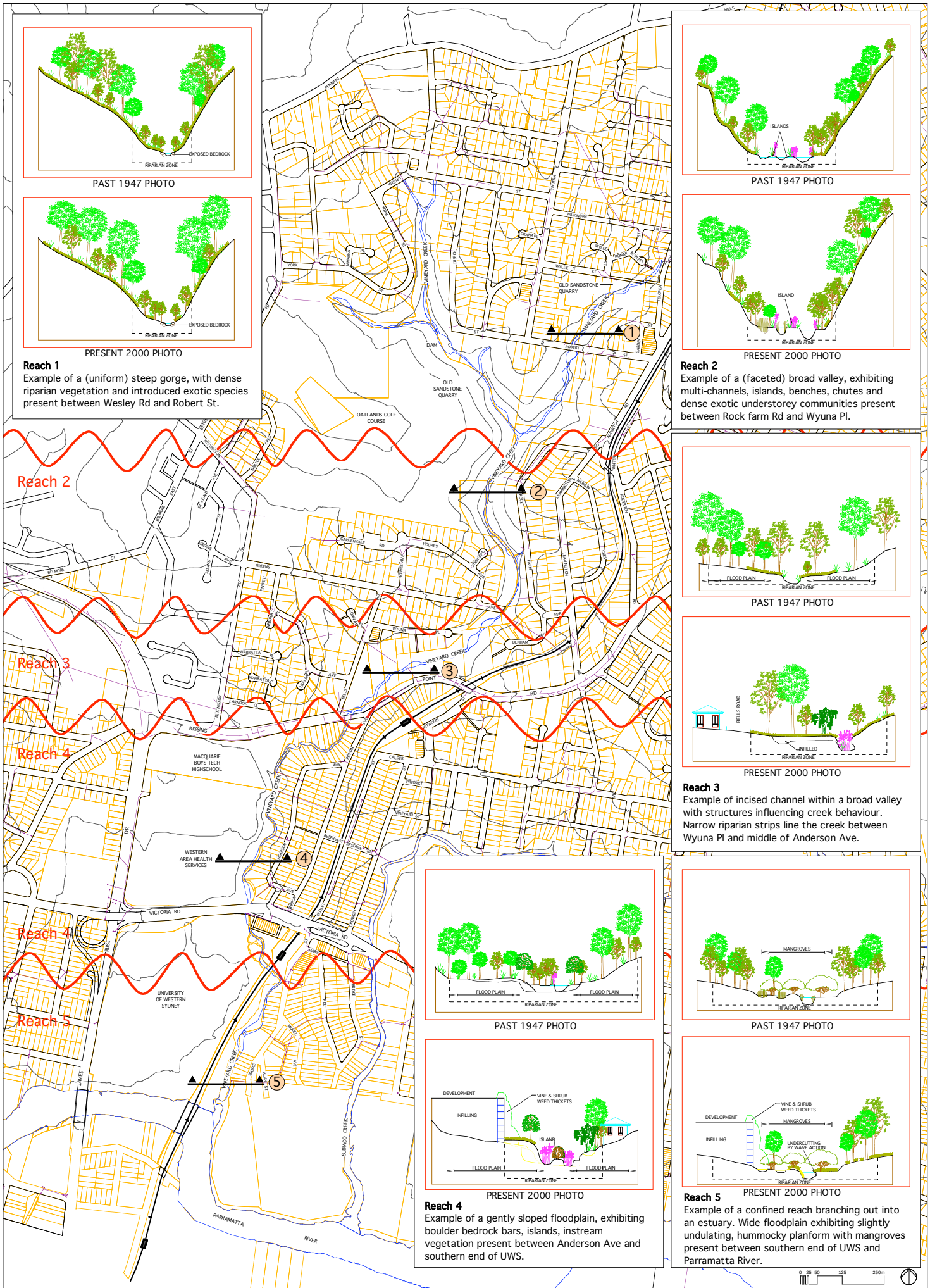
LOW rehabilitation priority (reach 4)		
Location	Principal Masterplan Activity	Priority Rank
4.6	❑ Management maintenance - Activity Type S – Review Setbacks	1
4.2	❑ Stormwater Management - Activity Type L – Minor works ❑ Management Maintenance - Activity Type – P Monitor/Maintain	2
4.4	❑ Revegetation - Activity Type C, D and F	3
4.3	❑ Revegetation - Activity Types A, B, D and F ❑ Management maintenance - Activity Type S – Review Setbacks	4
Reach generally	❑ Education/recreation - Activity Type G – edge impacts	5



1.6 Target Conditions and Rehabilitation Potential for Vineyard Creek Corridor

The recovery and rehabilitation potential was assessed for Vineyard Creek and has provided input into the overall priority for rehabilitation activities. The identification of target conditions was based on the geomorphologic, ecologic and recreational attributes of the waterway corridor. Target conditions provide a sound basis to rehabilitating waterways according to the Best Practice methodology “Rehabilitate having regard to the modified condition of the urbanised catchment”.

Target conditions and rehabilitation priorities are listed in **Table 1.7**. All management actions resulting from this Masterplan have been developed in relation to target conditions, rehabilitation priorities and the vision developed by stakeholders and the community for Vineyard Creek.



PAST 1947 PHOTO

PRESENT 2000 PHOTO

Reach 1
Example of a (uniform) steep gorge, with dense riparian vegetation and introduced exotic species present between Wesley Rd and Robert St.

PAST 1947 PHOTO

PRESENT 2000 PHOTO

Reach 2
Example of a (faceted) broad valley, exhibiting multi-channels, islands, benches, chutes and dense exotic understorey communities present between Rock farm Rd and Wyuna Pl.

PAST 1947 PHOTO

PRESENT 2000 PHOTO

Reach 3
Example of incised channel within a broad valley with structures influencing creek behaviour. Narrow riparian strips line the creek between Wyuna Pl and middle of Anderson Ave.

PAST 1947 PHOTO

PRESENT 2000 PHOTO

Reach 4
Example of a gently sloped floodplain, exhibiting boulder bedrock bars, islands, instream vegetation present between Anderson Ave and southern end of UWS.

PAST 1947 PHOTO

PRESENT 2000 PHOTO

Reach 5
Example of a confined reach branching out into an estuary. Wide floodplain exhibiting slightly undulating, hummocky planform with mangroves present between southern end of UWS and Parramatta River.

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Vineyard Creek Waterways Maintenance and Rehabilitation Masterplan

Figure 1.8: Vineyard Creek cross-section analysis

Table 1.7 – Target conditions and recovery potential for Vineyard Creek Reaches

Reach	*Target condition*	*Recovery / rehab. potential*
1	The target condition for this reach is a stable gorge-like reach (ie. stable creek banks, no erosion) featuring stable floodplain pockets (and flood-channels) where they occur. Target vegetation includes the establishment of a north-south wildlife corridor with lateral connections to other bushland, the re-establishment of native vegetation with a 70%+ canopy closure. Threatened species *Epacris purpurascens* var. *purpurascens* protected. Target social conditions include greater signage at reserve entry points, increased visual and recreational amenity.	*HIGH*
2	The target condition for this reach is a stable, multiple-channel creek environment featuring stable, appropriately planted high flow (flood) channels. Target vegetation includes the establishment of a north-south wildlife corridor with lateral connections to other bushland. Weed infestations stabilising sediment deposits replaced with appropriate native species. Plant to complement native bushland on slopes (plant more densely than in natural bushland). Target social conditions include greater signage at reserve entry points, increased visual and recreational amenity, and a rationalised, upgraded bushland trail network.	*HIGH*
3	The target condition for this reach is to create a new reach form. Once an alluvial river style with floodplain on both sides of the creek, due to current creek condition, the reinstatement of this condition is no longer possible. Rehabilitation works to aim for long-term bank stability. Target vegetation (within 3 m of Creek) includes riparian species characteristic of local plant community gully forest with a continuous canopy and retain the park as an open recreation area – not bushland.	*MODERATE*
4	The target condition for this reach is the equilibration of the new reach form. The current form-process equilibrium is shifting towards a creek characterised by sandy terraces and bank materials with an inset creek channel (for median creek flows) and islands. Flood flows in this reach would rise as high as the top of vegetated sand terraces and lateral bars. The new condition needs to support these high flows (and flow constriction). Target vegetation includes species tolerant of sandy soils which are subjected to periodic inundation and which will offer significant bank stability. Weed reduction is the short-term target for this reach, long-term management includes the gradual development of native riparian buffers. Upper weed sources need to be managed as a priority. The protection of both banks is essential to prevent bank erosion related to creek “buffering”.	*LOW*
5	The target condition for this reach is a stable bedrock dominated environment in the upper sub-reach (features include waterfalls, cascades, riffles, and steps) characterised by appropriate vegetation. The target condition for the lower reach is stable sedimentary environment featuring channel islands and flood channels characterised by appropriate vegetation. Weed reduction is the short-term target for this reach, long-term management includes the and the gradual development of native riparian buffers.	*MODERATE*

1.7 Additional Actions

Certain waterway issues investigated in the detailed mapping stage of this project are required to be addressed through a catchment activity approach. As described in Council's **Waterways Strategy – 'Rivers of Opportunity'**, Council has developed several strategic plans as a mean to achieve Council's 4-year objectives in managing waterway issues including:

- Stormwater Management Plans
- Floodplain Risk Management Plans
- Land Use Plans (LEP's, DCP's) eg Review of waterways setback Control.

This Masterplan is one such strategic plan.

Several issues have been identified in the development of the Masterplan which are outside the immediate scope of this plan. These will be incorporated into these other strategic documents (**Table 1.7**).

Table 1.8 - Additional Issues Identified

Additional issues	Plans or projects where issue to be addressed
Sewer Overflows	Catchment Abatement Program
Increased flows impacting on stream	Water Sensitive Urban Design DCP and best practice manual Floodplain Risk Management Plans
Street Sweeping	Stormwater Management Plan
Litter and other pollution from catchment	Stormwater Management Plan
Property boundaries and development setbacks for riparian protection	RIVERCARE Plan

2 ACKNOWLEDGMENTS

The following **Masterplan** has been prepared by.

STORM Consulting Pty Ltd

Environmental Partnership (NSW) Pty Ltd

Urban Bushland Management Consultants

Funding assistance has also been provided for the preparation of this Masterplan and associated documents from the following organisation.

NEW SOUTH WALES
Department of Infrastructure Planning & Natural Resources

Department of Infrastructure, Planning and Natural Resources