WITNESS COPY

Joseph John Bannan

BCC

Statement dated 8 September 2011

Volume 1 of 2

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Statement of Joseph John Bannan

I, Joseph John Bannan, Manager, Asset Management branch, Brisbane City Council, of 266 George Street, Brisbane, in the State of Queensland, state on oath as follows:

1. Attachment "**JJB-01**" is a copy of a notice from the Commissioner of the Queensland Floods Commission of Inquiry (**Commission**) dated 19 August 2011 requiring me to provide certain information to the Commission in the form of a statement by 7 September 2011 (**Notice**). This Statement is provided in response to the Notice.

2. For the purposes of responding to the Notice and preparing this Statement I have, in my position as Manager, Asset Management branch (formerly known as City Assets branch) of the Brisbane City Council (**Council**), had access to:

   (a) the business records of Council; and

   (b) Council officers,

   to obtain information to provide a response to the Notice. I have also been advised on some issues of statute which arise by Clayton Utz. Unless otherwise stated, the matters set out in this Statement are based on my own knowledge and the information derived from the above sources.

3. The documents from the above sources and attached to this Statement have been collated by Council officers under my instruction.

4. I set out below my responses to each of the questions set out in the Notice based on the sources of information set out above.

Qualifications and Background

5. I hold the following academic qualifications:

   (a) Master of Engineering Science, University of New South Wales;

   (b) Bachelor of Engineering, Queensland University of Technology;

   (c) Associate Diploma in Civil Engineering, University of South Queensland.

6. I am a Registered Professional Engineer in Queensland.

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7. I have held my current position since 17 January 2011. Prior to that:

(a) I was employed by Moreton Bay Regional Council as Manager of its Asset Management branch from mid-2008 until December 2010;

(b) prior to mid-2008, I was employed in a number of engineering roles by each of the now superseded Pine Rivers Shire Council and Caboolture Shire Council for approximately 13 years.

8. The Notice covers a wide range of issues relating to stormwater network design and operation. There is no one branch of Council which has responsibility for all the areas raised by the Notice. In general terms:

(a) policy in respect of design capacity standards is guided by Water Resources branch with input from Planning and Design branch of the City Projects office on technical and design issues;

(b) policy in respect of planning and development policies is guided by Water Resources branch with input amongst others from City Planning and Economic Development branch;

(c) application of planning and development policies relating to stormwater and sewerage is the province of Development Assessment branch;

(d) policy in respect of long term planning for the stormwater network is guided by Water Resources branch; and

(e) responsibility for general planning and policy in respect of the maintenance and rehabilitation of defects identified in the stormwater network lies with Asset Management branch.

9. My branch works closely with the Field Services group, which is responsible for carrying out in detail the direction provided by Asset Management in respect of maintenance and rehabilitation of defects. The infrastructure assets overseen by Asset Management go beyond stormwater infrastructure and include, for example: Council road infrastructure; park infrastructure; property infrastructure including Council owned buildings and Council owned bridges.

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Introductory Observations

10. Before addressing the specific matters raised by the Commission, it may be useful to make some introductory comments.

11. *First*, the Commission refers generally to stormwater infrastructure, stormwater drainage infrastructure and flood mitigation infrastructure. From my perspective as an engineer in Asset Management, stormwater infrastructure refers to infrastructure for which the primary purpose is the collection and conveyance of stormwater. Stormwater infrastructure has two functions: to manage the flow of stormwater and to manage the quality of water discharged.

12. Stormwater infrastructure that manages stormwater flow is properly described as having a flood mitigation function. Stormwater infrastructure that manages water quality only does not have a flood mitigation function. For the purposes of this Statement when referring to flood mitigation infrastructure, I am referring to stormwater infrastructure which has the purpose of managing stormwater flow. That seems consistent with the general thrust of the Notice and in particular the examples given of flood mitigation infrastructure in Request 1 of the Notice. While stormwater infrastructure may impact on the mitigation of major river and creek flooding, that is not ordinarily the purpose for which stormwater infrastructure is constructed.

13. *Second*, stormwater infrastructure refers to items of civil works built or created for stormwater collection and conveyance. It covers the familiar items such as the pipe network, the various kinds of gullies and inlets, culverts and so on. I list these in more detail in paragraph 18 below. Stormwater infrastructure, however, is only a part of the overall stormwater network which services the City (the **Stormwater Network**). The Stormwater Network includes not only the built infrastructure, but also other means of conveyance of stormwater such as overland flow paths and channels (which might be naturally occurring or partially or fully constructed) and natural waterways and wetlands. Stormwater planning for the City involves considering the performance of the whole Stormwater Network in conveying stormwater flow to a channel or natural watercourse.

14. The non-infrastructure components of the Stormwater Network are important. In particular, overland flow paths, where they can be established or maintained, are particularly effective in conveying stormwater efficiently because they involve minimal cost compared with the cost of constructing pipe and other infrastructure. I am aware that in recent years Council has

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undertaken extensive mapping of overland flow paths in the City and major overland flow paths are contained in Flood Flag Maps available to the public by internet search.

15. *Third*, some of the requests in the Notice refer to the sewerage network. Before 1 July 2010, Council was responsible for the provision of water services and wastewater services (that is, sewerage and trade waste related services (**Sewerage Network**)) in the City. Pursuant to the *South-East Queensland Water (Distribution and Retail Restructuring) Act* (the **Water Distribution Act**), Council was divested of the responsibility for providing water and wastewater services in the City. Together with Ipswich City Council, Lockyer Valley Regional Council, Scenic Rim Regional Council and Somerset Regional Council, Council's water and wastewater business was transferred to the Central SEQ Distributor-Retailer Authority trading as Queensland Urban Utilities (**QUU**). QUU was given responsibility for (amongst other things) providing water and wastewater services to the City on and from 1 July 2010. QUU does not represent the Council and is governed by an independent board.

16. *Fourth,* from the view point of stormwater management and flooding issues, it is relevant that the Sewerage Network is separate from the Stormwater Network and is not intended to convey stormwater. However, sewerage is designed with an allowance to carry additional water beyond the sewerage flow, which is included to provide a contingency allowance to minimise as far as possible the risk of overflows resulting from blockages or from leakage of stormwater into the sewerage network. Despite this, the Sewerage Network has (or at least it ought to have) no linkage to the Stormwater Network at all.

17. It is possible for the Sewerage Network to be affected by stormwater in the following ways:

(a) by an illegal connection from roof water downpipes or landscaping to the Sewerage Network;

(b) by reason of broken sewerage pipes and manhole lids allowing storm water to infiltrate;

(c) by flooding of the entire network up over the inlets or outlets of the Sewerage Network in a major flood event (i.e. the covering of pedestals by flood waters).

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Response to the Notice

1.	**The flood mitigation infrastructure (for example flood detention basins, stormwater culverts, back flow devices) in the Council's area, including a description of the maintenance programs for such infrastructure, for the following suburbs ('the Relevant Suburbs'):**
	a. Brisbane City;
	b. Fortitude Valley;
	c. New Farm;
	d. Newstead;
	e. Teneriffe;
	f. Bulimba;
	g. Hawthorne;
	h. Norman Park;
	i. East Brisbane;
	j. Kangaroo Point;
	k. South Brisbane;
	l. West End;
	m. Hill End;
	n. Fairfield;
	o. Yeronga;
	p. Rocklea;
	q. Chelmer;
	r. Graceville;

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s.	**Oxley;**
t.	**St Lucia;**
u.	**Toowong;**
v.	**Auchenflower;**
w.	**Milton;**
x.	**Rosalie;**
y.	**Fig Tree Pocket;**
z.	**Bellbowrie.**

Flood mitigation infrastructure

18. I understand flood mitigation infrastructure to comprise stormwater infrastructure whose purpose is the collection and conveyance of stormwater as explained in paragraphs 11 and 12 above. It covers the following kinds of assets:

(a) the stormwater pipe network which includes stormwater drains (the higher order parts of the pipe network) and inlet connectors (secondary pipes linking gullies and inlets, described in (e) below, to the stormwater drains) (the **Pipe Network**);

(b) culverts, which are short conduits, open at both ends, passing under roads primarily for the purpose of allowing stormwater to flow from one side of the road to the other without becoming dammed by the roadway;

(c) detention basins, which are areas specifically designed to catch and hold stormwater in a rain event to allow release of stormwater at a controlled rate;

(d) back flow prevention devices, which are valves or gates installed at or near pipe outlets to prevent rising water at the outlet side of the gate from entering the Pipe Network;

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(e) gullys and inlets which allow stormwater to enter the Pipe Network. The term "gully" typically refers to the grilled box inlets commonly seen in suburban streets, and the term "inlet" typically refers to an opening in a park or open area;

(f) kerbing and channelling which catches stormwater flow from urban roads and provides capacity on the road surface to convey overland flow along a roadway where the roadway is designed to perform that function.

19. The Stormwater Network also includes naturally occurring or constructed channels and watercourses and overland flow paths. Whilst these are not ordinarily considered to be items of infrastructure, channels and overland flow paths are sometimes constructed or modified or enhanced by some form of civil works.

Stormwater infrastructure in the Relevant Suburbs

20. Council maintains two databases which contain information about its stormwater infrastructure:

(a) First, there is a geographical information system (**GIS**) which shows graphically the location of relevant infrastructure and other parts of the Stormwater Network such as overland flow paths;

(b) Second, there is a data base known as "Elipse" which contains amongst other things Council's financial asset register for stormwater infrastructure.

21. These data bases can be interrogated to provide information about the Stormwater Network including items of stormwater infrastructure in particular areas. I have caused this to be done for the Relevant Suburbs and for the results of the interrogation to be tabulated. Although the databases are in my experience fairly reliable, it is possible that small sections of the Pipe Network are omitted or incorrectly recorded. Examples of this come to Council's attention from time to time, particularly in the course of CCTV pipe survey inspections referred to in paragraph 34 below. Such information is then added to the data base.

22. The table below shows the lengths of stormwater pipes (referred to as drains in Attachment JJB-02), and gully and inlet connections in the Relevant Suburbs. Rosalie and Hill End have been included in Paddington and West End respectively.

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SUBURB	STORMWATER PIPES (km)	INLET CONNECTIONS (km)	TOTAL (km)
Auchenflower	7.82	2.70	10.52
Bellbowrie	18.79	6.99	25.78
Brisbane City	17.76	7.55	25.31
Bulimba	13.82	4.29	18.11
Chelmer	7.65	2.17	9.81
East Brisbane	10.12	3.45	13.57
Fairfield	6.78	1.73	8.52
Fig Tree Pocket	8.04	4.68	12.73
Fortitude Valley	14.71	2.90	17.61
Graceville	8.94	2.94	11.88
Hawthorne	8.12	2.93	11.05
Kangaroo Point	9.07	2.90	11.96
Milton	11.28	3.25	14.53
New Farm	18.03	3.95	21.98
Newstead	10.05	1.88	11.93
Norman Park	11.94	5.11	17.05
Oxley	17.15	6.89	24.04
Paddington (includes Rosalie)	17.18	7.16	24.34
Rocklea	17.19	6.59	23.79
South Brisbane	15.01	5.84	20.85
St Lucia	15.66	4.58	20.24
Teneriffe	5.05	1.78	6.83
Toowong	15.44	6.04	21.47
West End (includes Hill End)	13.66	3.60	17.26

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SUBURB	STORMWATER PIPES (km)	INLET CONNECTIONS (km)	TOTAL (km)
Yeronga	12.23	4.29	16.52
Totals	**311.47**	**106.19**	**417.66**

23. The table below shows the number of culverts in the Relevant Suburbs:

Suburb	Stormwater Culverts
Auchenflower	4
Bellbowrie	19
Brisbane City	1
Bulimba	2
Chelmer	3
Fairfield	8
Fig Tree Pocket	17
Graceville	1
Norman Park	5
Oxley	27
Paddington (includes Rosalie)	1
Rocklea	25
St Lucia	10
Toowong	6
Yeronga	5
Total	**134**

24. The table below shows a list of detention basins in the Relevant Suburbs:

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Suburb	Detention Basins
Oxley	3
Paddington (includes Rosalie)	1

25. The table below shows a list of back flow prevention devices in the Relevant Suburbs:

Suburb	Backflow Prevention Devices
New Farm	2
Newstead	1
West End	1
Yeronga	1

26. The back flow prevention device in Yeronga (Brisbane Corso) is comprised of four pipes each with tide gates. It was designed to prevent high tides entering the concrete lined open drain upstream of the culvert to prevent the build up of silt and to reduce the likelihood of the growth of mangroves. Elsewhere, back flow prevention devices (tide gates) have been installed on the end of the pipe outlet to reduce the impact of flooding on nearby properties and roads from water flowing back up the pipe from high tides.

27. The stormwater infrastructure for the Relevant Suburbs is set out in the three maps which are Attachment "**JJB-02**". Generally, stormwater pipes discharge either to a channel, creek or the River. Where the Pipe Network appears to be remote from a creek or the River, it is because the relevant pipes discharge to a channel, natural gully or watercourse, or overland flow paths.

28. Other important parts of the Stormwater Network are stormwater channels and overland flow paths. The maps which I have caused to be prepared also include constructed channels and overland flow paths.

29. The maps only show:

(a) Council owned assets - as opposed to assets owned privately, or by the State or by other bodies, which are not included in Council's database; and

[redacted] [redacted]

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(b) Stormwater drains - as opposed to smaller secondary pipes linking inlets and gullys to the main network.

Maintenance of the Stormwater Network

30. Request 1 of the Notice seeks information about maintenance programs for flood mitigation infrastructure in the Relevant Suburbs. So far as I am aware from my own knowledge and from inquiries I have made within Council, maintenance in the Relevant Suburbs is carried out as part of the whole of City programs and activities carried out by Council. Those programs and activities are described below.

Inspection and maintenance of the Pipe Network (including gullies and inlets)

31. Council has an Asset Management Plan for Enclosed Stormwater Drainage Assets (**AMP-Enclosed Assets**) which deals comprehensively with management of such assets, a copy of which is Attachment **"JJB-03"**. The AMP-Enclosed Assets sets out a summary of the practices for maintenance of condition and serviceability of the Pipe Network. Clause 2.4 relevantly provides:

"2.4 Current Level of Service

Currently enclosed stormwater drainage assets are providing a level of service that is effected by the current intervention levels for condition and serviceability, which are:

- *Blocked Pipes (roots, debris, sediment, etc) identified by complaint or inspection are listed for remedial works.*
- *Video and defect recordings are taken within the pipe network to determine structural and serviceability scores. The intention is to inspect all pipes every 15-20 years for the first 60 years of life, and then every 7-10 years until replacement or rehabilitation. Currently LAS are surveying 60-80 km of pipe each year.*
- *Pipes and manholes that are not structurally sound are listed for repair or replacement in either the quarterly maintenance program or annual asset renewal program.*
- *Gullies with components in poor condition are listed for repair or replacement in either the quarterly maintenance programs or annual asset renewal program.*
- *Gullies identified to be causing a serious safety hazard are made safe and repaired as soon as is practical.*

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- *Poor condition gully grates and gully grates on bike routes that are not bike-safe are listed for replacement as directed by the 15 year plan (this plan commenced in 2001).*

- *Gully tops, particularly in sags and leafy areas are cleansed on a regular basis. The frequency is dependent on the amount of leaf litter experienced. (Some locations have a long history and therefore cleansed up to 12 times / year).*

- *Gullies and pipelines that are known to be prone to siltation are cleaned out on a regular basis. The frequency is dependent on the amount of silt and debris historically experienced (over the past 1-5 years).*

- *Feedback on poor gully or pipeline performance or after local flooding is investigated and the gully or pipeline restored to safe and serviceable condition where appropriate. This feedback may also lead to listings in future capital works schedules for enclosed stormwater drainage asset renewal or creation through augmentation or relief drainage works.*

- *Local Stormwater Management plans also identify the need for enclosed stormwater drainage asset creation / enhancement and related capital works listings."*

32. I refer to the pipe survey referred to in the second dot point in the above quote. The pipe survey is an important part of Council's on-going inspection of the Pipe Network to identify maintenance and repairs required. It is my understanding that Council has had for some time a pipe survey program for its Pipe Network. Pursuant to this program Council develops, on an annual basis, an inspection regime for part of the Stormwater Network. This inspection regime provides the basis for maintenance operations. As I understand it, the criteria for inspection is developed each year, bearing in mind the funding and staffing resources and specialised equipment available and the issues which appear important. Criteria which may be important include:

(a) flooding of parts of the Pipe Network;

(b) the age of pipes and the period since their last inspection; and

(c) recent infrastructure and residential developments.

33. As a consequence of the pipe survey, the surveyed assets are assessed and scheduled for maintenance. The results of the survey also provide a basis for scheduling rehabilitation or reconstruction works that are necessary to maintain design capacity. An example of a "Pipe Survey plan" is the 2010/2011 plan prepared by Council in September 2010, a copy of which is Attachment **"JJB-04"**.

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34. In practical terms, when stormwater pipe is surveyed by Council's Pipe Survey Unit and Council's contractors, it is inspected using CCTV in conjunction with the condition assessment guidelines described in the Stormwater Assets Pipe Survey CCTV - Specification & Guide (**SAPS Specification & Guide**). A copy of the SAPS Specification & Guide is Attachment **"JJB-05"**. The SAPS Specification & Guide contains procedures for inspecting pipes and recording and reporting maintenance issues. It also contains a standardised rating scale for overall performance of a particular part of the Pipe Network which allows an assessment for long term planning purposes of the state of that part of the network.

35. I am informed by Council officers that the process of planned pipe inspections began in approximately 1982 using manual techniques for pipes of 900 mm or greater, with CCTV inspection technique commencing in the mid 1990s. Since then, approximately 65% of the entire stormwater network has been inspected at least once with on-going budget expenditure to survey 80km of conduit annually. At this rate the present Pipe Network can be reinspected every 30 to 40 years.

36. The January flood event resulted in the 2010/2011 Pipe Survey plan referred to above being overtaken by events. As a result of the flood, Council officers revised the planning for pipe inspections to address, as quickly as possible, any potential maintenance and defect issues arising in the Pipe Network in the areas affected by flooding. To the extent that the Relevant Suburbs contained areas affected by flooding, they would have benefitted from this realignment of effort.

37. Attachment **"JJB-06"** is a copy of Asset Services Situation Reports (**Sitreps**) which record the progress made on post-event inspection of the Pipe Network as at 3 August and 31 August this year. All the Relevant Suburbs are shown in Table 1.1 of the 3 August 2011 Sitrep apart from Teneriffe, Hill End and Rosalie which are included in areas P, J and Q respectively.

38. In addition to the pipe survey process, the identification of maintenance issues occurs as a result of reports from residents or observations made by local maintenance staff. Local maintenance staff are well placed to carry out this role. Many of them are very familiar with their areas and the particular aspects of the Stormwater Network which need regular attention of a minor kind. Because local maintenance staff spend most of their time in the field, they are well placed to identify other maintenance issues that might arise and refer them to regional maintenance crews to be addressed.

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39. It is my understanding that detailed records are not kept of this more informal maintenance process. However, if field staff generate work by regional maintenance there would be a record created for that work.

Maintenance of culverts

40. Inspections of culverts are straightforward as most culverts can be visually inspected. Council has an Asset Management Plan for Bridges and Culverts (**AMP-Bridges and Culverts**) which provides for the inspection and maintenance of Culverts in accordance with the approach taken to bridges under the Bridge Inspection Manual issued by the Queensland Department of Main Roads and set out in the AMP-Bridges and Culverts. Attachment **"JJB-07"** is a copy of the AMP-Bridges and Culverts. Maintenance and inspection is dealt with at pages 33 to 40.

41. Notwithstanding the general application of the AMP-Bridges and Culverts to all culverts, a different approach is taken to culverts less than 900 mm in height. For these smaller culverts, the rigorous approach applicable to bridges is not considered necessary or appropriate. Smaller culverts are inspected in response to customer services requests or after a major storm or flood event, and they are also inspected when Council's Field Services officers are completing normal duties in the vicinity of particular small culverts.

Maintenance of detention basins

42. Council is in the process of preparing Asset Maintenance Management Plans (**AMMPs**) for the detention basins in the City, focussing first on the larger assets. An example is the AMMP for the Beryl Roberts Park Detention Basin, which is the first of Council's AMMPs completed for a detention basin. A copy of the AMMP for Beryl Roberts Park Detention Basin is Attachment **"JJB-08"**. Where an AMMP is in place, it mandates a schedule of inspection and maintenance. For major infrastructure like the Beryl Roberts Park Detention Basin, the AMMP provides for a detailed Hierarchy of Maintenance Inspections.

43. Council is currently developing AMMP's for detention basins in the City as follows:

(a) Gubberly Creek Detention Basin;

(b) North Basins (Telegraph Road Basin);

(c) South Basins (Hamish Street Basin);

(d) East Basins (Barrack Road Basin);

(e) West Basins (Gordon Road and Sedgley Street Basins).

[redacted]

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44. Additional Basin sites are to be included in the draft AMMPs for the North, South, East and West Basins. There is presently no AMMP for the four Detention Basins in the Relevant Suburbs.

45. Where no AMMP is in place, I am informed that Council undertakes maintenance in response to reports by field staff and residents. As I have already explained, local maintenance staff are familiar with problem areas and check on Detention Basins during rainfall events.

Backflow prevention devices

46. So far as I am aware, there is no documented inspection and maintenance regime for backflow devices. I am informed that as a matter of practice, backflow prevention devices are checked for effective operation prior to "King Tides" at least three times in summer and once in winter.

Channels and Natural Water Courses

47. Although natural and modified channels and water courses are not ordinarily considered to be stormwater infrastructure, they are an important part of the Stormwater Network and are also maintained by Council. Council is developing AMMPs for channels and water courses previously the subject of mitigation works designed to reduce local flooding impacts, amongst other things from stormwater flows. An example of one such AMMP is the Oxley Creek Flood Mitigation Assets AMMP a copy of which is Attachment **"JJB-09"**. It deals with maintenance requirements at pages 22 to 23. Oxley Creek runs through Oxley, Chelmer, Rocklea and Graceville of the Relevant Suburbs.

48. So far the only AMMP for channels or natural water courses is the Oxley Creek AMMP. There are presently the following further AMMPs in preparation:

(a) Breakfast Creek;

(b) Kedron Brook;

(c) Stable Swamp Creek;

(d) Norman Creek;

(e) Perrin Creek;

(f) Zillman Waterholes; and

(g) Gertrude Street open channel.

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49. It is intended that the AMMPs will formalise current maintenance practices that Council delivers by way of works undertaken by maintenance staff, that is, inspection regime, de-silting, vegetation management, weed spraying and clearing of debris etc.

2. The Council's planning scheme policy or other Council policy about sewerage or stormwater drainage infrastructure applicable to the Relevant Suburbs at any time since 1 October 2010.

Council policies on Stormwater and Sewerage Infrastructure Generally

50. There are two categories of policies which relate to stormwater and sewerage infrastructure.

51. The first category comprises planning scheme policies which apply in the assessment of assessable development under the *Sustainable Planning Act 2009* (Qld) (**SPA**). These policies relate to the requirements which can be imposed for the provision of stormwater and sewerage infrastructure and other aspects of the Stormwater and Sewerage Networks directly related to the particular development proposed (ie. non-trunk infrastructure).

52. The range of conditions for a development approval in relation to non-trunk infrastructure are a function of the scale of the development. A major subdivision will have to provide within the subdivision itself an effective Stormwater Network including necessary stormwater infrastructure, while an infill development in an established area might require only minor stormwater infrastructure connecting to Council's existing Stormwater Network. Council's power to impose conditions in this respect is recognised by s. 626 SPA.

53. The second kind of policies comprise policies relating to the City wide Stormwater Network including trunk infrastructure. Trunk infrastructure refers to Council owned infrastructure involving pipes equal to or greater than 750 mm diameter and associated infrastructure. Those policies deal, as I understand it, with two areas: Stormwater Network upgrading and the recovery of contributions from applicants for development approvals towards the costs of current and future trunk infrastructure. With recent legislative changes I understand that contributions are dealt with by a combination of Brisbane Adopted Infrastructure Charges Resolution (No.1) 2011 (**Resolution**), and the Draft State Planning Regulatory Provision (Infrastructure Charges).

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54. As I understand the position, Council no longer has a role in making policy for sewerage infrastructure (and water reticulation infrastructure) and that the powers in respect of that kind of infrastructure has passed to QUU under the Water Distribution Act.

Council Planning Scheme Policies

55. I am not familiar with the detail of planning scheme policies relating to sewerage and stormwater infrastructure and I have little knowledge of how the development assessment process operates in this respect. I have made some inquiries of other Council officers including officers of Development Assessment branch in this regard and they have provided me with some basic information which allows me to identify how the design standards are incorporated in the planning scheme. If the Commission seeks a more detailed and precise response on this issue, evidence will need to be obtained from another Council officer with development expertise.

56. I have been informed that the planning scheme contains provisions relevant to stormwater infrastructure through the Stormwater Management Code and the Waterways Code which, amongst other things, call up detailed provisions in the Subdivision and Development Guidelines relating to stormwater design standards. I deal in more detail with these design standards in my response to Request 5 of the Notice.

57. Council also develops from time to time Local Stormwater Management Plans (**LSMPs**). These plans are, as I understand it, also planning scheme policies. The plans are primarily concerned with identifying deficiencies and rectifying local flooding issues. They also make provision for considerations in respect of assessment of future development. Some of these plans apply to local catchments in some of the Relevant Suburbs. I deal with these further in my response on Request 5 of the Notice.

Other Policies about Stormwater Infrastructure

Stormwater Design Standards

58. Council also has had for some time a policy relating to the up-grading of the existing Stormwater Network in established areas. I deal further with policy for up-grading design capacity in my response to Request 5 of the Notice.

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Recovery of contributions by applicants for development approval to the cost of the Council's Trunk Infrastructure

59. As I understand it, Council has in recent years recovered contributions from applicants for development approvals contributions to the cost of current and anticipated future infrastructure, including for stormwater and, until recently, sewerage infrastructure. I am aware that in recent years, the process for levying the equivalent of head works contributions has been transferred from the planning scheme to a separate statutory scheme under the *Integrated Planning Act* and now the SPA. The manner in which the SPA deals with this issue is complex and not within my knowledge, except in the most general terms.

3. The Council's drainage plans applicable to the Relevant Suburbs at any time since 1 October 2010.

60. I refer to my response to Request 1 of the Notice and in particular to the maps referred to in paragraph 27. Those maps show plans of Council's stormwater infrastructure and other elements of the Stormwater Network as it currently exists in the Relevant Suburbs.

61. In addition, Council has further plans for stormwater infrastructure which are applicable to the Relevant Suburbs since 1 October 2010. These plans fall into three categories:

(a) the first category comprises plans of work completed in the 2010/2011 financial year to upgrade the Stormwater Network in areas falling within the Relevant Suburbs. It might be that not all of this work has as yet been included in Council's relevant data bases. Attachment "**JJB-10**" comprises copies of those plans;

(b) the second category comprises plans and relevant supporting documents for work to be completed in the 2011/2012 financial year to upgrade the Stormwater Network in areas falling within the Relevant Suburbs. Attachment "**JJB-11**" comprises copies of those supporting documents and plans;

(c) the third category comprises plans and/or relevant documents relating to work intended to be completed in future years to upgrade the Stormwater Network in areas falling within the Relevant Suburbs. Attachment "**JJB-12**" comprises copies of the relevant documents and plans.

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62. There are further works contemplated in the Relevant Suburbs arising from LSMPs for areas in those suburbs which have not yet reached the stage of preparation of plans.

4. The standards applicable to property owners or developers who seek to connect to a Council stormwater drain or sewerage infrastructure owned by Queensland Urban Utilities within the Relevant Suburbs at any time since 1 October 2010.

Connection to Stormwater Drains

63. I am not personally familiar with the detail of the applicable standards the subject of this Request of the Notice. However, I understand the position to be as follows, based on information from Council officers familiar with the issue.

64. For building work, the applicable standards for connection to a Council stormwater drain are contained in the Building Code of Australia and the Queensland Development Code which are called up by s. 30 of the *Building Act 1975* (Qld). For other aspects of assessable development under the Brisbane City Plan 2000, the applicable standards for connection to a Council stormwater drain are contained in Part B Chapter 2, Part C Chapters 3 to 5, and any relevant design and construction procedures set out in Part D, of Council's Subdivision and Development Guidelines 2008.

Connection to Sewerage Infrastructure

65. The standards for connection to sewerage infrastructure owned by QUU are not a matter for Council.

5. The stormwater design capacity and urban run-off capacity, sewerage design capacity and the most recent review of these capacities, including any plans to upgrade, for the Relevant Suburbs.

66. I am familiar with the expression "stormwater design capacity" and can address Request 5 of the Notice by reference to that concept. I am not familiar with the expression "urban run-off capacity" and I am unsure what the Commission means by that expression. Accordingly this part of my Statement address stormwater design capacity.

[redacted]

Joseph John Banham

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Sewerage Design Capacity

67. As stated above, following water reforms introduced by the State of Queensland in July 2010, responsibility for Brisbane's sewerage infrastructure lies with QUU.

Stormwater Network Design Capacity for New Development

68. Design standards for stormwater capacity are specified for new developments in the Subdivision and Development Guidelines. The guidelines apply to all development including development in the Relevant Suburbs. As I have said, I am not familiar with how those guidelines are incorporated into the planning scheme. Those guidelines, relevantly, apply the standards specified in the Queensland Urban Drainage Manual (**QUDM**). Clause 3.2 of Chapter 2 of Part B of the Subdivision and Development Guidelines provides:

"The major and minor drainage systems as described in Section 5.03 of QUDM forms the basis of the drainage system within the urban area. The design standards are given in Table B2.1.

The major drainage system is that part of a drainage system in a catchment that is designed to convey rare design storms. The system may comprise open space floodway channels, road reserves, pavement expanses, overland flow paths, natural or constructed waterways, detention/retention basis and other major water bodies. Where the major system is within the road reserve, the design standard is the 50 year ARI storm event.

The minor drainage system is that part of a drainage system in a catchment that controls flows from the minor design storm such as the 2 year ARI and 10 year ARI events. The system usually comprises kerbs and channels, roadside channels, gully inlet pits, underground pipes, manholes and outlets."

TABLE B2.1 DESIGN STANDARDS FOR MAJOR/MINOR DRAINAGE SYSTEMS

Development category	Design parameter	Design standard
2-5 dwelling units per hectare (typically in Rural/Environmental Protection Areas where predominant uses include house on large allotment and farm)	Minor drainage system Major drainage system	Minimum 2y ARI Minimum 50y ARI (less piped flow if applicable)
>5 and ≤ 20 dwelling units per hectare (typically in Low Density Residential Area comprising mainly one or two	Minor drainage system Major drainage system	Minimum 2y ARI Minimum 50y ARI (less piped flow

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Joseph John Bannan

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Development category	Design parameter	Design standard
storey single houses)	Roofwater drainage	if applicable) Level II *QUDM* Section 5.13.4
>20 dwelling units per hectare (typically in Low-medium to High Density Residential Areas comprising multi-unit dwellings)	Minor drainage system Major drainage system Roofwater and lot drainage	Minimum 10y ARI Minimum 50y ARI (less piped flow if applicable) Level III and IV *QUDM* Section 5.13.4
Industrial areas	Minor drainage system Major drainage system Roofwater and lot drainage	Minimum 2y ARI* Minimum 50y ARI (less piped flow if applicable) Level IV *QUDM* Section 5.13.4
New use centre activities (incorporating a wide range of commercial, retail and residential uses)	Minor drainage system Major drainage system Roofwater and lot drainage	Minimum 10y ARI Minimum 50y ARI (less piped flow if applicable) Level IV and V *QUDM* Section 5.13.4
Major roads (district access, suburban route, arterial route, major industrial access through road)	Kerb and channel flow Cross drainage (culvert) flow Roadway flow width & depth limits	Minimum 10y ARI To suit flood immunity requirement of Chapter 1 of Part A of this document Refer *QUDM* Table 5.04.1
Minor roads (local access, neighbourhood access, minor industrial access)	Kerb and channel flow Cross drainage (culvert) flow Roadway flow width & depth limits	Refer relevant development category, minimum 2y ARI To suit flood immunity requirement of Chapter 1 of Part A of this document Refer *QUDM* Table 5.04.1

* For industrial roads that will be major through roads, the minor drainage design will need to increase to 10y ARI.

69. I understand that the above standards are generally consistent with those which have applied since the adoption of QUDM by Council in June 1994 as set out in the memorandum referred to in paragraph 58 above. Further, I understand that there have been revisions to the QUDM manual from time to time since June 1994, but that the stormwater design capacity standards

[redacted]

Joseph John Bannan

[redacted]

have not been altered. It is likely that Council would adopt any revisions to stormwater design capacity made to QUDM.

70. I am not aware of any plans to upgrade those standards either for the Relevant Suburbs or generally. Council applies equivalent standards to those contained in the Subdivision and Development Guidelines in planning for greenfields extensions to the Stormwater Network.

Council's approach to upgrading existing Stormwater Network capacity

71. Notwithstanding the design capacity standards currently applying to new development, there are many parts of the City where the Stormwater Network does not perform to those standards.

72. The first stormwater infrastructure was constructed in Brisbane in 1860 when the local population was about 5,000 people. Currently serving a population in excess of 1,000,000 people, Council's network of stormwater drainage infrastructure has an estimated length in excess of 2,640 km and a replacement value of $2.9 billion.

73. Drainage in most of the older areas of Brisbane City was constructed prior to the introduction of modern design standards, when Council had less control over the subdivision of land and the construction of dwellings. In addition, the density of development was lower and there was less recognition of flood hazards and the importance of preserving natural flow paths for stormwater.

74. As a consequence, some older areas of Brisbane do not meet current design requirements. Residents within these areas suffer nuisance flooding which varies from yard pondage to flooding of low-lying utility areas. In more extreme instances, habitable areas are flooded at an unacceptable frequency. Many of the Relevant Suburbs are older areas of Brisbane which have areas which have stormwater flooding issues which need to be addressed.

75. I understand that Council has had for many years undertaken relief drainage schemes for parts of the City which have difficulties with stormwater flooding issues. Attachment "**JJB-13**" is a memorandum dated 23 October 1995 which reflects the approach taken by Council in 1995 to such relief schemes.

76. Prior to about 1997, I understand that Council's approach to relief drainage schemes was generally responsive to particular problems. From about 1997 (when Council obtained a report on relief drainage strategic planning a copy of which is Attachment "**JJB-14**"), Council has adopted a more proactive approach to relief drainage schemes. While such schemes might

[redacted]

Joseph John Banham

still be in response to particular events, Council also undertakes the preparation of LSMPs for older areas.

77. LSMPs have been prepared for a number of prioritised catchments. The purpose of the LSMPs is to assess the existing stormwater drainage system capacity, identify the problem areas within the catchment and the cause of problems, and develop relief drainage options to reduce inundation. The plans provide an assessment of the extent of flooding before and after relief works are in place for existing and ultimate catchment development and identify the overland flow paths to be protected from development. The LSMPs which involve catchments which are in general terms in the Relevant Suburbs are set out in the table below:

LSMP	DATE	RELEVANT SUBURB
West End Local Stormwater Management Plan Technical Report	October 2004	South Brisbane, West End
Local Stormwater Management Plan Albion Catchment Technical Report	July 1999	Albion
New Farm - Teneriffe Catchment Report On Relief Drainage Investigation	March 1997	New Farm, Teneriffe
Relief Drainage Investigation Sydney Street, Merthyr Catchment	April 1997	New Farm
Castlemaine Street - Caxton Street Catchment, Milton Report On Relief Drainage Investigation	18 September 1996	Milton
Stratton Street Catchment Relief Drainage Investigation	June 1997	Newstead
Stratton Street Drainage Report on Additional Investigations	November 1997	Newstead, Fortitude Valley, CBD
Stratton Street Drainage Report on Revised Drainage Relief Options	September 1998	Newstead, Fortitude Valley, CBD
Water-Campbell Streets Catchment Relief Drainage Investigation	Undated	Fortitude Valley
Faulkner Park, Graceville Local Stormwater Management Plan	Undated	Graceville, Chelmer

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Joseph John Bannan

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Long Street East, Graceville Local Stormwater Management Plan	January 2003	Graceville
Local Stormwater Management Plan Pashen Creek, Hawthorne Catchment	March 1998	Bulimba, Hawthorne, Norman Park
Yeronga Local Stormwater Management Plan	June 2003	Yeronga, Fairfield
Local Stormwater Management Plan Technical Report Western Creek Catchment Milton	June 2004	Rosalie, Milton
Langsville Creek Local Stormwater Management Plan	approx. 2003	Auchenflower, Toowong

78. Council's LSMP process has identified significant and expensive works to improve, so far as reasonable in the circumstances, the capacity of particular problem areas in the Stormwater Network. In addition, Council's investigations in response to particular complaints also generate recommendations for works to improve the capacity of the Stormwater Network.

79. At present, the total cost to carry out all upgrading works identified by the above investigations vastly exceeds any possible capacity of Council to undertake. Accordingly, Council adopts a prioritisation methodology to try to match the most pressing works to available resources.

80. The first step is to categorise the character of the flooding issue by reference to the following classes:

(a) S Safety Issue

(b) A Flooding of Living Areas

(c) B Flooding of Utility Areas

(d) D Flooding of Other Properties (commercial, industrial)

(e) E Flooding on Roads

(f) F Flooding of Parks

(g) H Other.

81. Priority is allocated to works in the order set out in the previous paragraph.

[redacted]

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Joseph John Banman

82. The works within each category are also very extensive. Therefore they are further prioritised by reference to:

(a) cost effectiveness;

(b) severity of flooding;

(c) number of affected residential properties;

(d) frequency of flooding events/frequency of flooding inundation;

(e) weighting factors are applied to each property based on the category of inundation - that is, flooding to living areas, utility areas or yards of residential dwellings.

83. Council maintains a spreadsheet that deploys a formula for prioritising works in accordance with the criteria in the previous paragraph.

84. The total cost of works identified in the categories S and A alone is very substantial. Attachment **"JJB-15"** is a copy of the spreadsheet maintained by Council in respect of just those works, prioritised as specified above. It shows that there is $875M in works which have been identified as at 24 June 2010. Attachment **"JJB-16"** is a copy of that spreadsheet showing just such works in respect of the Relevant Suburbs. Despite the accumulated cost of works, I understand that further works continue to be identified each storm season. Frequently, the costs and complexity require construction of relief works to be staged over a number of financial years.

85. Attachment **"JJB-17"** is a copy of Council's five year rolling program comprised of the current financial year construction works and four years of future works. As is apparent from the program, Council is committed to deliver stormwater infrastructure to minimise flooding impacts to residential properties. The projects allocated under specific years are subject to change dependent upon future budget funding and other high priority projects identified during any future flood events.

[redacted] [redacted]

Joseph John Bannan

6. Whether and how the Council monitors the capacity of its stormwater drainage infrastructure, and in particular, assesses the suitability of its capacity for the existing and future need.

86. Council monitors the performance of its existing stormwater infrastructure by its inspection and maintenance practices set out in my response to Request 1. Council assesses the suitability of its existing Stormwater Network, including stormwater infrastructure for existing need by the processes identified for assessing adequacy of the Stormwater Network set out in my response to Request 5 of the Notice.

87. Council's LSMPs also assess the suitability of the capacity of the Stormwater Network for future need in the areas covered by each plan. This is done by developing the LSMP by taking into account the likely future development in the area based on the current City Plan.

88. Outside the LSMP process, Council is presently in the process of developing a Priority Infrastructure Plan (**PIP**) which is called for by the provisions of the SPA. As I understand it, the PIP remains in draft. However, prior to the PIP process, Council had undertaken the development of Stormwater Management Plans (**SMPs**). In contrast to LSMPs, SMPs were specifically directed at planning the Stormwater Network necessary to address future need in likely greenfield sites for future development. Attachment **"JJB-18"** is a plan showing areas subject to both LSMPs and SMPs for the Relevant Suburbs and adjacent areas included in the particular plan. As can be seen, the SMPs relate to areas of future development for which there is as yet no extensive constructed Stormwater Network.

89. Further, as set out in paragraph 95 below, Stormwater Network Trunk Infrastructure Plans showing future infrastructure have been prepared for use in the PIP. To the extent that those plans are not based on LSMPs or SMPs, they will have been derived from computer modelling of likely future need.

7. The existing and future need for stormwater drainage infrastructure within the Relevant Suburbs, including any report, study, investigation or briefing note prepared or commissioned by Council.

90. So far as I am aware, Council has the following documents which respond to Request 7.

[redacted] [redacted]

91. First, there are a number of LSMPs which relate to areas within some of the Relevant Suburbs as identified in paragraph 77 above.

92. Second, there is the list of proposed major drainage works for residential areas relating to the Relevant Suburbs at Attachment JJB-16.

93. Third, to the extent that planning exists for works to be undertaken in the current or future financial years to address stormwater issues in the Relevant Suburbs, those documents appear in Attachments JJB-11 and JJB-12.

94. Fourth, there is a SMP which covers the Pullen Pullen Creek area which impacts on Bellbowrie.

95. Fifth, there are the Stormwater Network Trunk Infrastructure Plans prepared for the PIP which identify planned future stormwater infrastructure for the whole City including the Relevant Suburbs. There would be an overlap between the works identified in the LSMPs and the future works shown in those plans. Attachment **"JJB-19"** is a copy of the Stormwater Network Trunk Infrastructure Plans.

8. Whether and how the Council monitors the capacity of the sewerage infrastructure owned by Queensland Urban Utilities and, in particular, assesses the suitability of its capacity for existing and future need.

96. Council does not, nor is it required to, monitor the capacity of the sewerage infrastructure owned by QUU. However, the capacity of such infrastructure will be relevant to the consideration of future infrastructure and planning requirements.

9. The Council's regulatory role in relation to property owners or developers who seek to connect to sewerage infrastructure owned by Queensland Urban Utilities.

97. Although I have had some experience in relation to the matters the subject of Request 9 in the past, I am not familiar with the current position in respect of those matters. It is my understanding however, that the position is as follows.

98. Connection to sewerage infrastructure is affected by the provisions of the following regulatory regimes:

(a) The development assessment process under the SPA:

[redacted]

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(b) Connection to or interference with a service provider's infrastructure under the *Water Supply (Safety and Reliability) Act 2008* (Qld);

(c) Compliance assessment of regulated plumbing or drainage work under the *Plumbing and Drainage Act 2002* (Qld).

99. Council's role in relation to sewerage infrastructure during the development assessment process is not addressed in any detail in this Statement for the reasons given in paragraph 55 above.

100. Council has no regulatory role in relation to connection to a Distributor-Retailer's sewer infrastructure under the Water Supply (Safety and Reliability) Act.

101. Council has a role in relation to compliance assessment under the Plumbing and Drainage Act for certain "regulated work".

102. The Plumbing and Drainage Act requires that a connection, disconnection or change to a Distributor-Retailer's infrastructure be approved by or for the Distributor-Retailer, or alternatively, that Council be given written advice by the Distributor-Retailer that such approval is not required for particular connections.

10. The use of backflow prevention devices, including any plans to expand, upgrade or investigate the use of these devices, in the Relevant Suburbs.

103. Backflow prevention devices have been used primarily to reduce tidal water entering to drainage systems during high tides in low lying areas. Council is maintaining a number of backflow prevention devices in tidally affected areas. Attachment **"JJB-20"** is a list of locations of backflow prevention devices. Only five such devices are in any Relevant Suburb. Those devices are located in New Farm, Yeronga, West End and Newstead.

104. The Flood Response Review Board (**FRRB**) recommended:

"Council investigate the feasibility of the installation of devices to prevent back flow from river flooding in locations such as in parts of the Central Business District (CBD) and in high rise buildings which would not have been flooded otherwise where all those potentially affected by back flow flooding have responsibility for the oversight of the maintenance of the device in working order. No back flow prevention device should be incorporated into the stormwater network system unless a complete risk based flood management analysis has confirmed that this is the best option."

[redacted]

[redacted]

105. Consistent with the recommendation of the FRRB, investigations have commenced to assess the back flow flooding experienced in January 2011 and the feasibility of installing back flow prevention measures. A project brief for that purpose was prepared by Council and dated 7 July 2011. Attachment **"JJB-21"** is a copy of the project brief. MWA Environmental has been retained to carry out those investigations. The initial stage of the investigations involves a case study on three areas:

(a) Milton (including Rosalie);

(b) New Farm; and

(c) CBD.

106. Community consultation and information sessions have already commenced. Attachment **"JJB-22"** is a fact sheet produced by Council in respect of the investigation process. Attachment **"JJB-23"** are maps showing the areas the subject of the back flow case study investigation.

[redacted]

[redacted]

Joseph John Bannan

I make this statement conscientiously believing the same to be true, and by virtue of the provisions of the Oaths Act 1867 (Qld).

Signed and declared by Joseph John Bannan at
Brisbane
in the State of Queensland
this 8th day of September 2011
Before me:

[redacted]

[redacted] n the declaration is made

Signature of declarant

[redacted]

Full name and qualification of person before whom the declaration is made

Our ref: Doc 1681702

19 August 2011

Mr Joe Bannan
Manager of City Assets
Brisbane City Council
C/- Clayton Utz
Attn: Scott Sharry and Mark Sammut
GPO Box 55
BRISBANE QLD 4001

REQUIREMENT TO PROVIDE STATEMENT TO COMMISSION OF INQUIRY

I, Justice Catherine E Holmes, Commissioner of Inquiry, pursuant to section 5(1)(d) of the Commissions of Inquiry Act 1950 (Qld), require Mr Joe Bannan, Manager of City Assets, to provide a written statement, under oath or affirmation, to the Queensland Floods Commission of Inquiry, in which the said Mr Bannan:

- provides all information in his possession and identifies the source or sources of that information;
- makes commentary and provides opinions he is qualified to give as to the appropriateness of particular actions or decisions and the basis of that commentary or opinion;

in respect of the following topics:

1. the flood mitigation infrastructure (for example flood detention basins, storm water culverts, back flow devices) in the Council's area, including a description of the maintenance programs for such infrastructure, for the following suburbs ('the Relevant Suburbs'):

    a. Brisbane City;
    b. Fortitude Valley;
    c. New Farm;
    d. Newstead;
    e. Teneriffe;
    f. Bulimba;
    g. Hawthorne;
    h. Norman Park;
    i. East Brisbane;
    j. Kangaroo Point;
    k. South Brisbane
    l. West End;
    m. Hill End;
    n. Fairfield;
    o. Yeronga;
    p. Rocklea;
    q. Chelmer;
    r. Graceville;
    s. Oxley;
    t. St Lucia
    u. Toowong;
    v. Auchenflower;
    w. Milton;

400 George Street Brisbane
GPO Box 1738 Brisbane
Queensland 4001 Australia
Telephone 1300 309 634
Facsimile +61 7 3405 9750
www.floodcommission.qld.gov.au
ABN 82 696 762 534

x. Rosalie;
y. Fig Tree Pocket;
z. Bellbowrie;

2. the Council's planning scheme policy or other Council policy about sewerage or stormwater drainage infrastructure applicable to the Relevant Suburbs at any time since 1 October 2010;

3. the Council's drainage plans applicable to the Relevant Suburbs at any time since 1 October 2010;

4. the standards applicable to property owners or developers who seeks to connect to a Council stormwater drain or sewerage infrastructure owned by Queensland Urban Utilities within the Relevant Suburbs at any time since 1 October 2010;

5. the stormwater design capacity and urban run-off capacity, sewerage design capacity and the most recent review of these capacities, including any plans to upgrade, for the Relevant Suburbs;

6. whether and how the Council monitors the capacity of its stormwater drainage infrastructure, and in particular, assesses the suitability of its capacity for the existing and future need;

7. the existing and future need for stormwater drainage infrastructure within the Relevant Suburbs, including any report, study, investigation or briefing note prepared or commissioned by Council

8. whether and how the Council monitors the capacity of the sewerage infrastructure owned by Queensland Urban Utilities and, in particular, assesses the suitability of its capacity for existing and future need;

9. the Council's regulatory role in relation to property owners or developers who seek to connect to sewerage infrastructure owned by Queensland Urban Utilities;

10. the use of backflow prevention devices, including any plans to expand, upgrade or investigate the use of these devices, in the Relevant Suburbs.

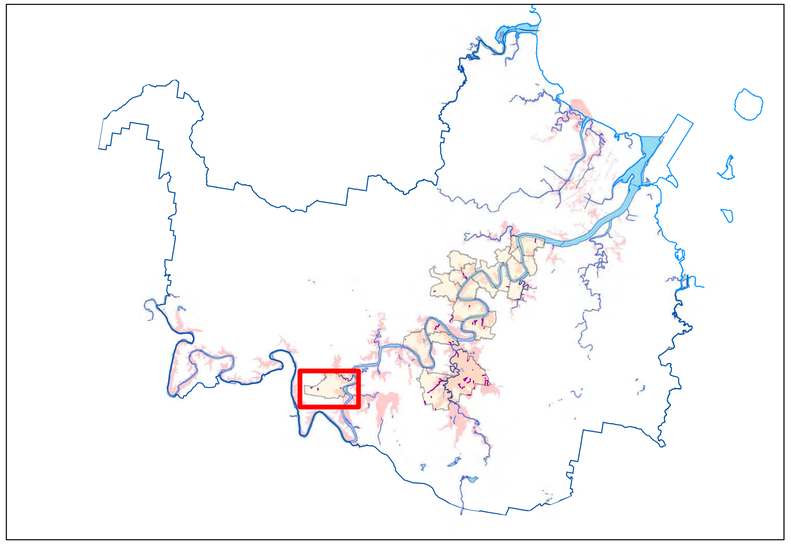
Mr Bannan may also address other topics relevant to the Terms of Reference of the Commission in the statement, if he wishes.

The statement is to be provided to the Queensland Floods Commission of Inquiry by 5 pm, Wednesday, 7 September 2011.

The statement can be provided by post, email or by arranging delivery to the Commission by emailing info@floodcommission.qld.gov.au.

[redacted]

Commissioner
Justice C E Holmes



BELLBOWRIE

- Back Flow Prevention Devices (5 Locations)
- Detention Basins (4 Locations)
- Culverts (134 Locations)
- Streets
- Stormwater Drains (311 Km)
- Stormwater Open Drains
- Overland flow
- River and Creeks
- Waterways
- Relevant Suburbs
- Jan 2011 Flood Innundation

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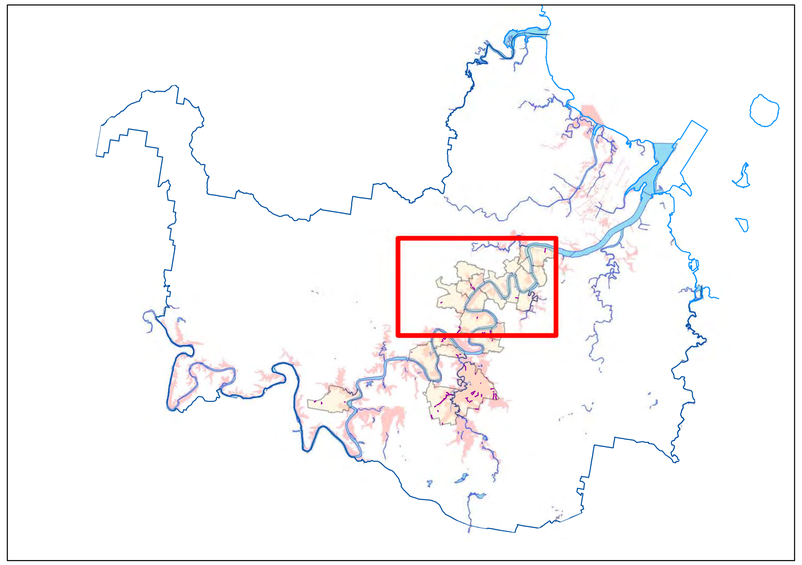
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Brisbane City Council
Level 19
266 George Street
Brisbane QLD 4000

Brisbane City Council Stormwater Infrastructure

September 2011

N W E S

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PADDINGTON
AUCHENFLOWER
TOOWONG
MILTON
WEST END
FORTITUDE VALLEY
BRISBANE CITY
NEWSTEAD
TENERIFFE
BULIMBA
HAWTHORNE
NEW FARM
SOUTH BRISBANE
EAST BRISBANE
ST LUCIA
YERONGA
FAIRFIELD
CHELMER

0 4 8 16 24 32 Kilometers

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Brisbane City Council Stormwater Infrastructure

September 2011

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Brisbane City Council Stormwater Infrastructure

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ST LUCIA
CHELMER
GRACEVILLE
FIG TREE POCKET
YERONGA
FAIRFIELD
ROCKLEA
OXLEY

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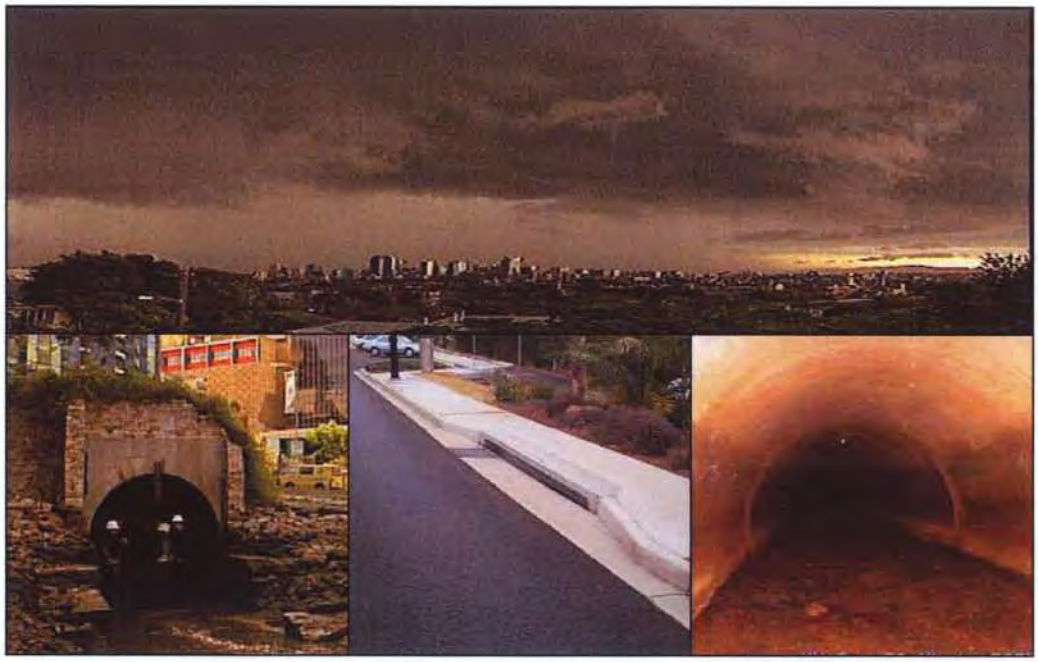
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Asset Management Plan

BRISBANE CITY COUNCIL



Enclosed Stormwater Drainage Assets

Prepared by City Assets Branch
Brisbane Infrastructure Division
August 2009

BCC.123.0185

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	July 2007	3.3 Review and Update
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Update Authorised by:

Name / Title	Date	Signature
[redacted] Principal Engineer Stormwater Infrastructure City Assets	10/8/09	[redacted]
[redacted] Manager City Assets	10/8/09	

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1 INTRODUCTION

1.1 Background

1.1.1 History – The Beginning

[1]The Municipality of Brisbane was proclaimed on 7 September 1859 when the local population was about 5,000. One of the first drainage problems in the city precinct, which needed attention, was that high spring tides covered much of Frog's Hollow, bounded by Alice, Albert, Elizabeth and Edwards Streets.

The first construction of stormwater drainage was a stone egg shaped drain (4ft x 3ft 6ins) in March 1860. This drain was constructed along Albert St, from Elizabeth St to Margaret St and then later extended to the river along Margaret St.

There was much talk about "Big Creek" which ran from the now Roma St railway yard, along Albert St, then between Adelaide and Queen Streets to just pass Creek St and then down Creek St to outlet at the foot of Creek Street. The creek was a flood problem and becoming a health hazard, due to the washing down of butcher shops, the overflow of cesspools and the washing of horse manure from the streets.

After extensive flooding on the 24th of February 1875 when 190mm of rain fell in a 24-hour period, the Premier, the Council and shopkeepers met to discuss the problems and a major drainage investigation was promised. By 13 September 1875 design drawings were completed and signed. The first contract for stormwater drainage was placed on 20 October 1875. Five other contracts followed in the next two years.

Contract No.1 – Adelaide St & Creek Street. The main outfall from Albert St where a 6 ft culvert was built under Adelaide Streets and a 9 ft culvert in Creek St to the river.

Contract No.2 – An egg shaped drain was constructed along the original watercourse at a grade of 4 ft in a mile (1 in 1320) connecting the culverts in Contract No.1.

Contract No. 3 – A small drain connecting Queen St with the main drain.

Contracts No. 4 & 5 – These were built in 1877, one running as a diversion from Roma Street railway yard, under Makerston Street to the river. The other started near the reservoir, which was situated near Tank St and joined Contract No.1.

1.1.2 Purpose of the Plan

The purpose of this Asset Strategic Plan (ASP) is to record the current asset management practices employed for enclosed stormwater drainage assets in Council. It will facilitate understanding of the

strengths and weaknesses of current ASP practices and will identify priorities for future ASP developments and improvement.

The initial use of this plan is for strategic asset management planning by staff of City Assets Branch, Brisbane Infrastructure Division. It is envisaged that ultimately this plan will be used as a management tool to assist the Program Manager in asset management decision making. It is also a useful document for demonstrating responsible asset management to Council, Councillors and other stakeholders impacted by the performance of these assets.

The aim of this plan is to enable Brisbane City Council to deliver the required level of service to the stakeholders and customers for Council's enclosed stormwater drainage assets in the most cost effective way through creation/acquisition, operation, maintenance, rehabilitation and disposal of these assets.

The benefits from an asset strategic plan include:

- Demonstration of responsible asset management
- Cost effective achievement of strategic goals of Council
- Compliance with accounting standards
- Stewardship and accountability of assets
- Maintaining communication and relationship links with the stakeholders
- Basis for reporting of asset performance against expected service levels
- Risk management of the assets (financial and environmental)
- Review and audit processes
- Full asset life cycle consideration
- Documented process

This plan should be updated each year after the budget is approved.

1.1.3 Assets included in the Plan (refer Table 1)

Council's enclosed stormwater drainage network consists of four asset classes:

- Pipe (PI)
- Stormwater Quality Improvement Device (SQID)
- Gully (GU)
- Manhole (MH)

Each asset class comprises a number of asset types:

Asset Class	Asset Type	Description
PI	Pipe	The primary purpose of a pipe is to convey stormwater.
PI	Box culvert	The primary purpose of a box culvert is to convey stormwater.
MH	Manhole	A structure provided at the junction of two pipes or box culverts to permit access by maintenance personnel. Generally these are provided at a maximum spacing of 90m and are constructed in accordance with Standard Drawings.
MH	Lamphole	Lampholes are junctions in pipes or box culverts to permit the entry of light (lamps) and air during maintenance activities. Lampholes are no longer constructed.
MH	Vent	Vents serve a similar function to manholes however they are not large enough to permit access by maintenance staff. Vents are no longer constructed
MH	Gully Manhole	A gully with a pipe inlet and outlet. (i.e. a gully upstream is connected directly to this gully)
MH	Chamber	Maintenance access point and junction in pipes or box culverts that are large or of a non-standard size.
MH	Inlets	Protective structures at the upstream entrance to a pipe. The inlet generally consists of a head wall, two wing walls and an apron.
MH	Outlets	Same as for an inlet except it is provided at the outlet from a pipe. These may include scour protection features e.g. energy dissipaters.
To be develo ped	Safety Racks	A metal grill that has safety as its primary function. They are generally provided to stop unauthorised or accidental access to the drainage network.
GU	Gully	An inlet to the enclosed drainage system. These are generally provided on the kerb line of road and consist of a pit (usually 900 x 600), in plan view, a lintel (to allow back entry of stormwater), and a grate (to allow visual inspection, cleaning and additional capture of stormwater.
SQ	SQID	A Stormwater Quality Improvement Device (SQID) is a device that is designed to improve the quality of urban creeks. SQIDs utilise physical, biological and chemical processes to remove pollutants (floating litter, suspended and dissolved components, organic material, etc) before they enter waterways. This ASP does NOT include SQIDs
Assets NOT included in this ASP		
Open drains, Open channels, creeks, rivers, culverts, easements, swales, gross pollutant traps, trash racks, gully baskets, sediment ponds, wetlands, lakes, retention or detention basins, roof water drainage, flood mitigated creeks		

Table 1 Summary of Assets included in this Document

Stormwater enters the enclosed drainage network through gullies and inlets. Stormwater flows through pipes and/or box culverts, which are accessed via manholes. Stormwater is filtered by SQIDs and conveyed to outlets where it is discharged into open drains / channels, lakes, retention/detention basins, wetlands, creeks, rivers or the bay. This is shown in Fig.1 below.

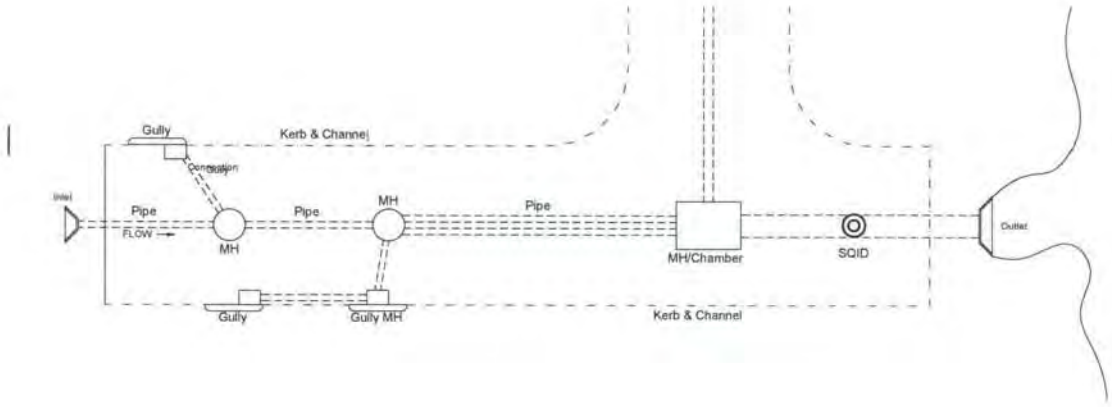


Fig. 1. Enclosed Stormwater Drainage Network

This Asset Strategic Plan covers strategic asset management planning for Council owned, enclosed stormwater drainage assets. These assets are located in roadways, parks and in some cases, in privately owned property.

1.1.3.1 PI - Pipe or Box Culvert

Most stormwater pipes and box culverts are constructed from precast concrete units which are either round (pipes) or rectangular (box) in cross section. These are typically installed as shown below:

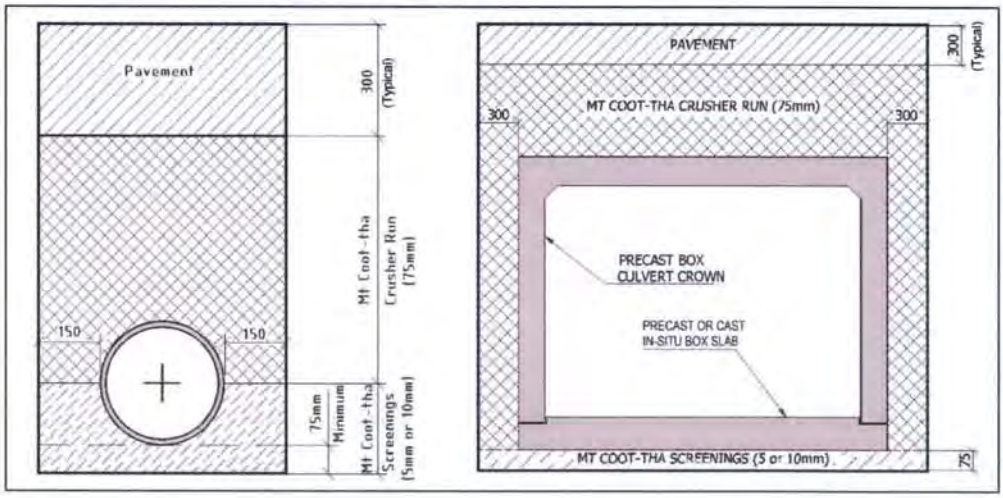


Fig. 2. Typical Pipe Installation (refer Standard Drawing UMS 311)

Older stormwater pipes or box culverts are also constructed of other materials such as brick or stone, and can be arched or egg shaped. Newer pipe materials such as fibre reinforced concrete (FRC) and High Density Polyethylene (HDPE) and Polypropylene (PP) are also used. A list of the existing pipe materials and shapes is given in Table 2 below:

Pipe Material Types		Pipe Shape Types	
Precast Concrete	Plastics (PVC, HDPE...)	Irregular	Round
Cast In Situ Concrete	Steel	Trapezoidal	Box Section
Brick	Cast Iron	Coffin	Arch Channel
Stone	Aluminium	Inverted Egg	Semi Circular
Porphyry Blockwork	Timber	Box Section Over Half Pipe	Egg Shaped
Asbestos Cement	Natural Material	Half Pipe Over Box Section	Oval
Fibre Reinforced Concrete	Corrugated Iron		
Vitreous Clay			

Table 2 Pipe Materials and Shapes

1.1.3.2 Manholes (includes chambers, lampholes, vents, and inlets and outlets with or without safety racks or energy dissipaters)

Manhole

Manholes are usually round or expanded ranging in diameter from 1050mm to 1950mm. These can be expanded by up to 900mm in diameter. Round manholes are generally either precast or cast-in-situ concrete, while expanded manholes are generally constructed from cast-in-situ concrete. Older manholes may vary in size and shape and can also be constructed using brick. A typical manhole configuration is shown below in Fig 3. Note that the diameter of the pipe is less than the diameter/width of the manhole to ensure its structural integrity.

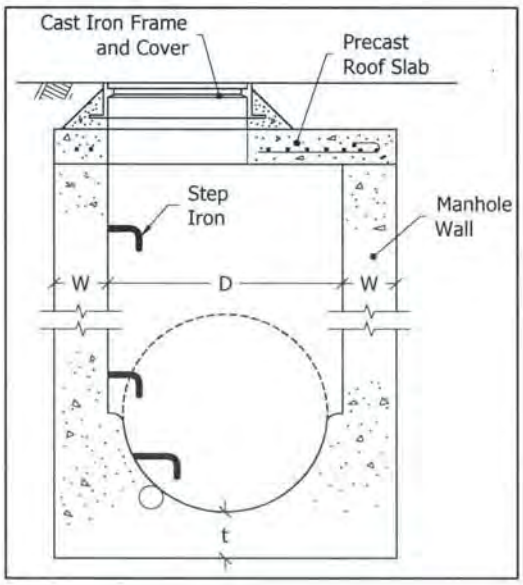


Fig. 3. Typical Manhole Configuration
(Refer BCC Standard Drawing UMS 321)

Chamber

Chambers are typically larger in size and are square or rectangular in shape. These are constructed from cast-in-situ concrete, or in some cases, brick. A typical configuration is shown below.

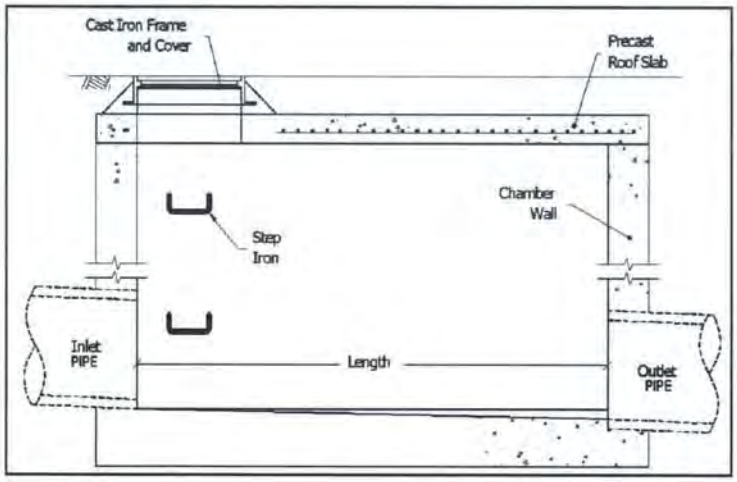


Fig. 4. Typical Chamber Configuration (Refer BCC Standard Drawing UMS 324)

Inlet and Outlet

Inlets and outlets are structures built at the location where a pipe begins, or discharges into an open drain, creek, river or the ocean. These structures generally consist of a head wall, wing walls and apron, and may be constructed from precast concrete, cast-in-situ concrete, stone pitching or brick. The typical geometry is given below in Fig 5.

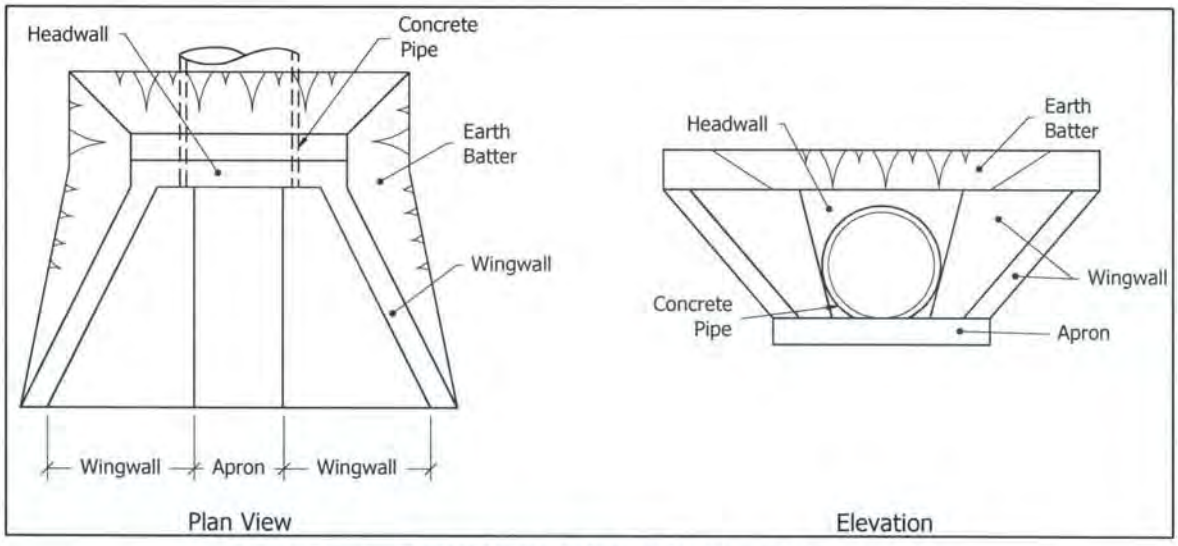


Fig. 5. Typical Inlet or Outlet Configuration (Refer BCC Standard Drawings UMS 341 and UMS 342)

Where outlets are on steep grades, they may incorporate energy dissipaters, scour curtains and plunge pools at or immediately downstream of the end of the apron. These features are a significant attribute of the outlet structure and are provided to minimise downstream erosion.

Safety Rack

Safety racks are generally metal grids secured over the inlet and/or outlet structure to either minimise unauthorised access or to protect the works from damage by foreign objects such as logs.

Vent and Lamphole

Brisbane's existing drainage system contains vents and lampholes. These structures are generally of historic significance and may be heritage listed. They are no longer needed. Vents were installed when the stormwater drainage system catered for grey water. Their purpose was to ensure that odours from the grey water were removed with minimal offence to residents. Lampholes were provided to check for blockages in the drainage system. A lamp was lowered down each lamphole in turn, and if the lamp could be seen from the nearest manhole then that section of the line was assumed to be clear.

Gully Manhole

Gully manholes are gullies that have an inlet pipe and an outlet pipe. They are generally only permitted at the upper end of the catchment where gully-to-gully connections provide the most economic solution for the drainage network.

1.1.3.3 Gully

The gully asset class consists of various gully types. These are generally on road or in parks and have a grated and/or back inlet. The typical gully geometry is shown in Fig. 6. A range of gully types are shown in Fig. 7.

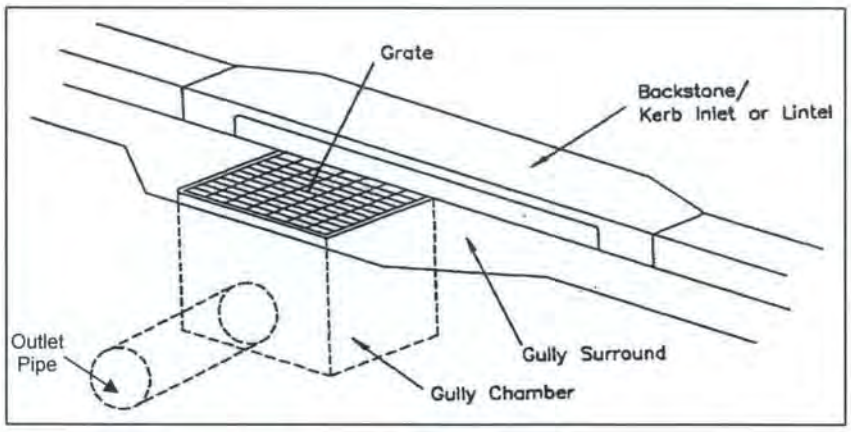


Fig. 6. Typical Gully Configuration

(Refer BCC Standard Drawings UMS 330 to 337)



Grated Inlet on Road



Back Inlet on Road



Field Inlet



Trench Grating

Fig. 7. Gully Types

1.1.4 Relationship with other planning documents

Asset Strategic Plans are strategic documents for managing Council's infrastructure assets in order to cost-effectively achieve the organisation's long term strategic goals. The figure below illustrates how asset management plans relate to other organisational plans.

- Living in Brisbane 2026
- BCC Corporate Plan 2008-12
- BCC Organisation 2012 Strategy
- An Integrated Water Cycle Management Strategy for Brisbane
- Local Stormwater Management Plans
- Stormwater Management Plans

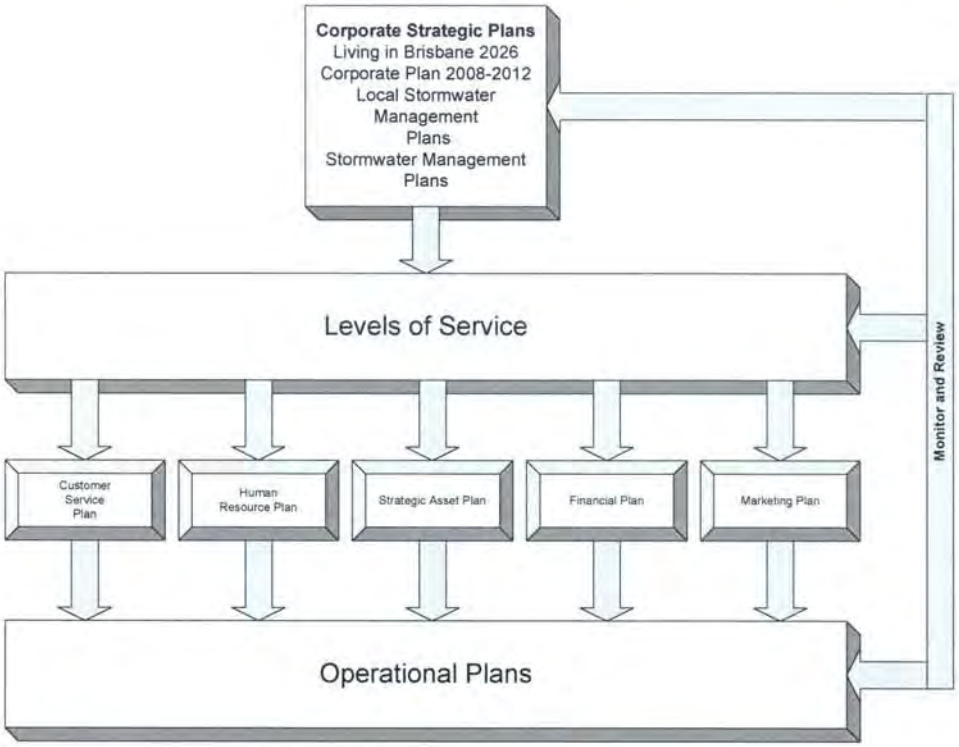


Fig. 8. Relationship between this Asset Strategic Plan and other Corporate Plans

Figure 9 below shows the relationship between the key Corporate Planning, Service Planning and Program Planning processes of Council. It also shows how strategic asset planning contributes to the implementation of Council's programs.

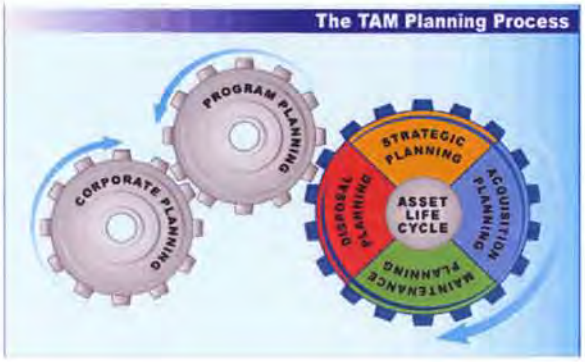
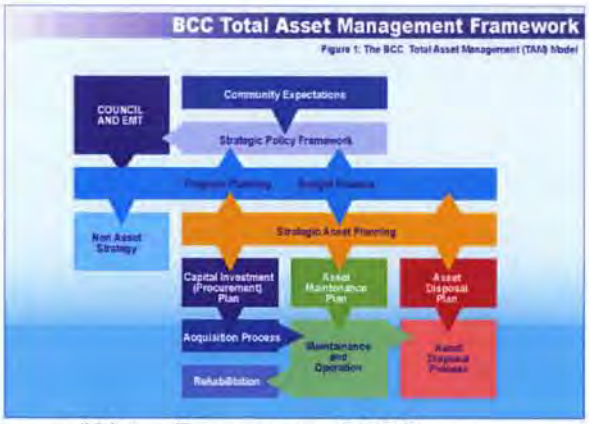


Fig. 9. Total Asset Management (TAM) Planning Process

1.1.5 Key stakeholders in the plan

The key stakeholders in the asset management planning of enclosed stormwater drainage assets are:

- Residents and businesses in Brisbane
- Traffic corridor users (including pedestrians, cyclists and motorists).
- Councillors.



- Program Manager (Water Resources, CP&S).
- Asset managers (Strategic Asset Management, City Assets, BI).
- Local asset managers (Local Asset Services, F&CS).
- Design and project managers (City Design, BI)
- Construction and maintenance managers (Brisbane City Works, BI).
- Development and assessment managers (Development Assessment, CP&S).

1.1.6 Organisational Structure

The organisational structure for the asset management of enclosed stormwater drainage assets is as follows:

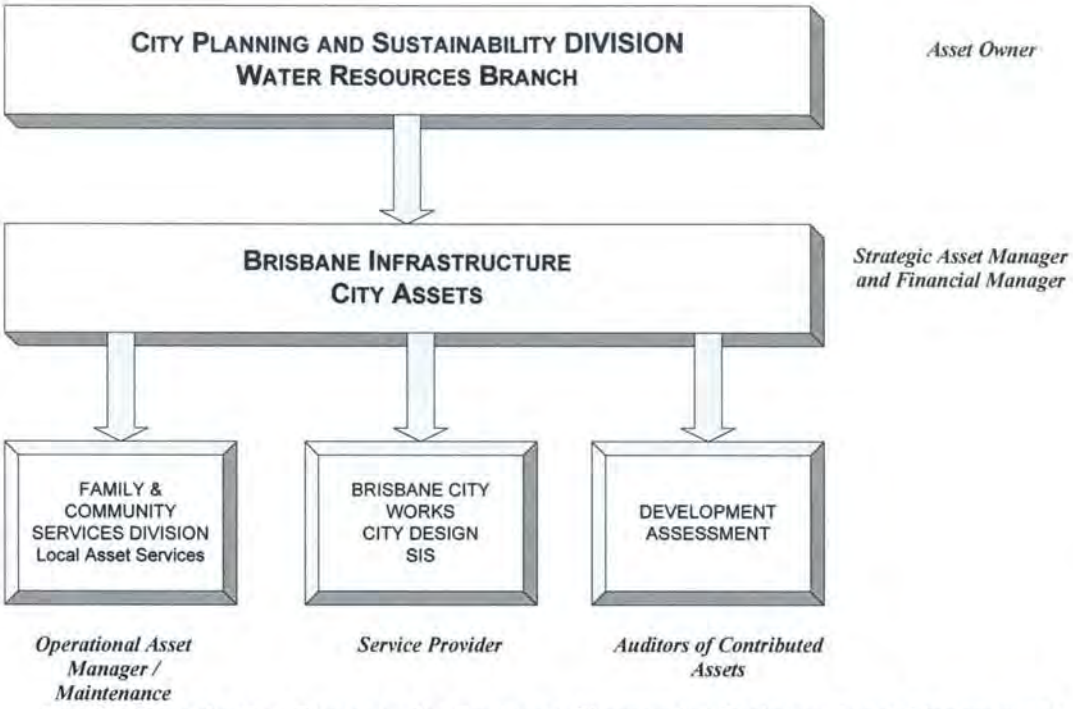


Fig. 10. Organisation Structure for Enclosed Stormwater Drainage Asset Management

Water Resources in partnership with key stakeholders sets policies for minimising the impact of flooding on people, properties and infrastructure, protecting the health of Brisbane's waterways and Moreton Bay from the adverse impacts of stormwater, and securing public access to waterways.

Water Resources' key roles in relation to this plan are policies to:

- Implementing Council's stormwater drainage programs to reduce the impact of flooding to properties and roads
- Ensuring the stormwater drainage system operates to its optimal capacity
- Reduce the amount of stormwater pollutants entering the city's waterways.

Water Resources Branch is the owner of the enclosed stormwater drainage network.

City Assets Branch provides strategic asset management direction and coordinates the delivery of annual construction and rehabilitation programs on behalf of the Water Resources.

City Assets Branch is responsible for the development and dissemination of Specifications and Standards. City Assets Branch also coordinates the collection and maintenance of stormwater asset data / information.

Local Asset Services provides operational maintenance management in terms of scheduled, reactive and programmed maintenance, including project listing, estimating and coordinating design.

City Design, Spatial Information Services and Brisbane City Works are internal service providers.

City Design provides enclosed stormwater drainage design services.

Brisbane City Works provides stormwater drainage construction, repairs, rehabilitation and maintenance.

Spatial Information Services carries out data input services to the corporate asset management systems.

Development Assessment approves development applications and ensures that contributed assets comply with relevant plans, standards and specifications.

1.1.7 Terminology

Manhole

In the remainder of this document the term "manhole" will refer to chambers, lampholes, vents, inlets and outlets.

Pipeline

The term "pipeline" will refer to the continuous drainage system formed by the interconnection of the pipes or box culverts with manholes and gullies.

Culvert

The prime purpose of a "culvert" is to pass stormwater under a roadway or pathway. A culvert has an inlet and an outlet connected directly to a waterway usually without any bends or manholes and is typically made of precast pipes or box culverts.

Note: - Culverts are NOT part of this Asset Strategic Plan.

1.2 Goals and objective of ownership

Council's enclosed stormwater drainage network provides for the efficient transfer of stormwater for flood mitigation and stormwater management purposes.

Council's environmental and sustainability focus has now added pollution management, erosion management control, general waste management, biodiversity management, catchment, creek, river and bay management.

The stormwater drainage network will be managed so that is consistent with those responsibilities.

This Asset Strategic Plan is compatible with City Plan and at least the following *Living in Brisbane 2026* themes:

- *Clean, green city*
- *Well designed, subtropical city*
- *Accessible, connected city*
- *Smart, prosperous city*

Part of the *Clean, green city* theme is to improve the health of our local waterways, river and bay by reducing the impact of flooding.

1.3 Plan Framework

This asset strategic plan consists of the following elements:

- Levels of Service
- Future Demand
- Life Cycle Management Plan
- Risk Management
- Financial Summary
- Management Systems
- Plan Improvement and Monitoring
- References
- Appendices

2 LEVELS OF SERVICE

2.1 Customer Research and Expectations

An objective of this asset strategic plan is to match the level of service provided by the existing stormwater drainage network with the expectation of customers (those impacted by the performance of the enclosed stormwater drainage network and their Councillors). For some areas of Brisbane the expectations of the community may exceed the practical, economic and design limitations of the enclosed stormwater drainage system.

Feedback from Councillors, residents and other stakeholders impacted by the performance of the network provides an indication of the level of service expected.

The levels of service expected are:

- Stormwater drainage assets manage stormwater runoff and reduce the impact of local flooding on transport corridors and properties.

- Enclosed stormwater drainage assets work efficiently and effectively during storm events.
- Gullies, pipes and manholes are periodically cleaned of leaves, silt or other debris which would impede design objectives.
- The integrity of the pipeline network and their surrounds is maintained.
- Gully grates along bike routes are bike-safe.
- Gully components are in safe working order.
- Gullies do not adversely impact on the rideability or safety of the transport corridors.
- Prompt responses to public complaints regarding enclosed stormwater drainage infrastructure.

2.2 Legislative Requirements

The Local Government Act 2009 will impact on the way Council manages its assets. The regulations have not yet been passed and until it is made law (expected end of 2009) the full impact will not be known.
The abolition of the "Non-Feasance[1]" rule by the High Court in 2001 has confirmed that Council has a duty of care, and a responsibility to provide enclosed stormwater drainage assets (particularly gullies) that do not present an unreasonable risk of injury to the public.

2.3 Strategic and Corporate Goals

None of our strategic or corporate plans directly prescribe the level of service to be provided by enclosed stormwater drainage assets, however the following corporate documents indirectly set the direction of the desired asset management strategies.

(a) ***An Integrated Water Cycle Management Strategy for Brisbane***

(b) ***Corporate Plan 2008-2012***

Integrated Water Management.
2.1 A water smart city
2.2 Focus on the river, bay and waterways.
2.3 Healthy waterways
2.4 Flood management.

(b) ***Local Stormwater Management Plans and Stormwater Management Plans***

(c) ***Subdivision and Development Guidelines (sets out levels of service required for flood immunity e.g. Q2, Q10)***

(d) ***City Plan 2000***

[1] Non-Feasance - The non-performance of some act which ought to be performed. When a legislative act requires a person to do a thing, its' non-feasance will subject the party to punishment; as, if a statute requires the supervisors of the highways to repair such highways, the neglect to repair them may be punished.

2.4 Current Level of Service

Currently enclosed stormwater drainage assets are providing a level of service that is effected by the current intervention levels for condition and serviceability, which are:

- Blocked Pipes (roots, debris, sediment, etc) identified by complaint or inspection are listed for remedial works.
- Video and defect recordings are taken within the pipe network to determine structural and serviceability scores. The intention is to inspect all pipes every 15-20 years for the first 60 years of life, and then every 7-10 years until replacement or rehabilitation. Currently LAS are surveying 60-80 km of pipe each year.
- Pipes and manholes that are not structurally sound are listed for repair or replacement in either the quarterly maintenance program or annual asset renewal program.
- Gullies with components in poor condition[2] are listed for repair or replacement in either the quarterly maintenance programs or annual asset renewal program.
- Gullies identified to be causing a serious safety hazard are made safe and repaired as soon as is practical.
- Poor condition gully grates and gully grates on bike routes that are not bike-safe are listed for replacement as directed by the 15 year plan (this plan commenced in 2001).
- Gully tops, particularly in sags and leafy areas are cleansed on a regular basis. The frequency is dependent on the amount of leaf litter experienced. (Some locations have a long history and therefore cleansed up to 12 times / year).
- Gullies and pipelines that are known to be prone to siltation are cleaned out on a regular basis. The frequency is dependent on the amount of silt and debris historically experienced (over the past 1-5 years).
- Feedback on poor gully or pipeline performance or after local flooding is investigated and the gully or pipeline restored to safe and serviceable condition where appropriate. This feedback may also lead to listings in future capital works schedules for enclosed stormwater drainage asset renewal or creation through augmentation or relief drainage works.
- Local Stormwater Management plans also identify the need for enclosed stormwater drainage asset creation / enhancement and related capital works listings.

2.5 Desired Level of Service

The desired level of service[3] for enclosed stormwater drainage assets relates to their condition and serviceability and is as follows:

- All pipelines structurally sound. Those with a mean structural score of 16 or more listed for remedial works within 12 months.

[2] For gully condition descriptions and examples refer to the Gully Asset Classification Manual

[3] The desired level of service should contain measurable criteria such as response times for rectification, targets to be met, reliability measures, customer complaints etc.

- One hundred percent of the pipe network surveyed (CCTV and defects recorded).
- All gully components in as new, good or fair condition[4] with any in poor condition listed for remedial works within 12 months and any in unserviceable condition rectified within 3 months.
- All "poor condition" gully grates identified by the Asset Strategic Plan for Brisbane's Gullies (1999) replaced by 2016
- All gully grates along bike routes are bike-safe by 2010.
- Gullies and pipelines work efficiently during storm events and are not clogged with leaves, silt or other debris. Those not meeting the design criteria to be rectified within 6 months.
- Sufficient stormwater drainage assets and network capacity to manage stormwater and ensure the immunity of properties from flooding in an appropriate storm event (Q2, Q10 etc) consistent with requirements set out in Q.U.D.M. and other Brisbane City Council standards.
- Stormwater customer complaints received through the contact centre and Councillors are actioned within 2 weeks.
- The quality of data (attributes and condition) held in the asset systems (iBimap and Ellipse) is accurate and maintained to represent current assets.
- Annual reviews of data integrity in asset management systems for enclosed stormwater drainage assets.

3 FUTURE DEMAND

3.1 Demand Forecast

The major factors that will contribute to the future demand for enclosed stormwater drainage assets are as follows:

- The development of land for residential, commercial or industrial purposes will require the construction of enclosed stormwater drainage assets as part of the infrastructure to manage stormwater within or through those developments.
- The development of land may lead to increased run-off and demands for additional enclosed stormwater drainage assets downstream of the development.
- Local Stormwater Management Plans and feedback from residents in flood prone areas will identify where additional enclosed stormwater drainage assets may be required.
- The growth in bicycle use and number of bike-routes will lead to an increase in the need for bike-safe gully grates.
- Rehabilitation of the aging stormwater drainage network.

[4] For gully condition descriptions and examples refer to the Gully Classification Manual

3.2 Changes in Technology / Alternative Solutions

The implementation of Water Sensitive Urban Design may change the number and type of gullies and pipelines installed in the future. The introduction of swales will mean more field inlets and seepage drains, and less piped drainage in streets. This type of technology may also increase the number of open drain systems.

Other measures such as porous pavements may also lead to a reduction in the number of new pipelines and gullies needed if run-off can be reduced. The porous pavements must be designed and constructed to ensure the structural performance of the pavement is not compromised.

Lip in line gullies take gully grates out of the line of traffic and reduce issues involving grates (e.g. bus rideability and bicycle safety on road ways). The grates and lintels will also be less prone to damage.

Flexible pipes are allowed to be used instead of concrete stormwater pipe under special circumstances but steel reinforced concrete (SRC) and fibre reinforced concrete (FRC) pipes are preferred.

3.3 Demand Management Plan

The introduction of water cycle management solutions such as rainwater tanks, detention/retention basins, lakes, etc will slightly reduce the amount of stormwater run-off and the demand for additional enclosed stormwater assets.

More environmentally sensitive stormwater solutions that leave creeks in their natural state rather than enclosing them will also reduce the future demand for enclosed stormwater drainage.

3.4 Climate Change

Predictions for climate change in South East Queensland indicate that rainfall events will become more erratic and extreme. This may mean that flood immunity provided by the stormwater drainage network will decrease. New drainage or enhancements will need to be designed in accordance with new standards. Engineers Australia is currently updating Australian Rainfall and Runoff to take into account anticipated rainfall patterns. The updated AR&R is due in 2011.

4 LIFE CYCLE MANAGEMENT PLAN

4.1 Background data

4.1.1 Physical Parameters

Council's enclosed stormwater drainage network consists of approximately 2,640 km of pipes or box culverts, 71,080 manholes and 95,733 gullies.

Of the 2,640 km of stormwater pipes, the main pipe materials are 91% precast reinforced concrete, 1% cast in situ concrete and 1% brick.

The length of stormwater pipes for each material type is shown in Fig. 11 below.

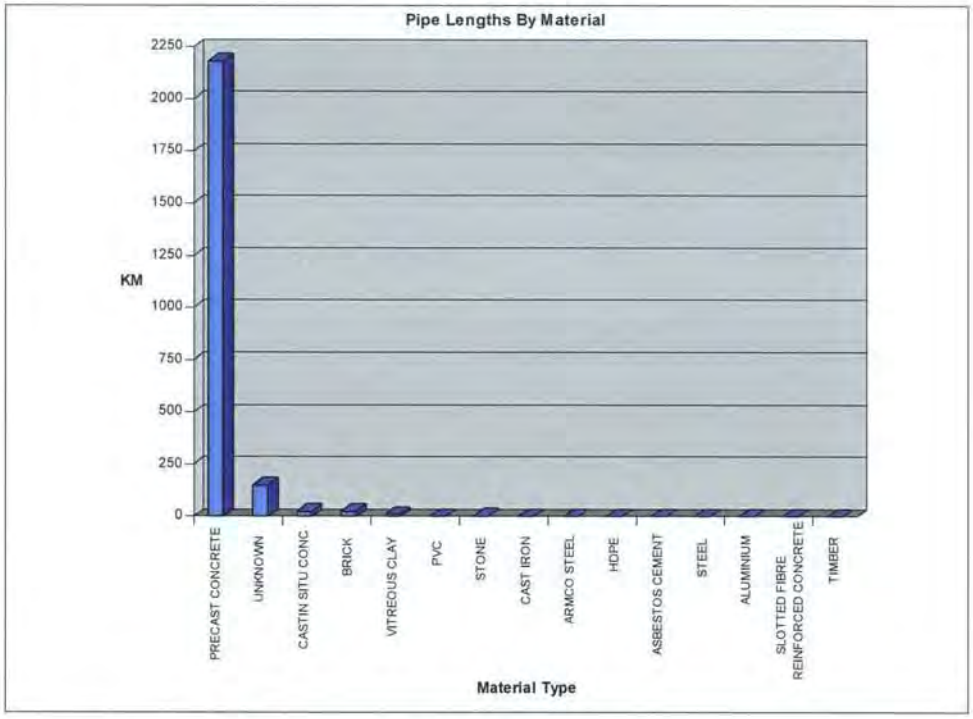


Fig. 11. Pipe Construction Materials by Length (km)

The majority of pipes or box culverts in Brisbane are small to medium in size. 49% of the network is less than 600mm in diameter, approximately 39% are between 600mm and 1200mm, and only 12% of pipes or box culverts are greater than 1200mm in diameter or width. The distribution of pipe sizes is shown in Fig. 12 below.

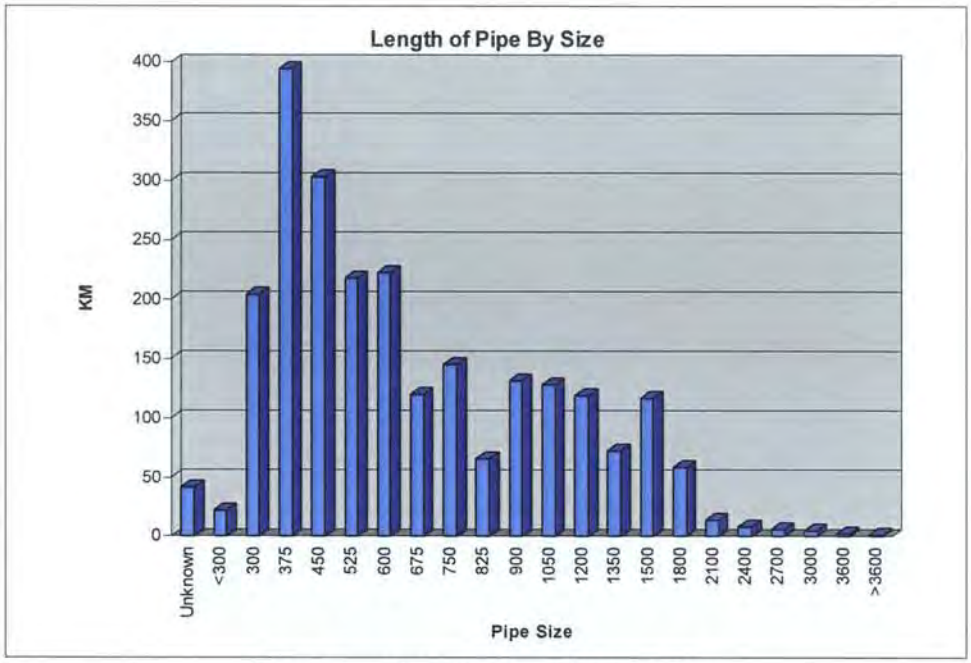


Fig. 12. Pipe Size (mm) Distribution

The majority of manholes in Council's Stormwater Network are standard round or expanded manholes. Of the 71,080 manholes approximately 52% are round, 3% are expanded, 10% are gully manholes, 5% are chambers, 20% are inlets, 7% are outlets and 3% are a non standard type. This is shown graphically below in Fig. 13.

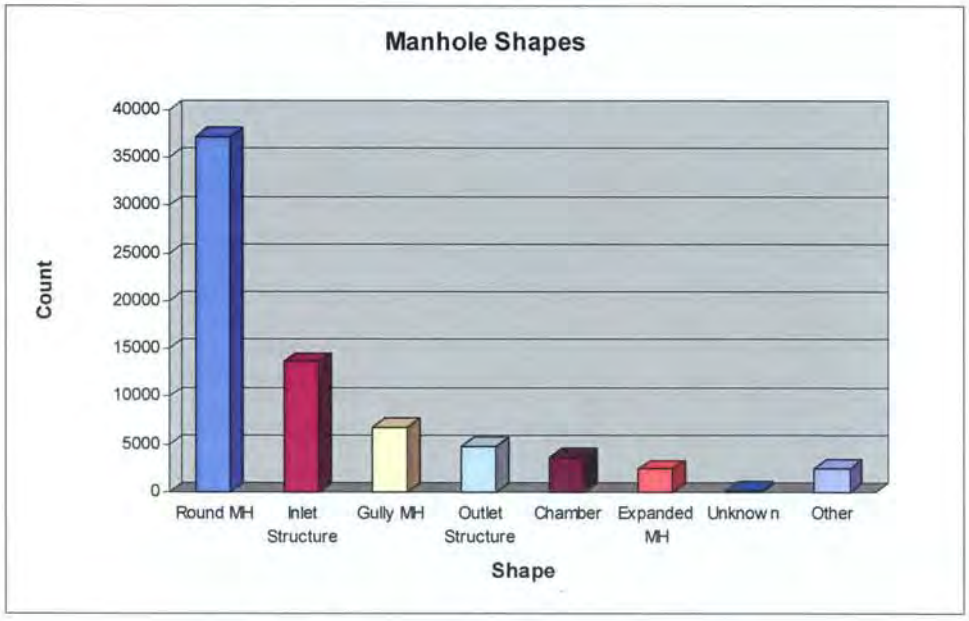


Fig. 13. Types of Manholes

The most common size of round manhole is 1050mm diameter, with approximately 64% being this size. The size distribution of all round manholes is shown below in Fig 14.

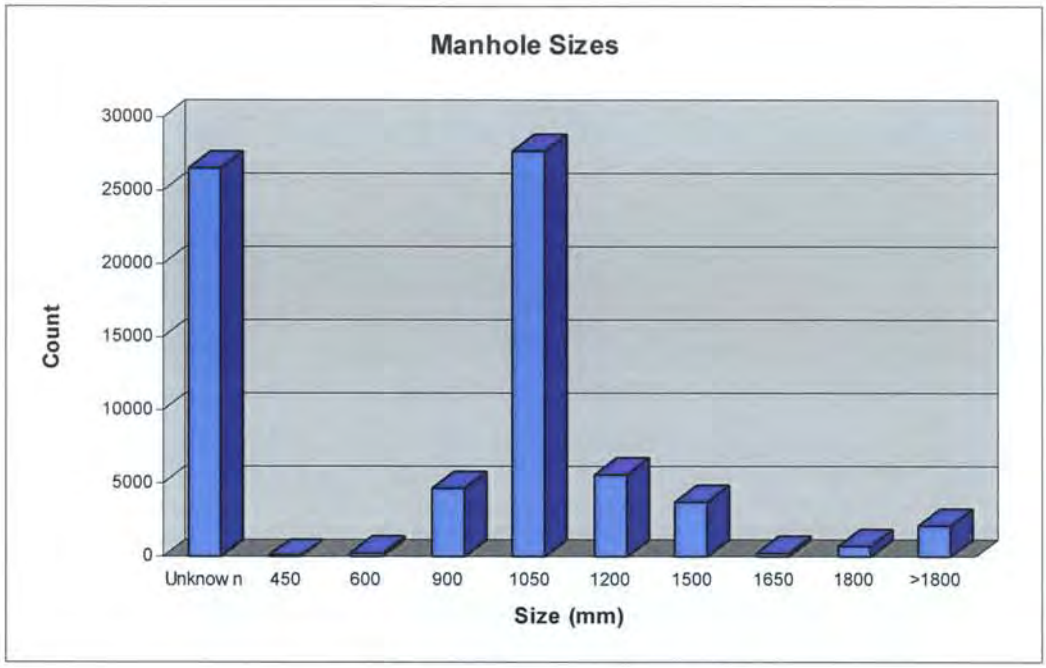


Fig. 14. Size of Round Manholes

Of the 95,733 gullies in the network 95% are grated inlets roadways, 1% are back inlets on the roadway, 3% are field inlets and 0.2% are trench gratings. This is shown diagrammatically below in Fig. 15.

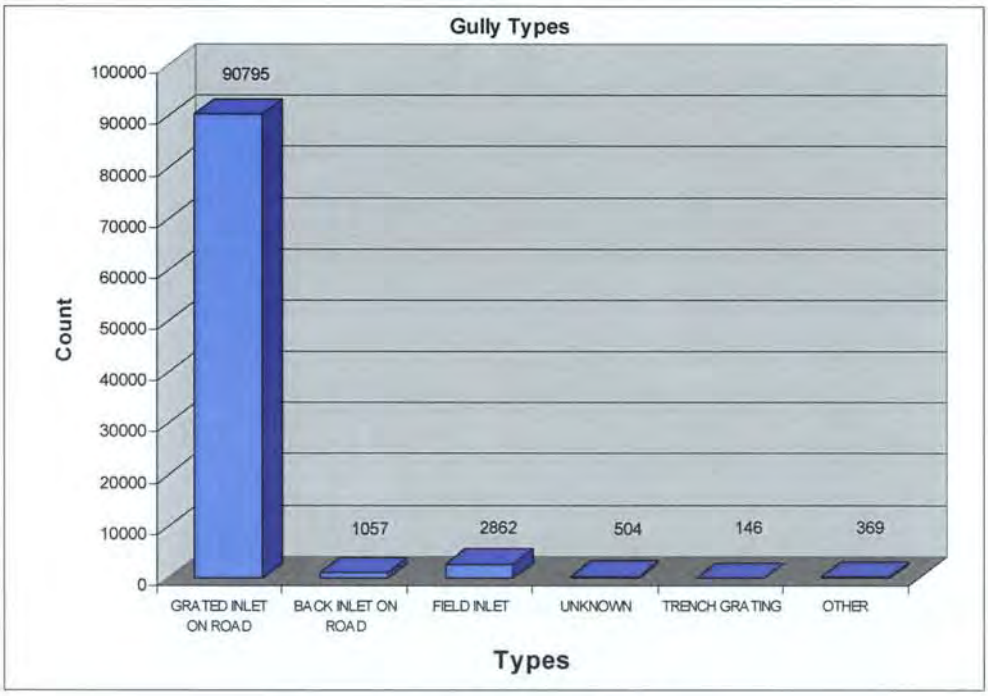


Fig. 15. Gully Types

The size of a gully is based on the length of the lintel or backstone, and the number of existing pits. The distribution of gully lintel sizes is shown in Fig 16 below.

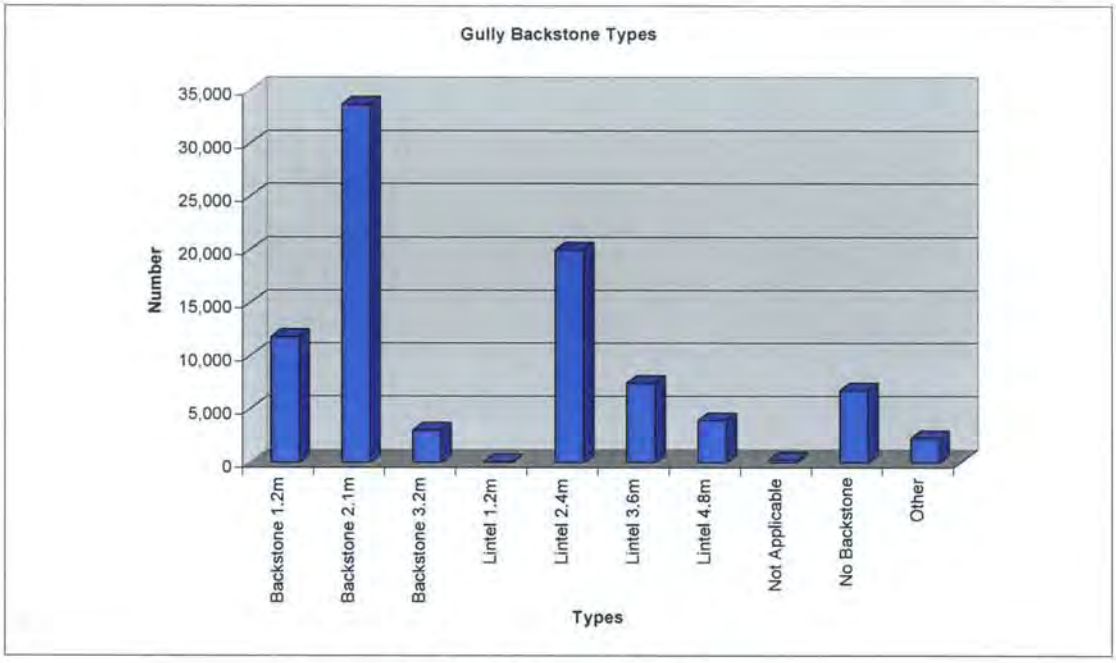


Fig. 16. Lintel Size of Gullies

4.1.2 Asset Condition

Pipes or box culverts and manholes are surveyed using Closed Circuit TV (CCTV). Manual surveys are carried out for the large diameter pipeline systems. Pipeline surveys began in 1982 and to date approximately 69% of the network has been inspected.

Gully assets are surveyed manually in accordance with the Gully Classification Manual, with the first city wide survey carried out in 1999/2000. Surveys are due every 10-15 years depending on age or condition of the gully. The next cycle of gully inspections will commence in 2009/10.

4.1.2.1 Condition of Asset

The condition of a pipe depends on the number of structural defects found during the pipe survey. Pipes are grouped by age into 10 year periods. The total structural defect score (as calculated by SEWRAT) is divided by the total length of the pipe for all pipes in the each 10 year period. Figure 17 below shows structural defect scores in relation to the age of the network.

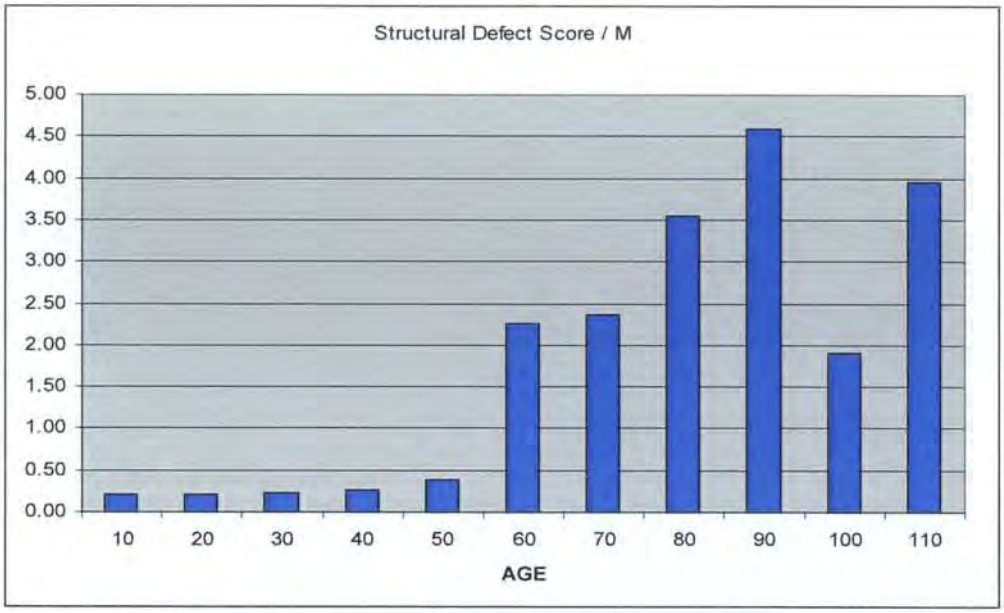


Fig. 17. Pipe Condition (mean structural defect score) with Age in Years

The condition of a gully is based on the condition of the grate and backstone or lintel, as these are the two most critical elements for both safety and water capture. A gully with a backstone/ lintel and grate in poor condition is considered to be a poor condition gully. At the time of the last condition survey (September 1999) 12,686 gullies, or 14%, were classified as being in poor condition. The breakdown of gully condition (1999) is shown below in Table 3 and Fig.18.

Condition (1999)	Grate		Backstone / Lintel		Overall Gully	
	No.	%	No.	%	No.	%
Good	75,817	86%	77,343	88%	67,935	78%
Fair	4,990	6%	3,518	4%	6,976	8%
Poor	6,790	8%	6,736	8%	12,686	14%

Table 3 Gully Condition (1999)

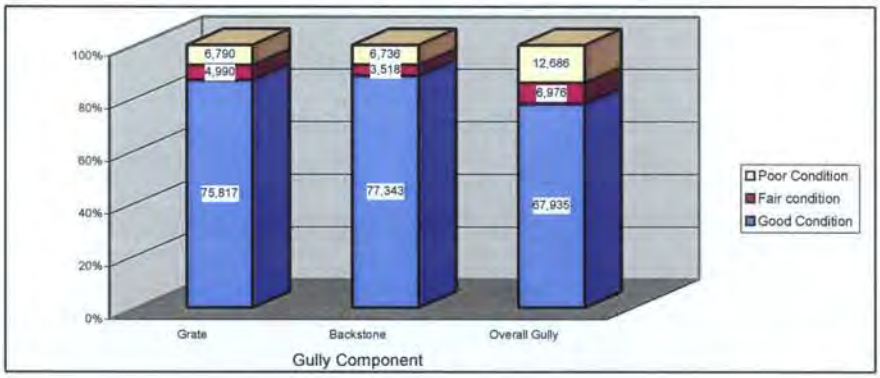


Fig. 18. Gully Condition (1999)

4.1.3 Asset valuations

Capital Replacement Value ***(as of 30 June 2009)***
Pipelines, Manholes and Gullies ..... $2,742 million

Depreciation ..... -$724 million

Written Down Value ***(as of 30 June 2009)***
Pipelines, Manholes and Gullies ..... $1,918 million

The capital replacement value of the enclosed stormwater drainage network is based on the value of the pipes or box culverts, manholes and gullies. The replacement value of a pipe or box culvert or manhole depends on its size, depth and material type. The replacement value of a gully is based solely on the lintel or backstone size.

The financial system records a total value for all pipes or box culverts. Manholes, gullies and gully connection pipes are apportioned to, and therefore included in the value pipes or box culverts, rather than as separate assets.

The written down value of a pipe or box culvert is based on the age of the asset. The design or planned useful life is 80 to 100 years.

A detailed description of the capitalisation and valuation methodologies is documented in the ***Non Current Asset Financial Management Manual (April 2002)***.

The enclosed stormwater drainage network will be valued in 2009/10 based on unit rates updated to 2009 prices.

4.2 Routine Asset Maintenance

Routine asset maintenance is managed by Local Asset Services based on maintenance strategies agreed to by City Assets. The maintenance work is carried out by Brisbane City Works.

4.2.1 Planned maintenance

LAS's periodic inspections (manually in the field and using CCTV) and feedback from residents are used to identify planned maintenance works. These are packaged quarterly for repairs and or cleaning. Some planned maintenance works such as regular gully top cleansing, gully eduction and pipe desilting are carried out in accordance with a planned cyclic schedule.

4.2.2 Unplanned maintenance

Unplanned maintenance works are reactive to reports/complaints of unsafe or unserviceable gullies or pipes or box culverts from residents, Councillors or others affected by the performance of these assets. A large amount of this work is identified after major storms and floods.

4.2.3 Routine Maintenance

Routine maintenance generally consists of minor pipe and manhole repairs, replacement of small lengths of pipe, replacing gully lintels or grates, or totally rehabilitating gully tops or full gullies. It also includes cleaning and desilting of gullies and pipes or box culverts. Recent maintenance funding is as follows (Fig.19):

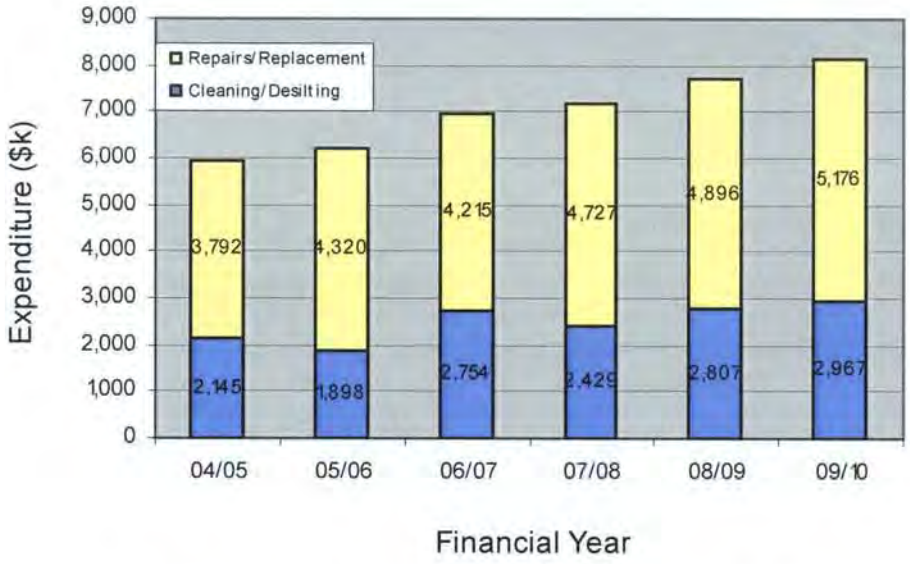


Fig. 19. Maintenance Funding for Enclosed Stormwater Drainage

4.3 Rehabilitation Plan

Gullies and pipes or box culverts requiring rehabilitation are identified through gully condition surveys, CCTV pipe surveys, or by LAS personnel, and are listed annually.

Feedback from residents, Councillors, cyclists or others affected by performance may also identify gullies or pipes or box culverts that require rehabilitation.

Gullies are generally listed for rehabilitation (repairs, replacement of components or reconstruction) when their condition meets the following intervention criteria.

- The grate and / or lintel are in poor condition.
- A gully is on a bike route and does not have a bike-safe grate (i.e. current standard grate).
- The gully apron is badly cracked or deformed.
- The gully lintel needs to be larger to capture the appropriate flow.

Pipes or box culverts are generally listed for rehabilitation when they become structurally unsound or are no longer serviceable[5].

City Assets Branch provides future budget forecasts based in part on information provided by LAS. These forecasts are derived using historical trends and survey condition data. In future asset degradation forecasting will also be used.

Past, present and forecast rehabilitation funding is shown below in Fig. 20.

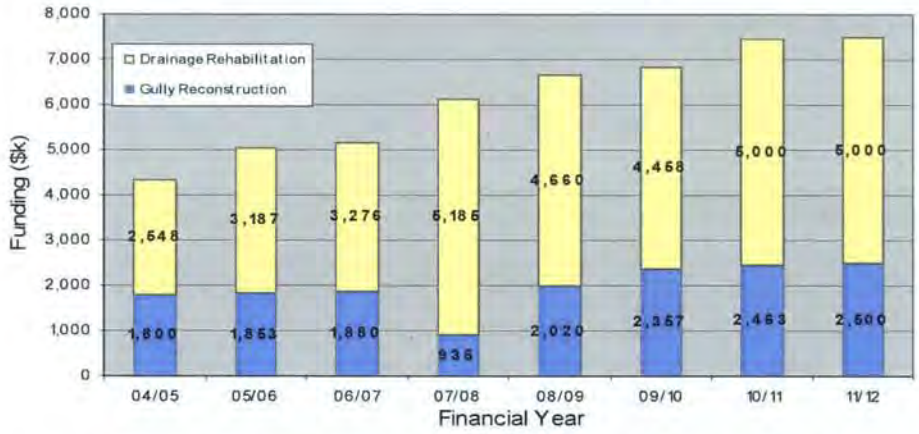


Fig. 20. Enclosed Stormwater Drainage Rehabilitation Funding

4.4 Asset Creation

Council obtains assets:

- Contributed as part of the development process,
- Constructed by or for Council.
- Transferred from other entities, e.g. State Government

Schedules of work have been created to define budgets and priorities. The schedules are as follows:

- Schedule 68 (Local Drainage, construction cost < $500k)
- Schedule 71 (Drainage Design)
- Schedule 72 (Major Drainage, construction cost > $500k)
- Schedule 73 (Gully Reconstruction)
- Schedule 74 (Drainage Rehabilitation)
- Schedule 82 (Stormwater ICP Infrastructure)

[5] These listings are generally created based defects identified by CCTV, or following complaints of flooding.

All works except Major Drainage projects are ranked for construction by Local Assets Services (LAS). LAS manage the investigation and design phase while City Assets manage the construction phase.

The ranking of the Major Drainage projects is on a "city-wide" cost effectiveness basis. Prospective projects are prioritised following assessment against the following criteria:

- Cost effectiveness;
- The number of affected residential properties;
- Frequency of flooding events;
- The use of areas affected by flooding
- Environmental, social and safety impacts.

The cost effectiveness of major drainage projects is calculated using the following formula:

$$\frac{\text{(Cost of work)}}{\text{(No. of dwellings affected}^{6}\text{) x (10 \ "frequency of flooding factor"}^{7}\text{ -1)}}$$

Council may also construct gully and minor pipeline assets as a part of roadworks projects in order to provide adequate drainage to the new roadway.

The budget breakdown for the Integrated Water Management Program for these schedules is shown in Table 4.

Schedule	06/07	07/08	08/09	09/10	10/11	11/12
68	$3,992	$2,858	$4,855	$4,320	$4,584	$4,560
71	$2,460	$1,460	$1,699	$1,810	$3,018	$3,039
72	$11,741	$6,566	$10,228	$12,028	$11,500	$11,500
73	$1,880	$935	$2,020	$2,357	$2,463	$2,500
74	$3,276	$5,185	$4,660	$4,458	$5,000	$5,000
82	$4,586	$7,253	$7,093	$8,650	$6,765	$6,464
Total	**$27,935**	**$24,257**	**$30,555**	**$33,623**	**$33,330**	**$33,063**

Table 4 – Funding for Drainage Schedules

Funding for new Major and Minor enclosed stormwater drainage assets, both past, present and forecast, is shown below including Contributed Assets in Fig. 21.

[6] The Number of dwellings is based on utility areas where 1 Living area flooded is equivalent to 5 Utility Areas and 10 Yards flooded is equivalent to 1 Utility area.

[7] The frequency of flooding factor (a number from 1 to 10) is derived by calculating the capacity of an existing drainage system and comparing it with Q10, i.e. Q2 and less =1, Q5 ≈ 4.7 and Q10=10 (Q2 = 84% Q10) [Frequency of Flooding Factor ≡ (x%Q10/100)^4.35*10].

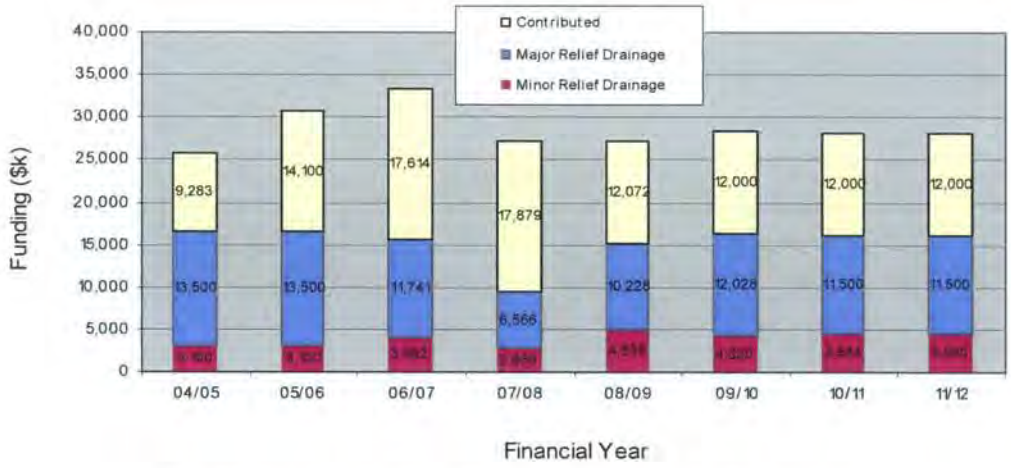


Fig. 21. Funding for New Enclosed Stormwater Drainage Assets

Contributed enclosed stormwater drainage assets are added to the network through the development of land for residential, commercial or industrial purposes. Assets are constructed in accordance with *City Plan 2000*, and Council's *Subdivision and Development Guidelines*, Reference Specification for *Civil Engineering Works* and *Standard Drawings*.

4.5 Asset Disposal

Stormwater assets are typically disposed of when they come to the end of their useful life. This occurs when the condition of the asset degrades to such an extent that it is beyond repair, or the asset becomes redundant (e.g. when alternative relief drainage schemes are constructed). When these events occur stormwater drainage assets are either abandoned (left in the ground and either plugged or filled) or physically removed.

These assets are retired from the Ellipse Equipment Register by changing their status from IS (In Service) to RE (Removed) or AB (ABandoned), depending on the circumstance, and setting the disposal date. This triggers the Ellipse financial asset register to financially dispose of the asset.

5 ASSET RISK MANAGEMENT

The abolition of the "Non-feasance" rule for local Councils means that Council may be exposed to more third party claims arising from poor gully or pipeline condition or serviceability. This ASP will mitigate this risk in that it demonstrates systematic management of the condition and serviceability of Council's enclosed stormwater drainage assets to minimise risks and liabilities.

Future improvements to the Asset Strategic Plan will include an update on the survey requirements of the entire network to enable a more accurate analysis of the condition of the network, and creation of a stormwater pipe degradation model specific to Brisbane.

The acceptance of non-standard or poorly constructed contributed assets constitutes a financial risk and a liability for Council. Council can mitigate this

by ensuring Development Assessment staff are adequately trained and resourced to check and accept contributed assets and collateral assets constructed by State Government as part of major infrastructure projects.

Table 5 below lists risks associated with the enclosed stormwater drainage network, the risk drivers and mitigation strategies for these risks.

Risk Event	Consequences	Probability	Risk Drivers	Mitigation Strategy
Poor standard of contributed or BCC constructed enclosed stormwater drainage assets	• Shorter than expected life span • Water capture capacity reduced • Higher maintenance cost	Low	• Lack of expertise or resources in DA or BCW • Overload during construction • Lack of supervision and inspection by DA	• Training and resourcing DA • Development of standard operating procedures by DA • Training of BCW staff and industry • Random audits of newly constructed gullies and pipelines • Video Surveys to be provided to Council
Poor condition of existing enclosed stormwater drainage assets	• Increased risk of flooding • Third Party claims against Council • Poor Council image • Injuries or fatalities	Low-Medium	• Corrosion of steel components • Damage from heavy vehicles • Ground movement • Root infestation • Vandalism • Lack of inspections by LAS • Aggressive ground conditions (acid sulphate soils) • Age of Asset	• Systematic survey of gully network • CCTV survey of critical pipelines • Rehabilitate gullies or components in Poor condition • Repair or replace pipelines that are not structurally sound • Repair/replace gully components that are a safety hazard • LAS / BCW update information in asset register following rehabilitation works
More rapid deterioration of asset/ premature end of asset life	• Shorter than expected life span • Gully not functional	Low-Medium	• Frequent heavy vehicle damage • Aggressive environmental conditions • Lack of inspection by DA • Poor quality of construction	• Use lip-in-line gullies particularly on major roads • Specify greater concrete cover in aggressive environments • Ensure assets are constructed to meet standards
Safety of cyclists riding over gullies	• Injuries and fatalities • Third Party claims against Council	Medium – High	• Gullies on designated bike routes • Non bike-safe gully grates on roadways	• Replace all poor condition grates by 2016 • Replace non-bike-safe grates on bike routes by 2010 • All new gully grates to be bike-safe • Use lip-in-line gullies where possible.

Risk Event	Consequences	Probability	Risk Drivers	Mitigation Strategy
Gullies and pipelines blocked with leaves, silt or debris	• Flooding of properties or roads • Surcharging manholes and displacement of lids • Injuries or fatalities particularly if roadways are flooded • Third Party claims against Council	Medium	• Gullies in sags in leafy areas • Large amounts of silt or debris entering gullies and pipelines • Lack of inspections by LAS	• Regular sweeping of gully tops in leafy areas • Regular eduction of gullies and desilting of pipelines known to be prone to filling with silt and debris • Gully baskets, trash racks etc regularly cleaned.
Pipe size less than current standard requires	• Flooding of properties or roads	Medium	• Standards change over time, e.g. rainfall events will be more intense due to climate change	• Ensure standards are updated as appropriate

Table 5 Risks Associated with Enclosed Stormwater Drainage Assets

6 ASSET MANAGEMENT PRACTICES

6.1 Accounting / Financial Systems

Ellipse and IFBIS are used for the financial asset management of these assets:

- Financial Asset information is recorded in the Ellipse Financial Asset Register (FAR).
- The Financial Asset Register module within Ellipse values, revalues and depreciates these assets.
- Summary financial asset information is recorded in IFBIS.

The methodology is described in detail in the ***Non Current Asset Financial Management Manual (April 2002)***.

6.2 Asset Management Systems

IBimap and Ellipse are used as the asset management systems for enclosed stormwater drainage assets.

- Inventory data is recorded in iBIMAP and Ellipse Equipment Register. In some cases inventory data is uploaded from iBIMAP to Ellipse, e.g. pipe data.
- iBIMAP is used to display information about these assets.
- Condition information for pipes, manholes and gullies is recorded in the Ellipse Equipment Register.

7 PLAN IMPROVEMENT AND MONITORING

7.1 Improvements

Several issues have been identified in the management of Enclosed Stormwater Drainage Assets. These include:

- Pipe inventory data held in the GIS system (iBIMAP) does not match data that is held in the Ellipse system.
- The process to ensure all new assets, and changes to existing assets, are recorded in the appropriate asset management systems is not robust.
- Pipe cleansing and desilting is not based on a rigorous risk management approach.
- Whole of life modelling is not used to forecast future rehabilitation needs.
- Pipe historical inventory data is not being managed in Ellipse or iBIMAP.

Action required to address these weaknesses include:

- Synchronise the data held in the two asset database systems for pipes (i.e. iBIMAP and Ellipse).
- Review and refine the current processes, including procedures for entering and updating stormwater assets.
- Undertake a high-level risk analysis on drainage maintenance.
- Undertake degradation modelling using available condition data to enable forecasting of future rehabilitation expenditure.

Projects currently underway to address the above issues are:

- Stormwater Asset Data Synchronisation as part of the 5 yearly valuation processes.
- Systematic survey of gully assets will commence in 2009/10 (the previous survey was undertaken in 1999/2000).
- Refinement of pipe survey data collection and storage.

7.2 Monitoring

This plan will be updated annually and reviewed on a five yearly cycle.

8 REFERENCES

- Living in Brisbane 2026
- Brisbane City Council Corporate Plan 2008 - 2012
- An Integrated Water Cycle Management Strategy for Brisbane
- City Plan 2000
- Gully Classification Manual
- Stormwater Pipes & Manholes – Asset Classification Manual
- LAS / BCW / City Assets Customer Service Agreement
- Reference Specifications for Civil Engineering Works

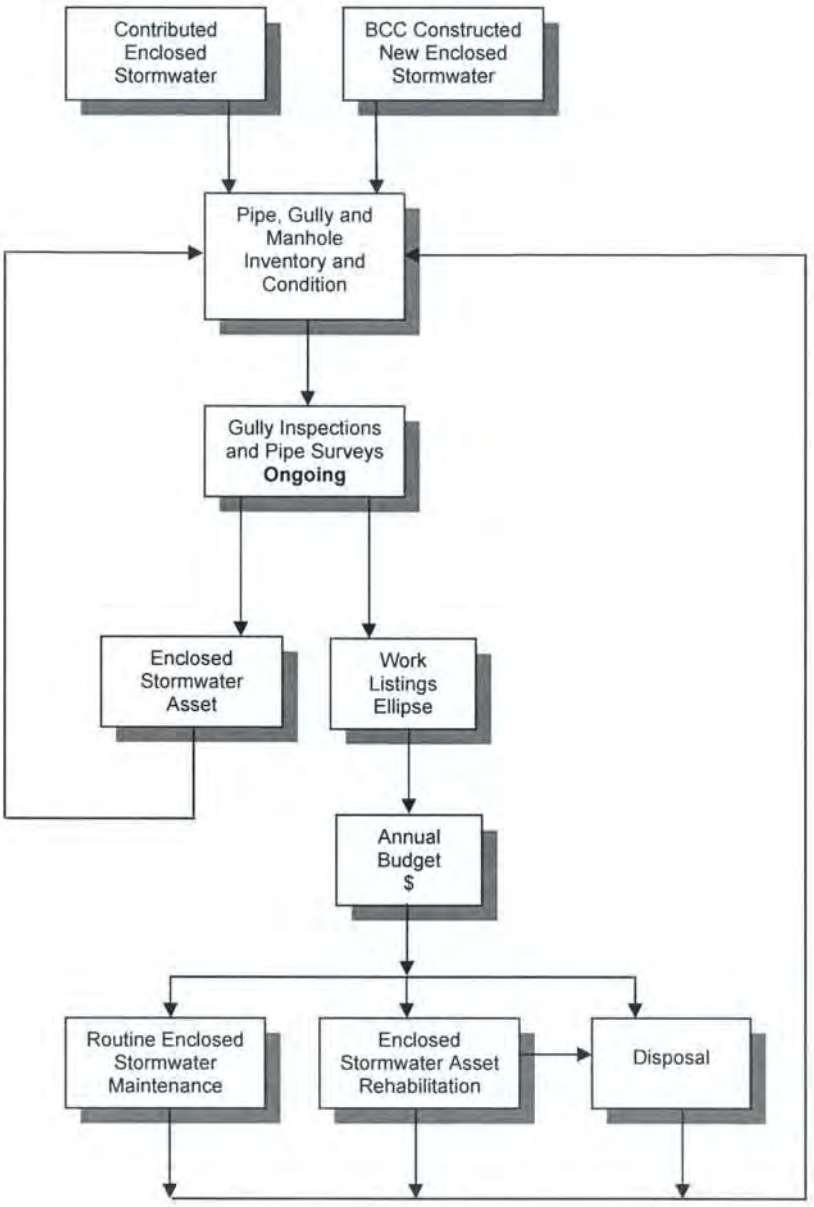
- Subdivision and Development Guidelines 2008
- Standard Drawings
- Non Current Asset Financial Management Manual 2002

9 APPENDICES

A: Asset Management Cycle for Enclosed Stormwater Drainage Assets

Appendix A

Asset Management Cycle for Enclosed Stormwater Drainage Assets



Pipe Survey Plan 2010/11

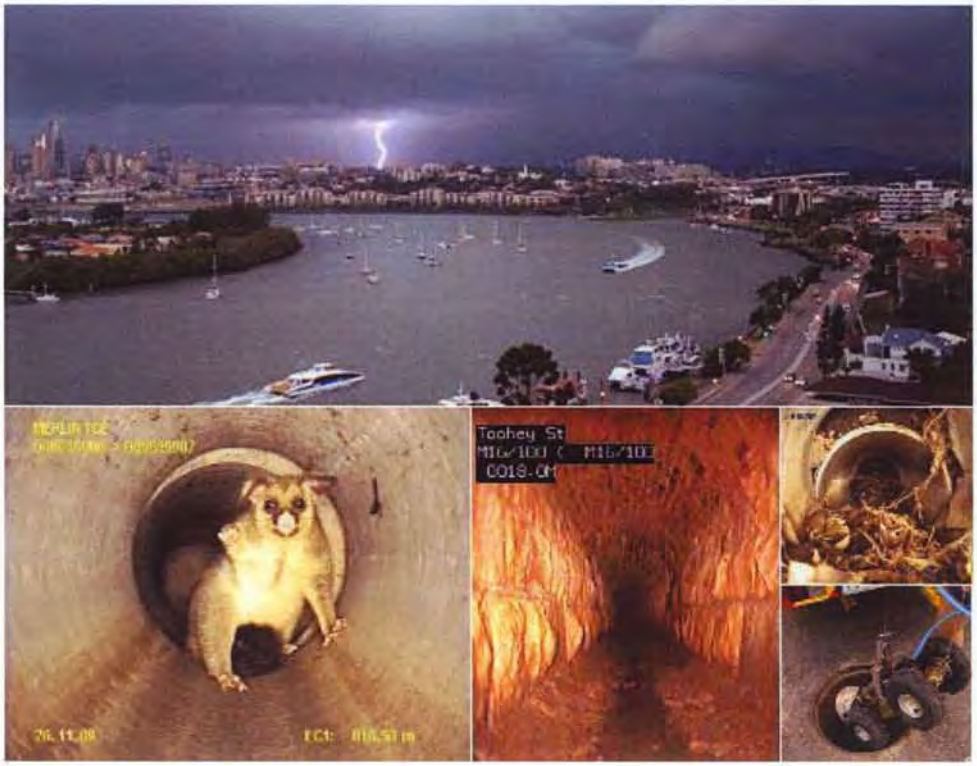
Strategic outcomes		
Strategic alignment - WaterSmart City	**Outcome**	**Activity**
Manage the city's flood prone areas economically effective manner	Focused on areas affected by May 2009 and November 2008 floods	Need to target and have the highest priority for pipe survey. As part of the infrastructure recovery process, stormwater pipes likely to require maintenance or rehabilitation following the November 2008 and May 2009 floods (e.g. Windsor/Bowen Bridge).
	Focused on locations likely to exacerbate flooding	Ensure all pipes affected by tides are surveyed
Ensure the future developments planned, designed and constructed to minimise flooding impacts	Integrated with high profile infrastructure projects	Ensure that all pipes associated with Clem7, Airport Link, ICB and Hale Street Link projects have been surveyed (check 'As Constructed' first)
	Pipes Constructed to Standard - BCW	Survey all pipes constructed by BCW 2009/10 – Schedules 68 & 72. Survey all pipes rehabilitated 2009/10 – Schedule 74.
	Pipes Constructed to Standard – Developer	Survey all pipes constructed by Developers 2009/10.
Improve the safety to residents and reduce the impacts of flooding	Condition of Ageing Pipes Determined	Survey pipes greater than 60 years old and "not previously surveyed" Survey pipes of medium to poor condition (Structural condition Score >16) with highest priority given to brick drains.
	Information gaps closed	Survey pipes missing key attributes e.g connectivity, diameters, material and length
	Integrated with other asset rehabilitation work	Schedule pipe surveys at proposed road resurfacing locations so that the optimum traffic control measures are deployed.

Operational outcomes	
Outcome	**Activity**
Update inventory of infrastructure already on iBimap	Pipe Survey team to log inventory data and check against iBimap for all pipe surveys. Diameter, Material, Length, Number of Barrels, Shape and Tidal attributes to be verified. Exceptions reported to City Assets (AIM).
Update inventory of newly identified infrastructure (i.e. not on iBimap)	Pipe Survey team to log any additional assets (not in iBimap) found at the time of survey. Sketch to be provided to City Assets (AIM). Assets identified include – Pipes, Manholes, Gullies and Gully Connections, Outlets and Inlets.
Pipe survey data synchronised	Pipe survey team to ensure Video and WinCan text data for each pipe surveyed is provided to AIM. All surveyed pipes must be entered into Ellipse.
Potential Maintenance Identified	Blue file system to be reported by LAS Pipe Survey to relevant Region: Serviceability Issues – Debris, Silt, Tree Roots, Obstructions. Structural Issues – Displaced Joints, Holes, Surface Erosion. Manholes that need raising.
Quality of data meets BCC standards	- 2010 contract documentation - Stormwater Assets Pipe Survey (new 2010 manual) - AIM Data Quality Standards
Achieve Budget targets / KPI's	- 100+ km annual target - Budget $ or unit rate

This plan was prepared by Stormwater Infrastructure, City Assets 3/9/10

Stormwater Assets
Pipe Survey

CCTV - Specification & Guide



Version 0.2

Version Control

Date	Name	Reason for change	Version
12/5/2010	[redacted]	Initial Document - DRAFT	0.1
10/8/10		Minor amendments - DRAFT	0.2

This is a living document and is subject to constant revisions.

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B – Conduit Broken 34
BJ – Conduit Broken at Joint 35
CC – Circumferential Crack 36
CCJ – Circumferential Crack at Joint 37
FC – Circumferential Fracture 38
FCJ – Circumferential Fracture at Joint 39
JDS – Displaced Joint – Slight (<20mm) 40
JDM – Displaced Joint – Medium (20-50mm) 41
JDL – Displaced Joint – Large (>50mm) 42
DH – Horizontally Deformed Conduit 43
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1 INTRODUCTION

1.1 Purpose

The purpose of this document is to outline the requirements of the Brisbane City Council in relation to Closed Circuit TV (CCTV0 Pipe Survey and give guidance to the recording of defects and other conditions found during stormwater pipe surveys.

This manual has been written in conjunction with and not as a replacement of the following documents:

1. BCC Contract for Pipe Survey, Jet Rodding and Root Cutting Services.
2. Australian Conduit Condition Evaluation Manual – First Edition June 1991.
3. Conduit Inspection Reporting Code of Australia – WSA 0502008 version 2.2.

Any discrepancy found between this Specification & Guide and the above documents are to be addressed immediately by contacting the BCC LAS Technical Officer Pipe Survey or the Technical Officer Stormwater Infrastructure in City Assets.

1.2 Background

It is Council's policy to regularly inspect each of its stormwater drains for structural defects and serviceability every 10 - 15 years for the first 60 years of service, and then every 7 – 10 years until rehabilitation. In order to maintain this rate of inspections, at least 150~200 kilometres must be surveyed each year. This task is managed by the (LAS) Pipe Survey team. Both structural and serviceability defects are recorded during the survey of each pipe.

1.3 Audience

The document is to be used by:

- Pipe Survey team and other LAS staff.
- Asset Management Officers.
- Pipe Survey Contractors.
- Various officers requesting Pipe Survey Reports, e.g. from:
  - City Design.
  - Development Assessment.
  - Brisbane City Works.

1.4 Stakeholders and Responsibilities

It is important that the key stakeholders and their responsibilities are clearly defined in this section.

	Asset Owner	Strategic Asset Manager	Data Manager	Asset Surveyor	Operational Asset Manager	Interested Parties
Water Resources Branch, CPaS Division	√					
Stormwater Infrastructure, City Assets, BI		√				
Asset Information Management, City Assets			√			
Asset Survey, Local Asset Services, FaCS				√		
Regions, Local Asset Services, FaCS					√	
QUU (similar to sewer pipe inspections)						√

Legend: The following relevant parties are required to sign off on this document.

Asset Owner (Officer Code) _____

Strategic Asset Manager (Officer Code) _____

Data Manager (Officer Code) _____

Operational Asset Manager (Officer Code) _____

2 IDENTIFICATION OF ASSETS

This section provides a quick description of the stormwater assets that may be encountered.

2.1 Stormwater network assets

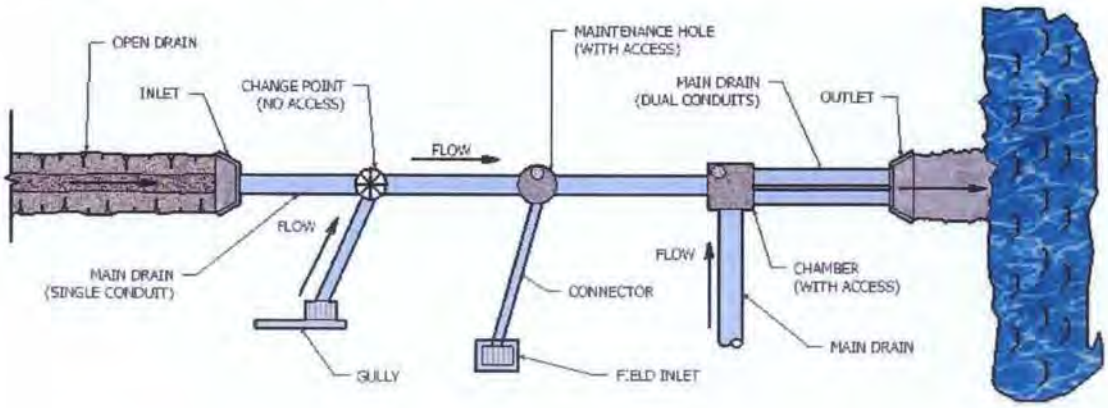
Brisbane City Council's stormwater drainage network consists of:

- Pipes and Conduits
- Maintenance Hole (MH)
- Chambers
- Change Points
- Inlets
- Outlets
- Field Inlets
- Gullies

Stormwater enters the underground drainage network through gullies and inlets and flows through the pipe to outlets where it is discharged into open drains, creeks, the river or Moreton Bay. Maintenance holes or chambers (MH) are placed at regular intervals and at main connection points where conduits form junctions. A MH provides access to the pipe for inspection and maintenance purposes.

A stormwater pipe is defined as a length of conduit that may consist of a single barrel or multiple barrels between asset nodes i.e. Gullies, Field Inlets, Maintenance Holes, Chambers, Change Points, Inlets and Outlets.

The diagram below shows a typical layout of stormwater assets.

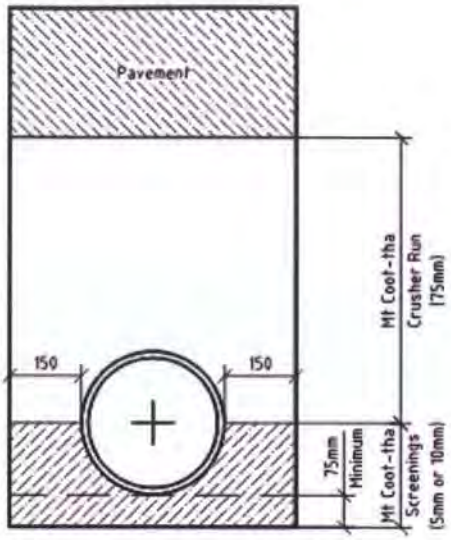


Pipe survey data is gathered for each pipe barrel between one Asset Node and the next Asset Node.

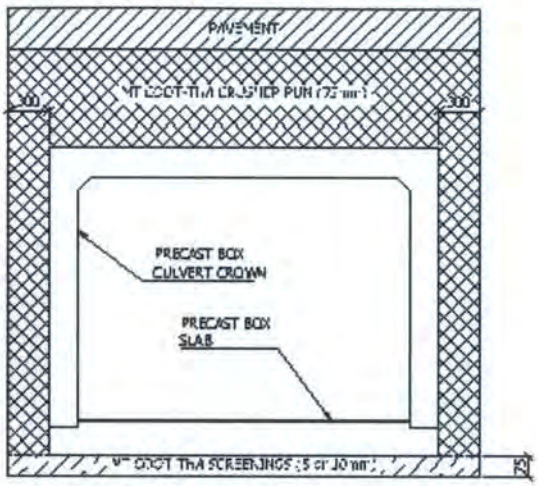
2.1.1 Pipes and Conduits

There are approximately 2,740 kilometres of stormwater pipes (excluding gully connections) in Brisbane.

Stormwater pipes and conduits are currently constructed using precast round concrete pipes or precast concrete box sections. The standard pipe and box installation details are shown below.



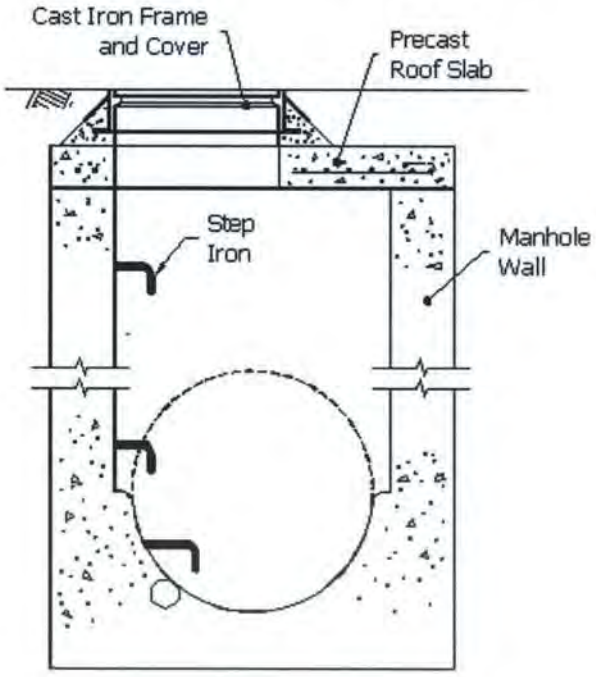
BCC Standard Reinforced Concrete Pipe Installation



BCC Standard Box Installation

2.1.2 Maintenance Hole (MH)

Formally known as a Manhole, these structures can be either round or rectangular.



Council's standard maintenance hole is round (cylindrical) ranging in diameter from 1050mm to 1500mm and can be expanded or stretched by up to 900mm. Round maintenance holes can be precast or cast-in-situ concrete. Older maintenance holes may also be constructed in cast-in-situ concrete, brick or stone. See BCC Standard Drawing UMS 321.

2.1.3 Chambers

Chambers are typically larger in size than Maintenance Holes and usually are square or rectangular in shape. Chambers are usually constructed from cast-in-situ concrete, or in some older cases are brick.

Note: Generally, chambers are called maintenance holes in the asset system.

2.1.4 Inlets & Outlets

Inlets and outlets are structures built at the upstream end of pipe, or where the pipe discharges into, an overland flow path, an open drain, a creek, the river or the ocean. These structures generally consist of a head wall, wing walls and apron, and are constructed from precast concrete, cast-in-situ concrete, stone pitching or brick.



2.1.5 Change Points

A change point is simply a point where pipe attributes change (such as direction, slope or diameter) or two pipes connect but no Maintenance Hole has been constructed. A Change Point is given a unique identifier (Plant Number) in the same manner as Maintenance Hole.

A change point identifier is also given to a connection of a branch line that connects to a main line without the construction of a Maintenance Hole.

2.1.6 Inlet Structures

An Inlet Structure collects or captures stormwater surface runoff and allows it to enter Council's underground pipe drainage network. Further information can be obtained from the Gully Asset Classification Manual.

The inlets come in many types and configurations and have been constructed to various Council Standards over the past 80 to 100 years. Some of these earlier structures are still in use and are functioning well as intended, that is, as a stormwater inlet structure but may not be fully compliant with the current BCC standards with respect to physical load capability and bicycle safety.

A Gully is an inlet located within the road reserve and is usually connected to kerb and channel. A Field Inlet is an inlet located in another location, e.g. parks.

Note: Gully connection pipe attributes are not currently included in the pipe survey process. Gullies are surveyed in a separate program to the CCTV pipe survey activity.

2.2 Ownership and Control

Brisbane City Council owns and maintains approximately 2,700 kilometres of stormwater pipes (excluding gully connections). Gully connections (the pipe connecting the gully to the manhole) make up an additional length of approximately 1,000 km.

Developers of new estates hand over ownership of new underground stormwater pipes and maintenance holes to Council after an initial survey, assessment and maintenance period. Council then maintains the assets.

Some pipes and maintenance holes are owned by the Department of Main Roads and some by Queensland Rail. Those assets are not surveyed by Council but many are recorded on Council records for investigation purposes.

2.3 Asset Information Systems

Attributes of Stormwater Assets are stored and maintained via the following systems:

Inventory:

- Ellipse Equipment Register
- Ellipse Pipe and Maintenance Hole Condition Survey Process

Survey Information:

- WinCan

Spatial:

- iBIMAP (Geographic Information System - GIS)
- Stormwater Activity Interface (connects GIS to Ellipse)

2.3.1 Ellipse

The Ellipse Equipment Register holds data about stormwater inventory in the Ellipse Equipment Register and was designed as an asset management system.

2.3.2 Survey Condition Data

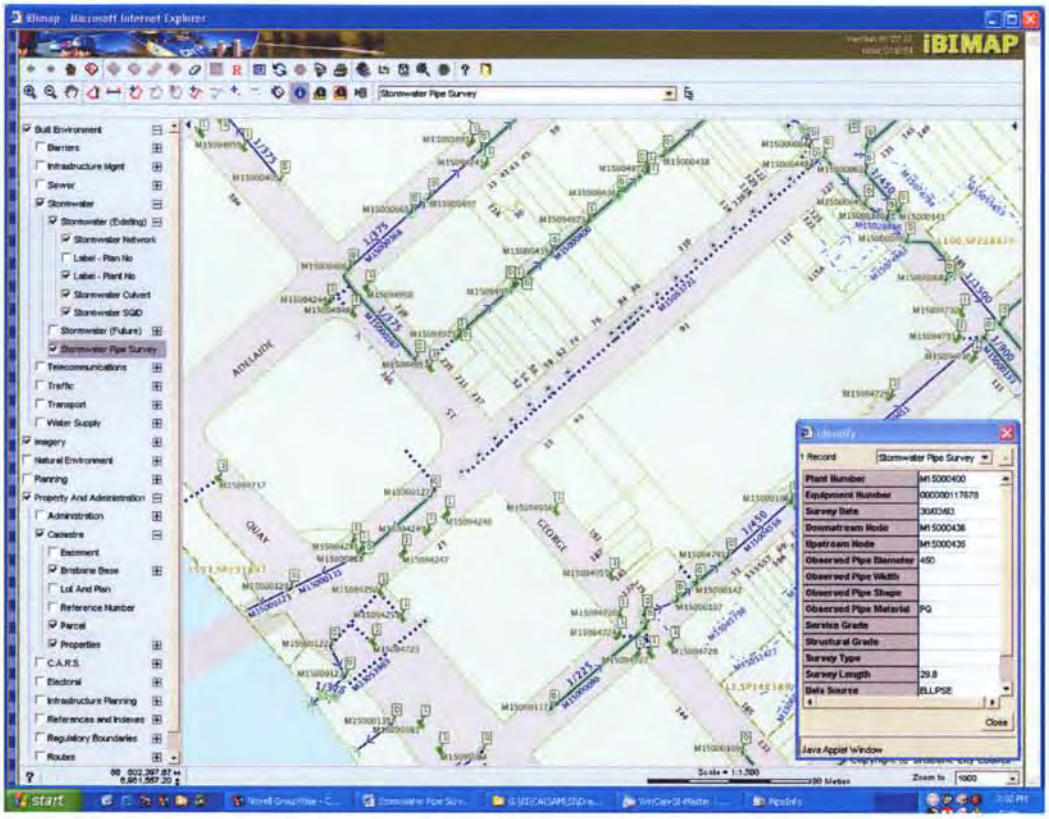
Up to June 2009, Pipe condition survey data were stored in a separate module of Ellipse called the Survey Module. This module is accessible from within the Equipment Register via a *Surveys* button.

After June 2009 and along with the upgrade of WinCan to Version 8, the data is no longer being uploaded into Ellipse. The Survey data is being stored in a local corporate drive.

2.3.3 iBIMAP

iBIMAP is Council's internal web-based spatial information tool. It gives access to and enables users to analyse and present spatial data for Council assets in graphical and tabular format.

Spatial information is an essential resource and through iBIMAP, asset, property, utility, development and compliance information is available via links from a single property search.



More than one theme can be shown at once, e.g. the Stormwater and Property Boundaries themes show the pipe and maintenance holes in relation to parcels of land.

iBIMAP can only display very limited Survey Information with no condition data. Pipes that have been surveyed are highlighted "Green" when the theme "Stormwater Pipe Survey" is activated (refer image above).

2.3.4 eBimap

eBIMAP is Brisbane City Council's online or external mapping service. Subscribers can use eBIMAP to find Council information via geospatial mapping technology. eBIMAP information is only to be used for business purposes, not for design purposes.



eBIMAP features and benefits:

- service compatible with Windows
- comprehensive information on properties in the Brisbane area
- unlimited access for all functions, including viewing, reporting and printing
- superior GIS (Geographic Information System) analysis tools such as spatial buffering and attribute queries
- an efficient search engine that allows you to search on address, lot, plan number, Map Grid of Australia (MGA) coordinates and postcode
- access to ISO standard metadata on map layers, with information on the origin and accuracy of the data
- high quality printing from A4 to A0 formats in portrait and landscape, including map exports into email-ready "pdf" type files
- exceptional digital aerial imagery including 1946 ,1999, 2005 and 2007 aerial photos

2.3.5 Identification of Pipes & Maintenance Holes in iBIMAP or eBimap

Facet/PID

The Facet/PID numbering system is used as a unique identifier for each Asset within a single Facet. In the case of the pipe system, the unique identifier is attached to the pipe(s) between two other assets, i.e. 2 maintenance holes or a maintenance hole and an outlet. This unique identifier is called the Plant Number. A Facet is the Map Number used within an older Queensland Orthographic Mapping System.

Orthophoto maps

In 1977 monotone orthophoto maps began to be produced at a scale of 1:10 000. These were enhanced with cadastral and property information. The first maps covered the 1:100 000 areas of Caboolture, Esk and Ipswich and were available as printed copies. All future orthophoto maps at 1:10 000 were sold as dyeline copies. Colour enhanced orthophotos at 1:25 000 were produced as duotones in 1979. This process then evolved into four colour topographic image maps in the early 1980's. (ref. Queensland Government Website)

A PID is a unique identification number generated at the time of loading into the iBIMAP system.

iBIMAP Identification

The same naming convention is used for Gullies and Maintenance Holes (including Inlets & Outlets); therefore, on any given Map (Facet) the same Facet/PID combination can exist. The system does however maintain a unique Plant Number for each asset class within a given Map (Facet).

A typical Pipe, Gully or Maintenance Hole in iBIMAP is denoted by Facet/PID combination e.g. "K18000058" where K18 is the Facet (or Map) and 58 is the PID. The PID is the next available number for the particular Asset Class.

iBIMAP has only one identifier for the stormwater pipe regardless of the number of barrels. Where there is more than one barrel, the label displaying the size also displays the number of barrels.

2.3.6 CCTV Survey

The Brisbane City Council currently holds the CCTV survey information in a corporate database in WinCan version 8 format. Therefore CCTV inspections, documentation, videos and reports are to be submitted to Council in WinCan version 8 compatible format.

3 DATA COLLECTION AND CODING OF OBSERVATIONS

This section refers to the Operational requirements including the following:

- Accreditation of Operators
- Minimum requirements of the CCTV equipment
- Operation specification of the CCTV equipment
- Reporting

3.1 Accreditation of Operators and Supporting Staff

Operators responsible for identifying and recording defects, preparing reports and operating equipment shall hold a suitable qualification issued by a Registered Training Organisation (RTO).

Refer to **WSA 05-2008 section 2.2 Training and Accreditation of Personnel**

3.2 CCTV Camera

Generally specification is as per **WSA 05-2008 section 2.5 - CCTV Camera** and therefore includes the following:

- Capability (Steerable) refer **WSA 05-2008 section 2.5.2**
- Picture Quality refer **WSA 05-2008 section 2.5.3**
- Video format refer **WSA 05-2008 section 2.10.3**
- Photographs refer **WSA 05-2008 section 2.10.4**

3.3 Camera Operation

Standardised operation of the CCTV camera is to be operated as per **WSA 05-2008 section 2.6 Camera Operation.**

Particular care is to be taken with regards to the following:

3.3.1 Camera Position

1. The camera lens shall be maintained centrally (within +/- 10%) of the diameter or vertical and horizontal dimensions.
2. Care will be required in conduits when a considerable amount of silt or debris is present. In some cases it may be acceptable to lower the camera lens to avoid the camera toppling over.
3. For additional information, refer WSA 05-2008 section 2.6.1

3.3.2 Camera Speed

1. The maximum speed of the camera travelling within the conduit (all sizes) is 0.2 metres per sec.
2. The speed of the camera is to be such that the operator can anticipate arrival at all defects and features which is dependent of the condition and/or cleanliness of the conduit.
3. For additional information, refer WSA 05-2008 section 2.6.2

3.3.3 Pipe Survey or Observation Procedure

1. At the start of the survey, the Maintenance Hole (MH) is to be checked for attributes and defects. There are a number of observations, attributes and defects that must be addressed before proceeding. Refer **Section 6 Maintenance Hole / Node – Condition Observations** for more information and guidance.
2. The Survey and therefore the video are to start as close as possible to the face of the MH. As a standard MH has a diameter of 1050mm, the start chainage should be approximately 0.6m.
3. Before proceeding along the conduit, the camera is to focus on the surface of the conduit and check for defects whilst rotating the camera through 360 degrees paying particular attention at the 3, 6, 9 & 12 o'clock positions for the start of Longitudinal Cracks or Fractures.
4. While the camera is travelling between each joint, the camera is to view (or point) directly along the conduit axis while ensuring that the surface of the conduit at 45 degrees to the axis is in focus at all times. While the camera is travelling along the conduit, the operator is to pay particular attention to the 3, 6, 9 & 12 o'clock positions for any defects.
5. If defects are observed while the camera is travelling along the conduit, the operator is to stop the travel of the camera and record the defect.
6. All joints must be checked for defects whilst rotating the camera through 360 degrees paying particular attention at the 3, 6, 9 & 12 o'clock positions for the start of Longitudinal Cracks.
7. If the start of a Longitudinal Crack or Fracture has been recorded, particular attention must be taken to record the finish chainage.
8. If a Longitudinal Crack or Fracture has been observed whilst travelling along the conduit midway between joints, the camera is to be rotated to focus on the crack and then the camera is reversed to locate the start chainage of the crack.
9. During the survey, if up to 20% or central focal area of the lens is covered by cobweb, dirt or other substance which is preventing a clear view of the conduit and defects, the lens is to be cleaned. If the camera is withdrawn to clean the lens, then the survey can be resumed from the chainage where the camera was withdrawn, however the video must be a single video file.
10. Just prior to the end of the conduit, before entering into the maintenance hole (MH), the camera is to focus on the surface of the conduit and check for defects whilst rotating the camera through 360 degrees paying particular attention at the 3, 6, 9 & 12 o'clock positions for the finish of any Longitudinal Cracks or Fractures.
11. While the camera is positioned in the end MH, the MH is to be observed and any defects to be recorded in the MH section of the Wincan reporting system refer **Section 6 Maintenance Hole / Node – Condition Observations** for more information and guidance.

3.4 Linear Measurement

Generally specification for Linear Measurement is as per **WSA 05-2008 section 2.7 Linear Measurement**

3.5 Data Display during Video Playback

For further information, refer to **WSA 05-2008 section 2.8 Data Display during Video Playback**

For the start of the video the following information is to be displayed for a period of not less than 30 seconds:

1. Pipe Asset Number, e.g. H1600123401
2. Start MH or Node Number, e.g. H16004321
3. Finish MH or Node Number, e.g. H16003412
4. Direction of Inspection, e.g. Upstream
5. Date of Inspection, e.g. 22-03-2010
6. Time, e.g. 13:16
7. Street, e.g. Queen St
8. Suburb, e.g. City
9. Pipe Shape, e.g. Round (or Box)
10. Pipe Diameter/Height (mm), e.g. 450 (or 1200 x 600)
11. Pipe Material, e.g. Precast Concrete
12. Company & Operator, e.g. BCC – John Doe
13. Camera, e.g. Pearpoint Large

During the survey, the following data is to be displayed:

1. The camera's longitudinal position (chainage) along the conduit, automatically updated
2. MH or Node reference numbers and direction, e.g. H16004321 ← H16003412
3. Direction of Inspection, i.e. a dial or graphical indicator that shows the camera's position with respect to the viewing angle.

3.6 Maximum Depth of Flow

Conduit inspections are to be carried out in dry weather so that the invert can be inspected.

Water flowing down the conduit is not to be recorded as a water level, only water that is ponding and therefore not flowing, is to be recorded as a water level. If water begins to flow during the course of an inspection and it is safe to do so, the inspection can be completed.

If the pipe is sagged and the water level increases as the camera travels along the conduit, record the water level in increments of 10%. Only continue after the camera is submerged if it is likely that the camera will become unsubmerged in a short distance. This defect is to be reported immediately for possible urgent maintenance action.

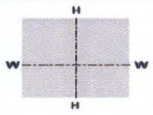
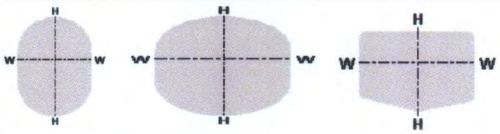
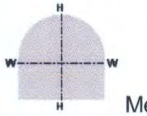
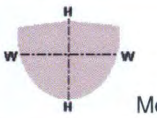
Refer to **WSA 05-2008 section 2.9 Maximum Depth of Flow** for further information.

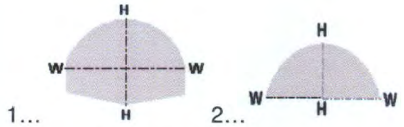
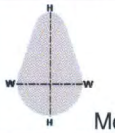
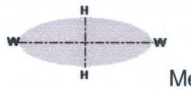
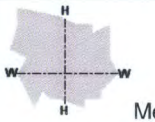
3.7 Inspection Report

Refer to **WSA 05-2008 section 2.10 Inspection Report** and Contract specifications.

4.1 Pipe Shape

The following table shows the possible Shapes of the conduit that may be encountered and the data required to record the type and size of the conduit.

Pipe Attribute	Database Codes/Example		Field Name	Description	How to Identify / Measure
	Ellipse	BIMAP			
Pipe Shape	RD	PIPE	Round	This is the common circular shape of precast steel reinforced concrete pipes (SRCP) and fibre reinforced pipes (FRC) Vitreous Clay pipes are still in existence. Plastic Pipes are not common in Brisbane but may be encountered.	 Measure: Diameter
	BX	BOX SECTION	Box	Reinforced Concrete Box Culverts (RCBC) are measured by their width and height, e.g. 2400 x 1200.	 Measure: Width and Height
	RB	OVAL	Rounded Box	This is not a common shape in Brisbane and is not to be confused with an Egg or Inverted Egg shape. This shape should have vertically flat sides and may have a flat obvert (ceiling).	 Measure: Height and Width
	BH	SEMI CIRCULAR	Beehive	Originally these conduits may have been an open concrete "U" shape drains with a dome (obvert or ceiling) added some time later.	 Measure: Height and Width
	IB	BOX SECT OVER HALF PIPE	Inverted Beehive	Originally these conduits may have been an open concrete "U" shape drain constructed with Brick or cast-in-situ concrete with a ceiling slab added some time later constructed from cast-in-situ concrete.	 Measure: Height and Width

Pipe Attribute	Database Codes/Example		Field Name	Description	How to Identify / Measure
	Ellipse	BIMAP			
	AR	ARCH CHANNEL	Arched	1... Originally these conduits may have been an open concrete "V" shape drains with a dome (obvert or ceiling) added some time later. 2... Humes BEBO Arch	 Measure: Height and Width
	CN	COFFIN	Coffin	These are an older drain design built before the 1930's and constructed from Brick or Stone. Similar to Inverted Egg but with a flat Invert. There are still quite a few of these is service which were built in the 1800's.	 Measure: Height and Width Wall Pitch (P)
	EG	EGG SHAPED	Egg	These are an older drain design built before the 1930's constructed from Brick or Stone. They are not very common and are not to be confused with the Inverted Egg which is more common.	 Measure: Height and Width
Pipe Shape (continued)	IE	EGG SHAPED	Inverted Egg	These are an older drain design built before the 1930's constructed from Brick or Stone. There are still quite a few of these in service which were built in the 1800's.	 Measure: Height and Width
	LE	OVAL	Lateral Egg	This shape is not common.	 Measure: Height and Width
	TZ	TRAPEZOIDAL	Trapezoidal (Slab Over)	Originally these conduits may have been a cast-in-situ open drain with a slab roof (obvert or ceiling) added some time later	 Measure: Height and Width
	IR		Irregular	Very few drains in Brisbane. Usually carved through rock without any liner or brick work.	 Measure: Height and Width
	UN	UNKNOWN	Unknown	This Code should only be used in exceptional circumstances.	

4.2 Pipe Material

The following table shows the possible Material types of the conduit and the data to be recorded.

Pipe Attribute	Database Codes/Example		Field Name	Description	How to Identify / Measure
	Ellipse	BIMAP			
Material Types		PA	Asbestos Cement	These are no longer manufactured. A replacement product is manufactured with cellulose fibre and called Fibre Reinforced Concrete (FRC) Pipes.	This pipe has a very smooth concrete surface with joint spacing generally at 4.8m. The maximum diameter is 750mm
		FRC	Fibre Reinforced Concrete	Similar to Asbestos Cement pipes but Cellulose fibre has replaced Asbestos.	This pipe has a very smooth concrete surface with joint spacing generally at 4.8m. The maximum diameter is 750mm
		PB	Brick	Drains constructed before 1930's made of brick construction	The brick material is usually a fired clay brick with a terracotta colour and the size of the brick is generally 230 (L) 110 (W) x 76 (H)
		PH	Cast-in-situ Concrete	Drains generally constructed before 1930's of concrete with internal formwork.	The surface of the drain has the telltale formwork boards along the conduit's surface. There are no noticeable joints at regular intervals.
		PC	Precast Concrete	Pipes manufactured after the 1940's. These pipes are generally spun in a cylindrical cast.	The surface may have trowel marks radially around the pipe's surface. These pipes are generally very smooth. Joint spacing is generally 2.4m.
		PP	Unknown	Use this only if the material cannot be identified.	
		OT	Other	If the material can not be identified, then use Unknown (PP)	
		PD	Cast metal (iron)	This material would be very rare.	Old brown scaled rusty surface.
		PE	Fabricated Metal	This material is very rare but could be found in short culverts.	Corrugated iron panels.
		PF	Natural Material	Very few drains exist where they have been carved through rock.	Material looks natural with no liner or brick work.
		PI	Porphyry blockwork	Drains generally constructed in the 1800's.	Large blocks of stone, where the blocks can vary slightly in size but are approximately 300mm x 200mm x 200mm

Pipe Attribute	Database Codes/Example		Field Name	Description	How to Identify / Measure
	Ellipse	BIMAP			
		PJ	Polyvinyl Chloride (PVC)	Smooth plastic surface.	Can be a variety of colours from white or light grey to black. Very smooth surface with joint spacing from 3 to 6 metres. Maximum diameter 600mm. Anything larger than 600 is probably a liner.
		PO	Steel	Not common. Might be used as a liner or in special locations. Could be a stainless steel or mild steel.	Smooth grey steel.
		PQ	Vitreous Clay	This material was used extensively in the very early 1900's. Maximum diameter 600mm.	Smooth surface usually a terra-cotta colour and joints at 600mm.
		P	PVC Liner	Many forms of liner are used from panelled type to full sock type.	Panelled type is a radially applied liner, which would appear to have many joints. The full sock type does not have ant joints. Both would be white or grey in colour when new.
		C	Concrete Lined	Not common and would be for special cases only. Not likely to be encountered.	Smooth white or light grey concrete.
		S	Steel Liner	Not common and would be for special cases only. Not likely to be encountered.	Smooth grey steel.

4.3 Pipe Dimensions

The follow table shows the possible Sizes of the conduit that may be encountered and the data to be recorded.

Pipe Attribute	Database Codes/Example		Field Name	Description	How to Identify / Measure
	Ellipse	BIMAP			
Pipe Dimensions			Pipe Width (W)	**Valid Values are:** 300mm up to 4200mm	
			Pipe Length (between joints)	**Valid Values are:** 0.6m, 1.2m, 2.4m, Other, Unknown	
			Pipe Diameter (D)	**Standard Values are:** 225 mm, 300 mm, 375 mm, 450 mm, 525 mm, 600 mm, 675 mm, 750 mm, 825 mm, 900 mm, 1050 mm, 1200 mm, 1350 mm, 1500 mm, 1650mm, 1800mm, 1950mm, 2100mm, 2250 mm, 2400mm, 2550 mm, 2700 mm, 3000mm.	
			Pipe Height (H)	**Valid Values are:** Record in mm	

5 PIPE SURVEY CODES

Pipe Survey codes fall into two defect categories:

1) Structural defects (see Section 5.2)

2) Serviceability defects (see Section 5.4)

All codes are automatically given a Chainage and some codes require additional data, e.g. Position (o'clock).

5.1 General Information regarding Cracks and Fractures

5.1.1 Definition of a Crack

Council requires that concrete pipes delivered to Council jobs or pipes that Council will maintain (e.g. contributed assets) are free of defects and cracks. This information can be found in the **Reference Specification for Civil Engineering Work S160 Drainage** which is available on Council's website.

The Reference Specification includes details for measuring the cracks with a "feeler gauge" but as this is for delivered pipes and the end of each pipe section is easily accessible, the physical measurement of cracks is not possible in small pipes that can only be accessed by CCTV.

Older pipes, such as Cast-in-situ and those manufactured from Vitreous Clay will decay and crack differently to Precast concrete pipes.

As the quality of CCTV cameras increases and with improved video formats and quality, cracks may appear to be more prevalent, therefore, the following explanation regarding "Cracks" and "Fractures" may be open to some interpretations and any concerns are to be addressed with the asset manager for clarification if necessary.

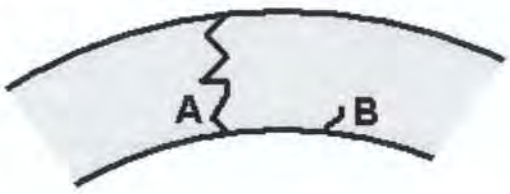
Predominantly, longitudinal cracks are a concern if visible at the 6 and 12 or 3 and 9 o'clock positions as these are generally caused by poor construction techniques or excessive loadings. Circumferential cracks in or near the middle of a conduit segment i.e. between joints, may also be the cause of poor construction techniques or excessive loadings.

Crack:

Surface cracks that appear to be fine cracks need not be recorded. Surface cracks are usually present from the time the pipe leaves the factory and are generally not more than 1mm deep.

Technically, if a crack is all the way through the wall of the conduit, it is a fracture, but because the outside of the pipe cannot be seen simultaneously, judgement is therefore limited.

Any crack that is visible and estimated to be more than 0.2mm wide is to be recorded. A crack may look larger in a smaller pipe than in a large pipe because the CCTV camera may be closer to the defect in the smaller pipe. A "Crack" should be no wider than 2mm.



Viewed from inside the pipe, cracks A and B would look the same. If either crack is more than 0.2mm wide, moisture can gain access to the reinforcement and therefore decrease the service life of the pipe. If the crack appears more than 0.2mm wide record as a crack otherwise it can be ignored as it is a surface crack.



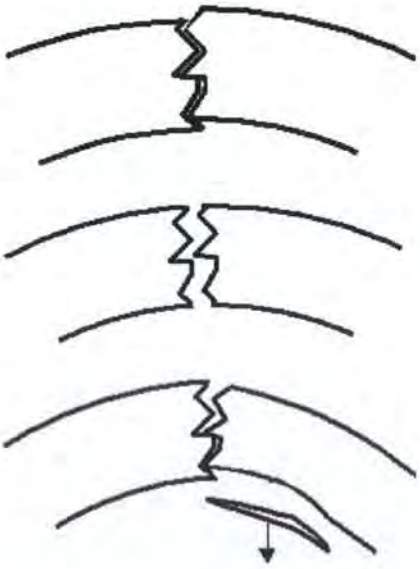
Cracks C and D would also look the same from the inside of the pipe and both pose a threat to the service life of the pipe. As the surface each side of the crack is in alignment, these are still recorded as cracks, provided the width appears less than 2mm.

5.1.2 Definition of a Fracture

A Fracture is classified as a crack that is completely broken through the wall of the conduit. There may also be signs of infiltration and/or encrustation that would signify that ground water is leaching through the wall of the conduit.

Some features of a crack may not present themselves as a fracture unless certain visual rules are applied, therefore cracks are recorded as fractures if:

1. The crack appears to be open and predominantly the width of the crack is greater than 2mm but less than 3~4mm (see Conduit Broken).
2. The wall of the pipe deviates at the crack from its usual curved appearance i.e. the pipe is out of round and shows signs of structural distress from loadings. Other condition codes may need to be recorded with this observation.
3. The surfaces on each side of the crack appear to be out of alignment or one side appears to be of a different level.
4. Pieces of the surface are missing and failure of the surface is visible.



From the inside of the conduit the surfaces each side of the fracture are out of alignment.

A fracture with a width of between 2 & 4mm. This form of fracture is due to movement under tensile forces but this would be rare, as lateral forces from the soil outside the conduit would usually keep the surfaces of the crack in contact.

This fracture displays spalling and pieces breaking away from the surface near the crack. The conduit may appear out-of-round.

The next phase to the deterioration of a conduit is Broken. This is where significant movement of the pieces of the conduit and the conduit is considerably deformed.

5.2 Common Structural Condition Codes

This section defines the common codes used to record the physical condition and structural integrity of conduits that are not constructed of Brick or Stone.

Common Structural defects in Drains other than Brick include:

BCC01	Longitudinal crack < 2m, (position), (length)
BCC03	Sagged Pipe
BCC06	Hole in pipe, (position), (diameter), (depth)
BCC07	Longitudinal fracture < 2m, (position), (length)
BCC08	Surface damage, spalling - minor, (position), (area)
BCC09	Surface damage, spalling - major, (position), (area)
B	Conduit broken, (position)
BJ	Conduit broken at joint, (position)
CC	Circumferential crack, (position)
CCJ	Circumferential crack at joint, (position)
FC	Circumferential fracture, (position)
FCJ	Circumferential fracture at joint, (position)
JDS	Joint displaced slight (<20mm)
JDM	Joint displaced medium (20-50mm)
JDL	Joint displaced large (>50mm)
DH	Conduit deformed, (%) change of horizontal dimension
DV	Conduit deformed, (%) change of vertical dimension
OJL	Open joint large (>50mm)
OJM	Open joint medium (20-50mm)
OJS	Open joint slight (<20mm)
CL	Longitudinal crack, (position)
FL	Longitudinal fracture, (position)
CM	Multiple cracks, (position)
CMJ	Multiple cracks at joint, (position)
FM	Multiple fractures, (position)
FMJ	Multiple fracture at joint, (position)
SEL	Surface damage, erosion large - no invert in conduit, (position)
SEM	Surface damage, erosion medium - holes and wear, (position)
SES	Surface damage, erosion slight - surface under cut, (position)
SS	Surface damage, spalling, (position), (depth)
SW	Surface damage, wear, (position)
X	Conduit collapsed, (%) cross-sectional area loss
PLB	Bulge in lining, (position)
PLM	Lining missing, (position)
PLS	Lining separated or hanging from conduit, (position)

BCC01 – Longitudinal Crack

This is a special BCC code for short cracks along the drain wall parallel to the direction of flow or axis of the drain that are no greater than 2 metres in length. If the Crack is longer than 2 metres record as CL - Longitudinal Crack. A Crack is a defect that is not open and predominantly the width of the crack is less than 2mm. Refer to 5.1 General Information regarding Cracks and Fractures.

Additional Notes

- Pay particular attention to the opposite clock position for another crack, as the defect may be due to poor construction techniques and therefore the pipe may have been slightly crushed.
- If the crack increases in width and becomes a fracture then the fracture and its length must be recorded also.

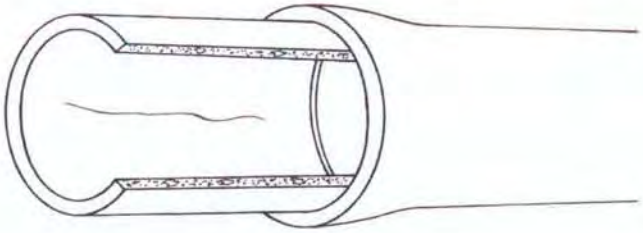
Example











Additional Data required

Position	Mandatory	__ o'clock
Length	Mandatory	millimetres (mm) e.g. 1750

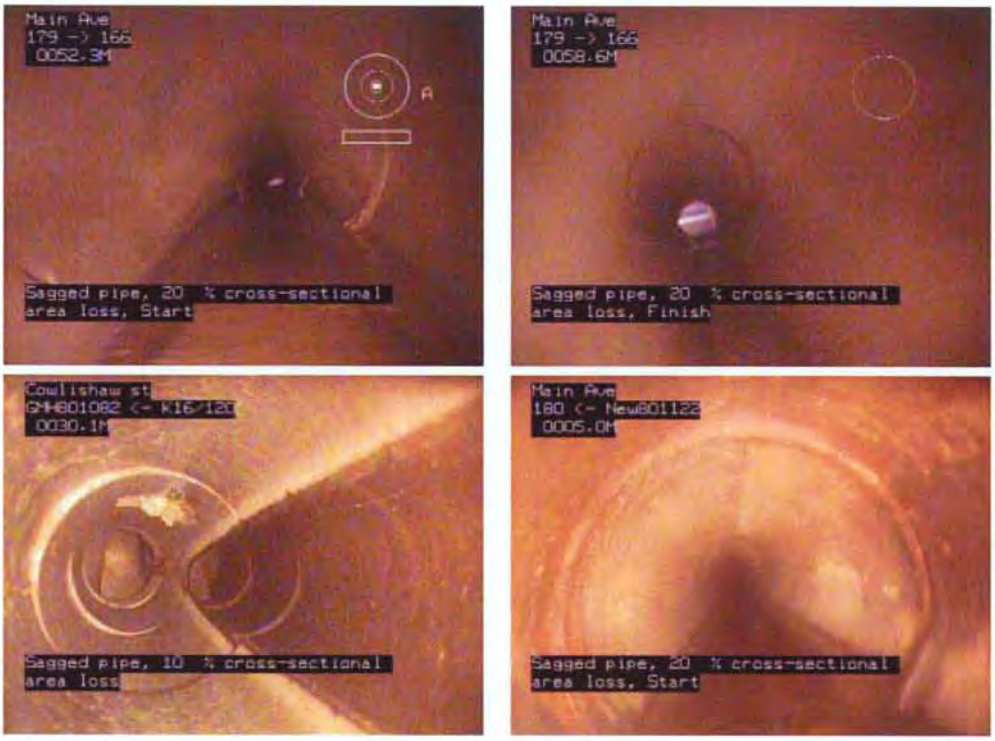
BCC03 – Sagged Pipe

This is a special BCC code for the subsidence of the whole drain, which causes water to pond at its invert. It is not to be confused with the codes for deviations, refer Line of conduit deviates Down, Up, Left or Right.

Additional Notes

- The survey should be continued, if safe to do so, otherwise record Survey Abandoned stating the reason.
- The depth of water at its deeper position along the length of ponding is to be recorded.

Example



Additional Data required

Start/End	Mandatory	Record start and end chainage
Percentage	Mandatory	% of cross-section area loss (at maximum depth)

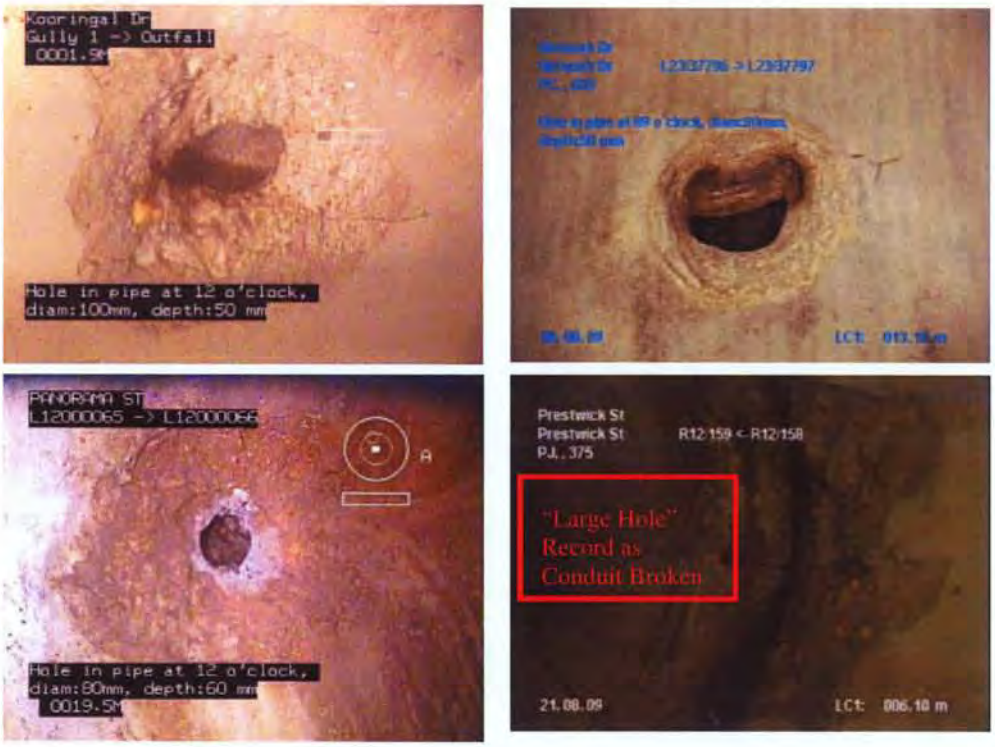
BCC06 – Hole in Pipe

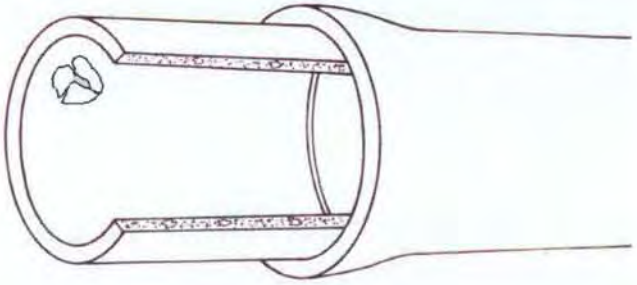
This special BCC code is to be used for a hole in an isolated location that is **not** the result of wear or erosion. Usually occurs if an object has speared the conduit and a piece of the conduit has broken inwardly.

Additional Notes

- Any continuation of holes that appear to be as a result of wear or erosion, is to be coded as SEM - Medium Erosion Surface Damage or SEL - Large Erosion Surface Damage
- If the Hole is larger that 200~300 mm, record as "Conduit Broken".

Example





Additional Data required

Position	Mandatory	__ o'clock
Diameter	Mandatory	millimetres (mm)
Depth	Mandatory	millimetres (mm)

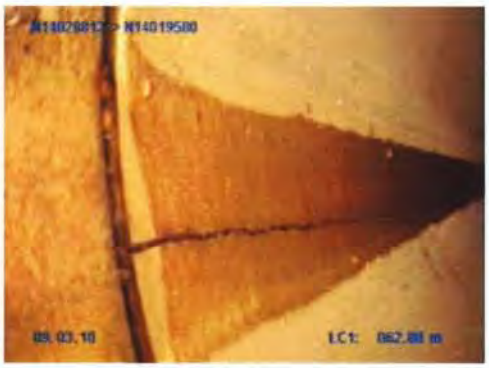
BCC07 – Longitudinal Fracture

This is a special BCC code for a Fracture (Crack) that appears to be open and predominantly the width of the crack is greater than 2mm but less than 3~4mm. If the fracture is greater than 3~4mm the condition may have to be recorded as Conduit Broken. Refer to 5.1 General Information regarding Cracks and Fractures.

Additional Notes

- Pay particular attention to the opposite clock position for another fracture as the defect may be due to poor construction techniques and therefore the pipe may have been crushed.
- If the fracture reduces in width and becomes a smaller crack then the crack and its length must be recorded also.
- If the Fracture is longer than 2 metres code as FL - Longitudinal Fracture.

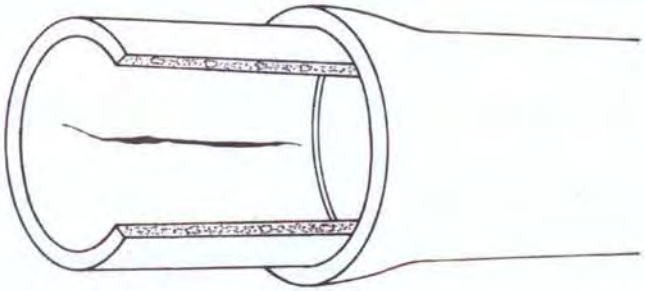
Example











Additional Data required

Position	Mandatory	___ o'clock
Length	Mandatory	millimetres (mm) e.g. 1250

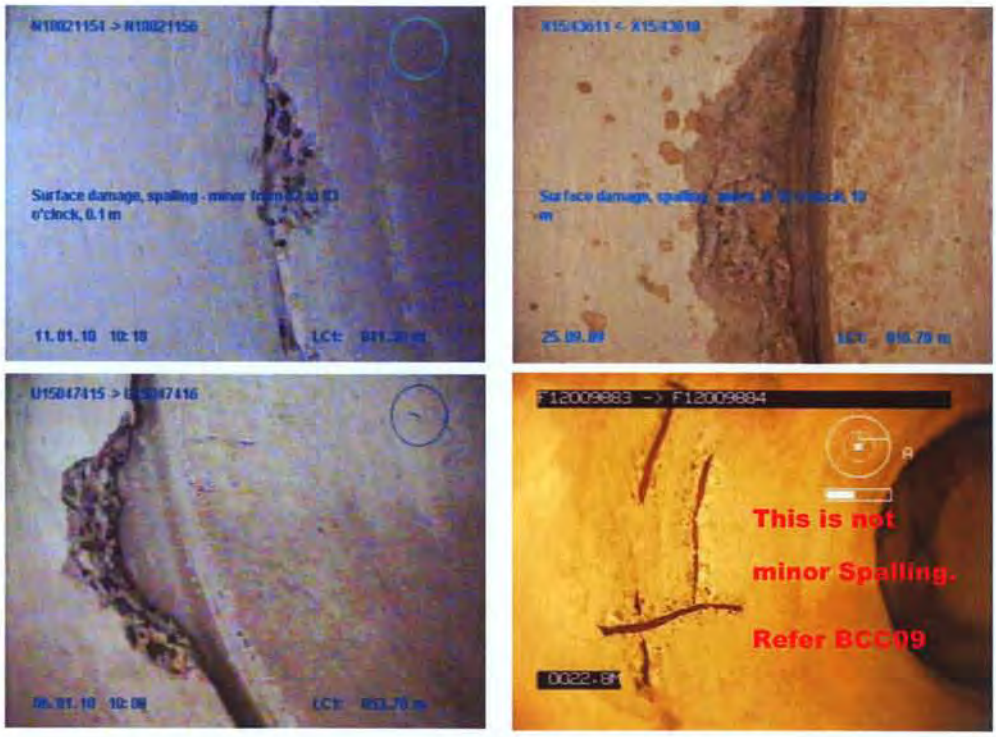
BCC08 – Minor Spalling Surface Damage

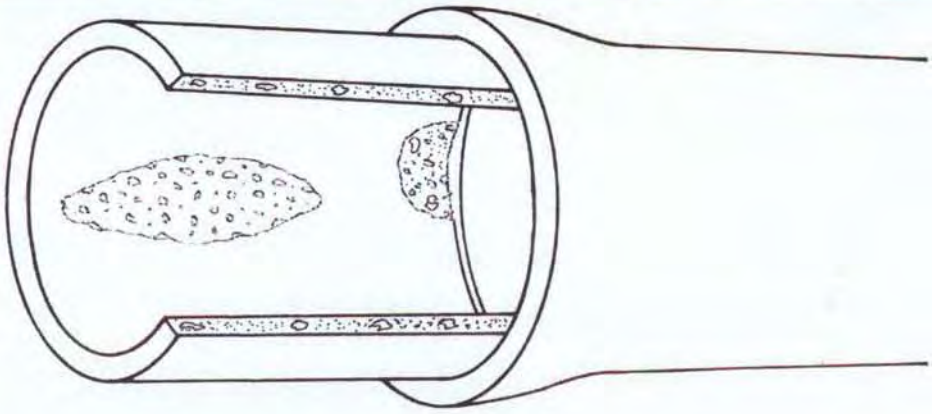
This is a special BCC code for where small sections of drain wall have started to chip or flake away. Steel reinforcement to drain has **not** been exposed at this stage. This code can also be used for unreinforced drains that are experiencing spalling to a depth not exceeding 50 millimetres.

Additional Notes

- For lengths greater than 1m, use the SS – Spalling Surface Damage or SW – Wear Surface Damage
- This defect is not caused by erosion. Refer Surface Damage codes SES, SEM & SEL.

Examples:





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length & Width	Mandatory	millimetres (mm) e.g. 500, 150

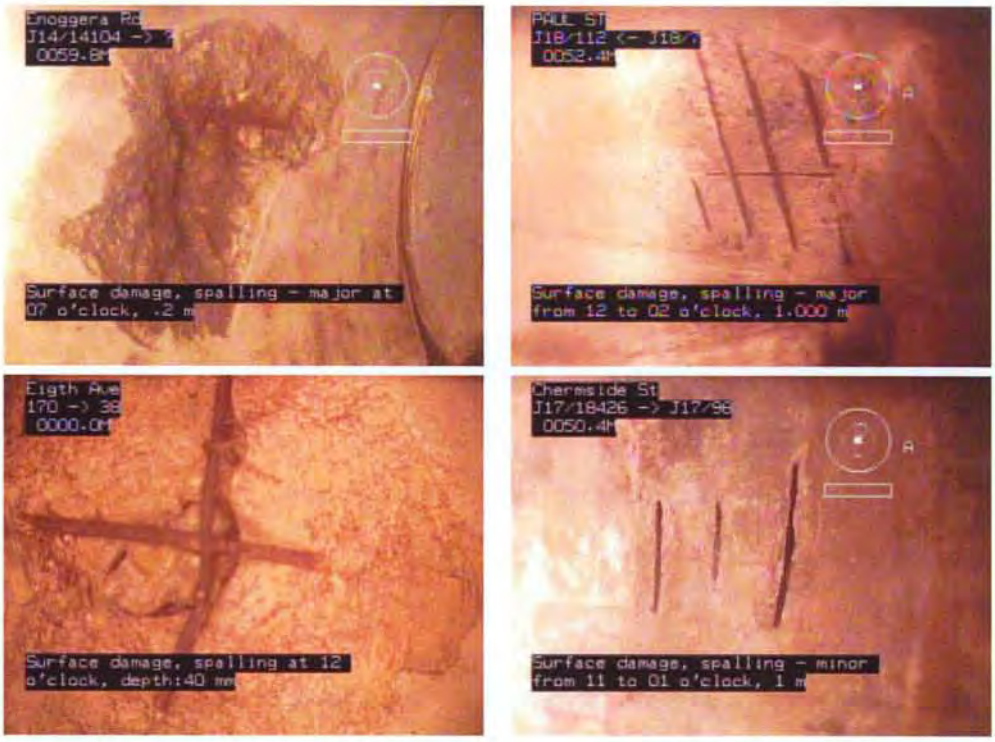
BCC09 – Major Spalling Surface Damage

This is a special BCC code is similar to BCC08, but the steel reinforcement is partially or fully exposed in reinforced concrete pipes or in unreinforced steel pipes the surface spalling depth exceeds 50 millimetres.

Additional Notes

- For lengths greater than 1m, use the SS – Spalling Surface Damage or SW – Wear Surface Damage.
- This defect is not caused by erosion. Refer Surface Damage codes SES, SEM & SEL.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length & Width	Mandatory	millimetres (mm) e.g. 500, 150

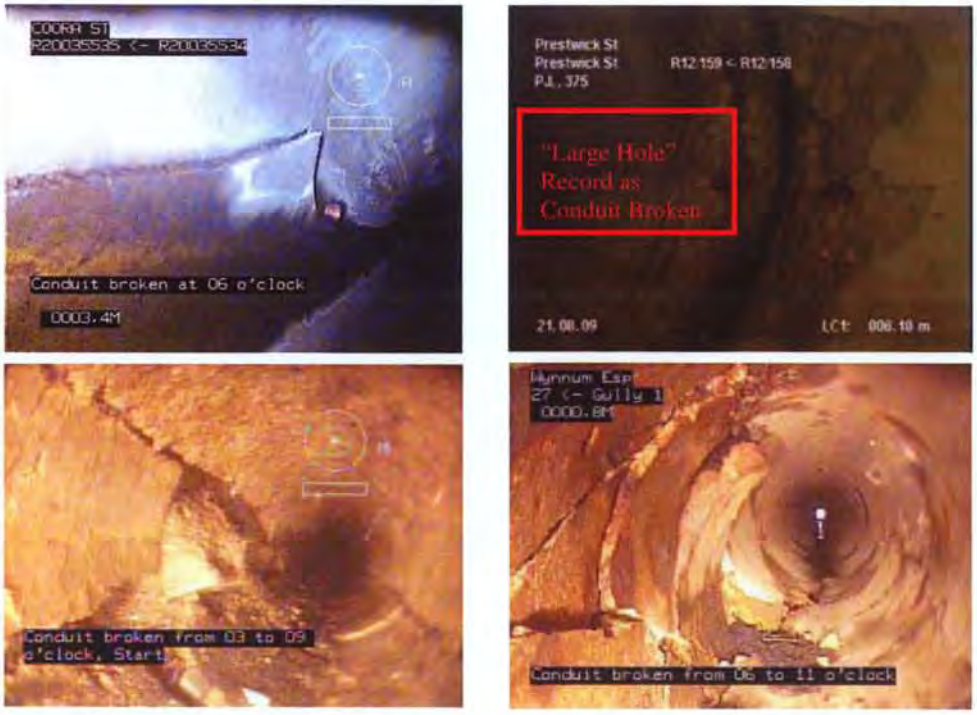
B – Conduit Broken

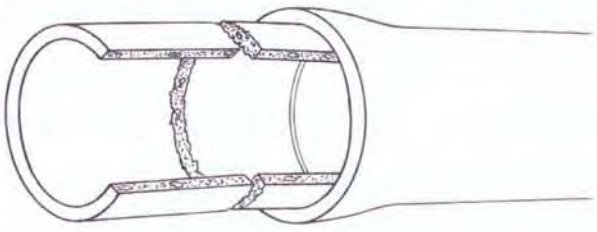
The conduit has not only fractured but also broken into a few or many separate pieces where there is significant movement of the pieces resulting in local or general distortion from the original conduit cross section. Pieces of conduit wall may be missing or the whole conduit may have been displaced through shear action such that soil or a void is visible. If the conduit is deformed then include the condition code, DH – Horizontally Deformed Conduit or DV – Vertically Deformed Conduit.

Additional Notes

- Where the length of the defect is less than 1m, measure and record the length of the break in millimetres (mm) to the nearest 100 mm. Where the length of the break is greater than 1m, record the defect using the continuous observation feature i.e. Start chainage and Finish chainage.
- This code may be used where a large hole has been caused as a result of some exceptional event and the adjoining sections of the conduit are not affected.

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	If <= 1m	Record in millimetres (mm)
Start/End	If > 1m in Length	Record start and end chainage

BJ – Conduit Broken at Joint

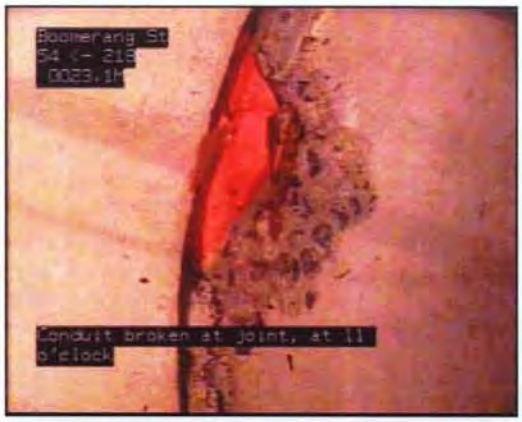
Use this code where the conduit has many Fractures but in a localised area at the joint. If the Fractures are continuous, more than 1m, then use B – Conduit Broken instead of the BJ code.

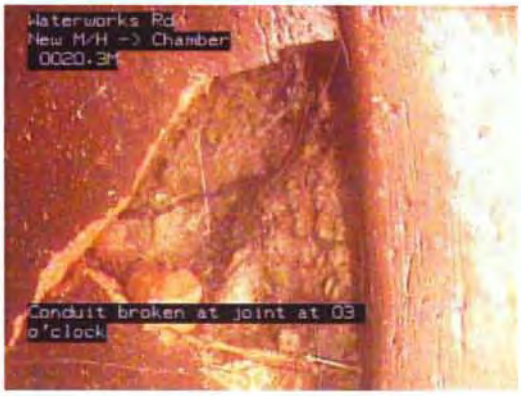
Additional Notes

- One or more pieces of the pipe are no longer present at the joint.
- If only a minor amount of conduit is missing, it may be recorded as BCC08 – Minor Spalling Surface Damage
- This code can also be used where all pieces are present but some of them are visibly displaced.

Examples









Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm)

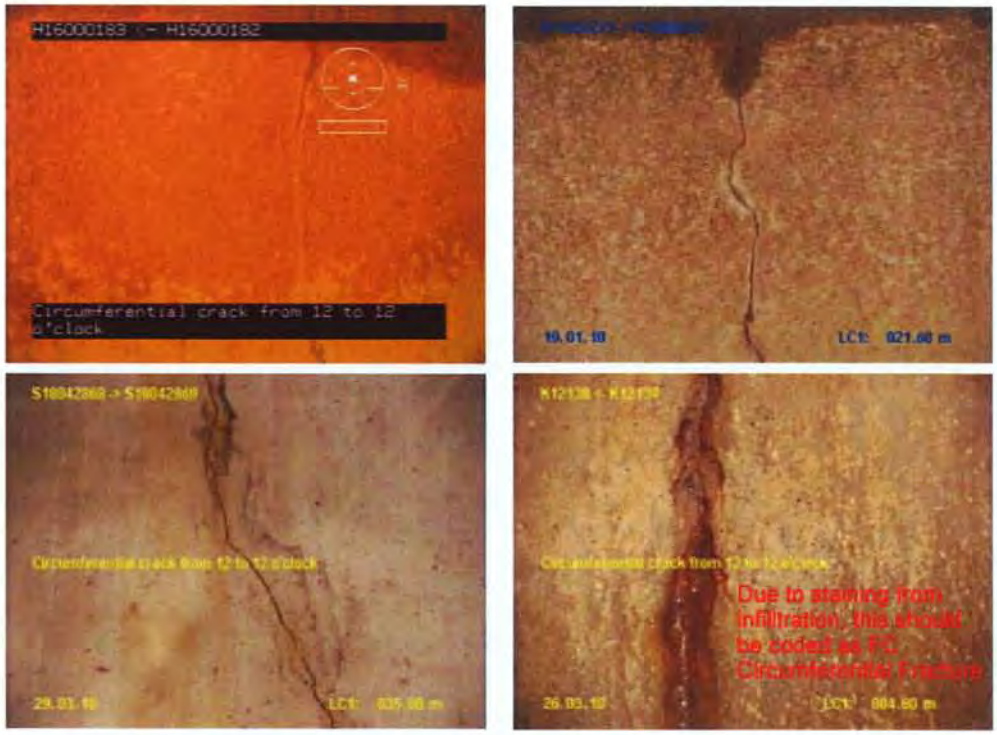
CC – Circumferential Crack

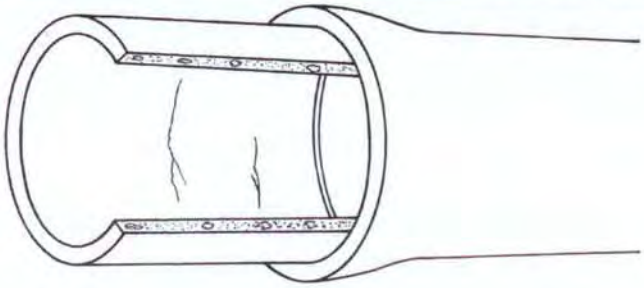
A crack no more than 2mm wide extending around the circumference of the pipe, which is not visibly open and where there has not been any movement at the crack, i.e. the surrounding pipe pieces, bricks or mortar are still in place.

Additional Notes

- If Infiltration is occurring through the crack then this would imply that the crack is right through the wall of the conduit, record as FC – Circumferential Fracture.
- If the crack is wider than 2mm but less than 3~4mm it is to be recorded as FC – Circumferential Fracture.

Example





Additional Data required

Position	Mandatory	From __ o'clock to __ o'clock

CCJ – Circumferential Crack at Joint

This code is very similar to CC – Circumferential crack, but the crack is within 150mm of a joint. A crack no more than 2mm wide extending around the circumference of the pipe at or near the joint which is not visibly open and where there has not been any movement at the crack, i.e. the surrounding pipe pieces, bricks or mortar are still in place.

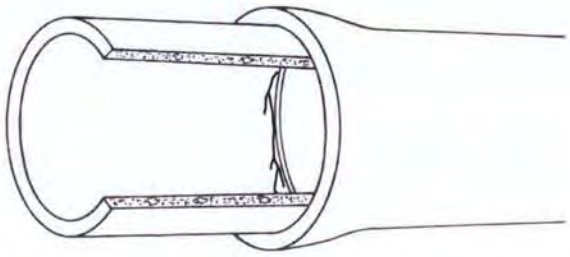
Additional Notes

- If Infiltration is occurring through the crack then this would imply that the crack is right through the wall of the conduit, record as FCJ – Circumferential Fracture at Joint.
- If the crack is wider than 2mm but less than 3~4mm it is to be recorded as FCJ – Circumferential Fracture at Joint.

Example







Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock

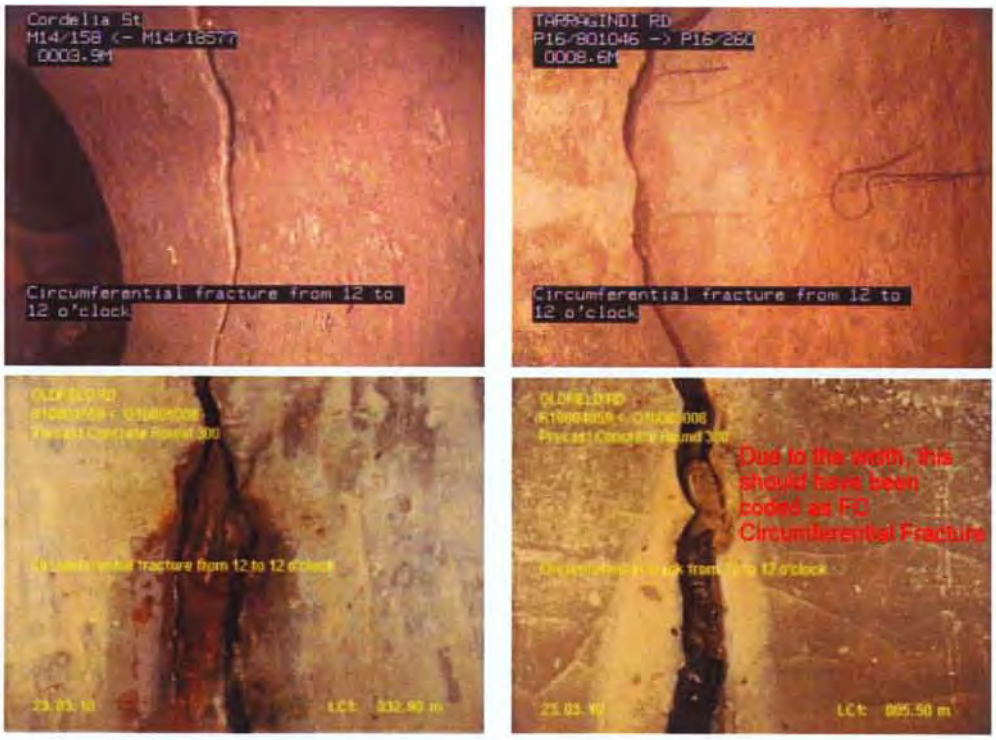
FC – Circumferential Fracture

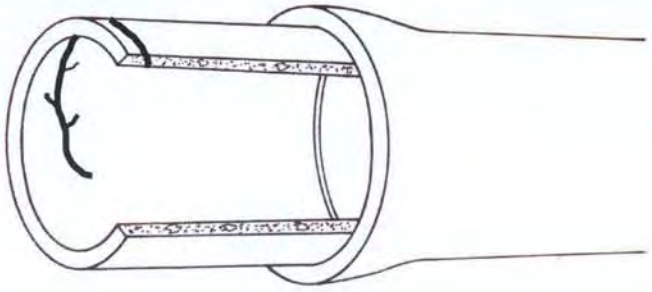
A Fracture extending around the circumference of the pipe not within 150mm of a joint, which is visibly open and predominantly the width of the crack is greater than 2mm but less than 3~4mm.

Additional Notes

- Surfaces each side of the fracture are relatively at the same level otherwise the conduit may be Broken, refer B- Conduit Broken
- If the fracture is greater than 3~4mm the condition may have to be recorded as B – Conduit Broken.

Example





Additional Data required

Position	Mandatory from __ o'clock to __ o'clock

FCJ – Circumferential Fracture at Joint

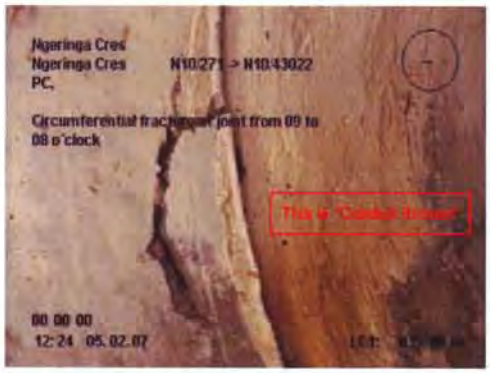
This is a Fracture extending around the circumference of the pipe within 150mm of the joint, which is visibly open and predominantly the width of the crack is greater than 2mm but less than 3~4mm.

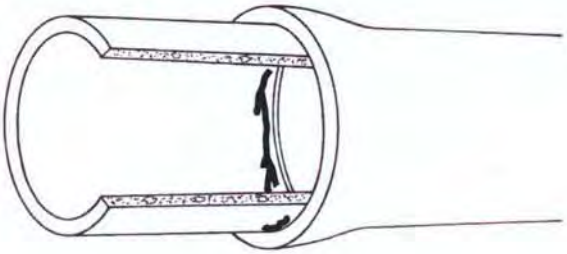
Additional Notes

- Surfaces each side of the fracture are relatively at the same level otherwise the conduit may be Broken, refer BJ – Conduit Broken at Joint.
- If the fracture is greater than 3~4mm the condition may have to be recorded as BJ – Conduit Broken at Joint.

Example







Additional Data required

Position	Mandatory from __ o'clock to __ o'clock

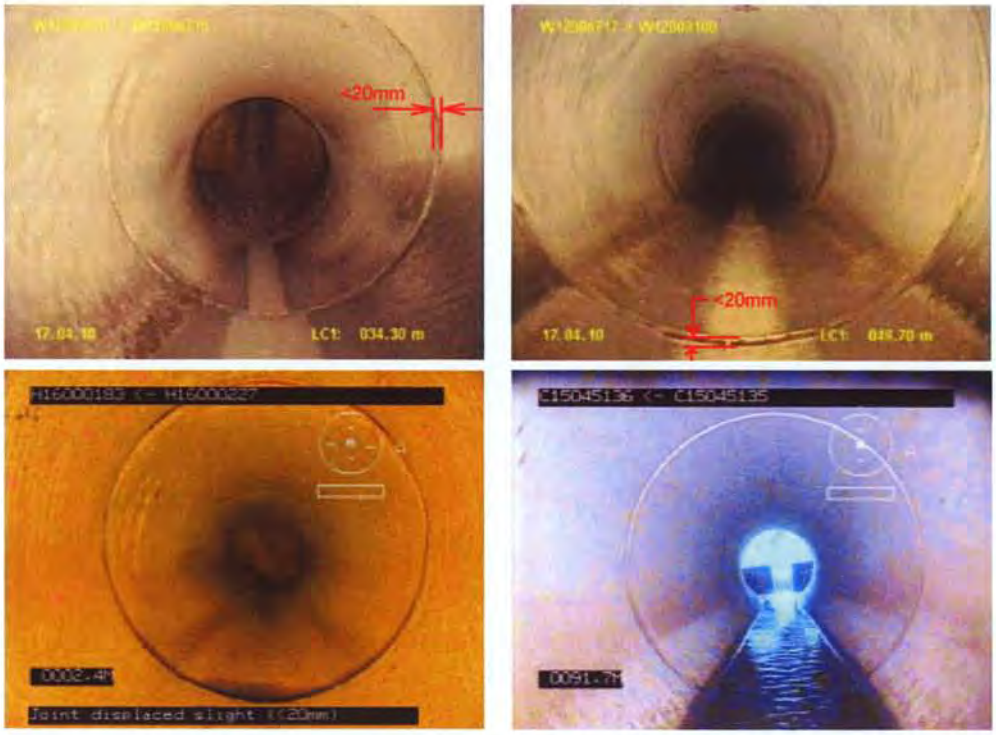
JDS – Displaced Joint – Slight (<20mm)

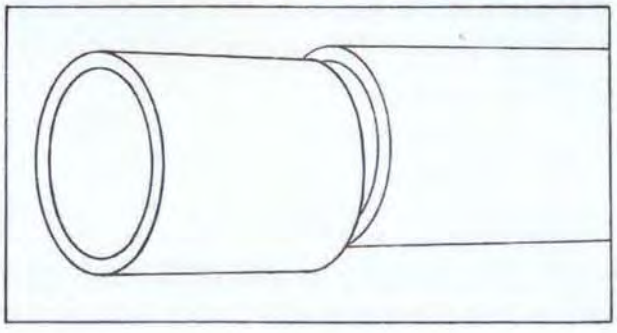
Movement or displacement at the joint of the conduit is observed and measured while approaching the joint. The displacement is estimated based on the amount of displacement compared to the diameter of the pipe.

Additional Notes

- For this defect, only record displacements that are considered between 10 mm and the 20mm limit, i.e. it is not necessary to record displacements of between 1mm and 10mm.
- The direction of the movement can be either up, down or sideways.

Example





Additional Data required

None		

JDM – Displaced Joint – Medium (20-50mm)

Movement or displacement at the joint of the conduit is observed and measured while approaching the joint. The displacement is estimated based on the amount of displacement compared to the diameter of the pipe.

Additional Notes

- The direction of the movement can be either up, down or sideways.
- A large portion of the pipe wall can be seen but soil is not observed

Example



375 dia Pipe



750 dia Pipe

Additional Data required

None		

JDL – Displaced Joint – Large (>50mm)

Displacement at the joint of the conduit is observed while approaching the joint.

Additional Notes

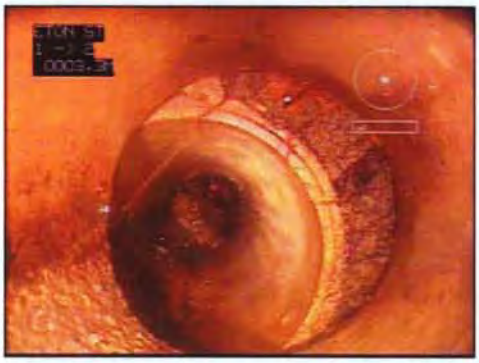
- The direction of the movement can be either up, down or sideways.
- End of the pipe or soil can clearly be seen.

Examples









Additional Data required

None		

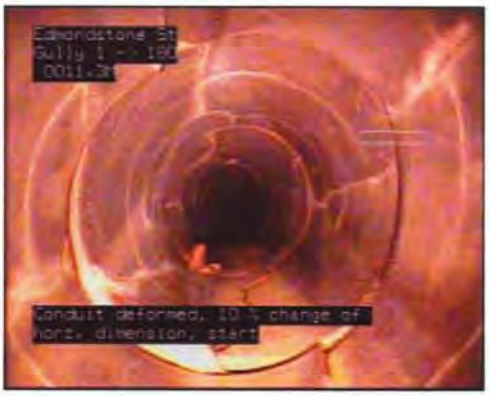
DH – Horizontally Deformed Conduit

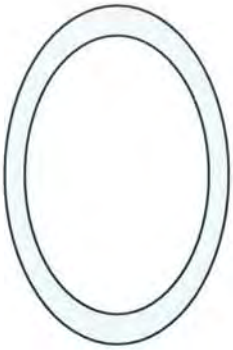
The original cross section of the drain has been reduced across the width (i.e. narrowed). This is very uncommon in rigid pipes (concrete) but could be a possible defect with Plastic Pipes where the sides of the pipe has been forced inwards during compaction of the soil around the conduit, either at the construction phase or due to heavy traffic near the conduit.

Additional Notes

- If greater than 25% and extending >0.5m, record as a collapse.

Example





Additional Data required

Length	Optional	in millimetres (mm) If < 1m
Percentage	Mandatory	% reduction of cross-section area (in 5% increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

DV – Vertically Deformed Conduit

The original cross section of the drain has been altered vertically (lower) and the combined longitudinal and circumferential cracks (major) are displaced causing the loss of structural integrity. The length of drain that has deformed is recorded.

Severity is based on % of pipe deformation.

Additional Notes

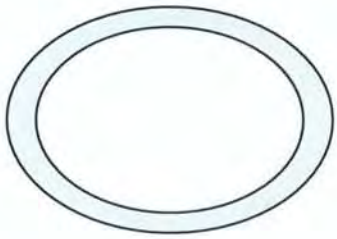
- If greater than 25% and extending >0.5m, record as a collapse.

Example









This may be incorrectly coded, as it may be more than 25% deformed. If so, record as collapse.

Additional Data required

Length	Optional	If < 1m
Percentage	Mandatory	% reduction of cross-section area (in 5% increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

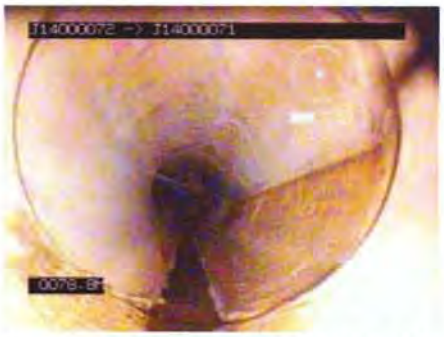
OJS – Slight Open Joint (<20mm)

An Open Joint is a defect where 2 adjoining conduits are not butted together. This can be a critical defect if soil is visible and the intrusion of tree roots is present or could occur.

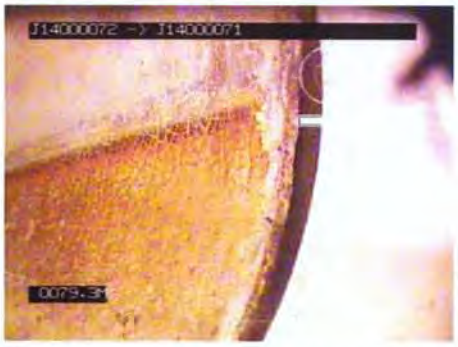
Additional Notes

- For this defect, only record openings that are considered close to the 20mm limit, i.e. it is not necessary to record openings of between 1mm and 15mm.
- As the camera is rotated through 360 degrees, check 3, 6, 9, 12 o'clock positions for possible start or finish of Longitudinal Cracks or Fractures
- Select the code that best describes the maximum gap distance.

Example



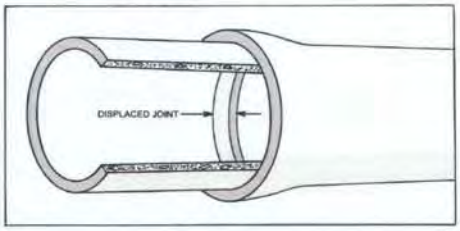
1... The camera approaches the joint, note: there is no displacement of the joint.



2... As the camera rotates to view the joint, it is revealed that the joint is "open".



3... The camera is rotated perpendicular to the joint to observe the joint and measure the gap.



Additional Data required

None		

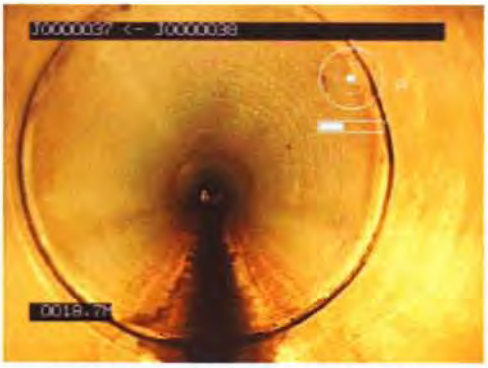
OJM – Medium Open Joint (20-50mm)

An Open Joint is a defect where 2 adjoining conduits are not butted together. This can be a critical defect if soil is visible and the intrusion of tree roots is present or could occur.

Additional Notes

- For an open joint of 20-50mm there should be no signs of soil or breakage at the joint.
- As the camera is rotated through 360 degrees, check 3, 6, 9, 12 o'clock positions for possible start or finish of Longitudinal Cracks or Fractures
- Select the code that best describes the maximum gap distance.

Example



1... The camera approaches the joint, it looks fairly "open".



2... As the camera rotates to view the joint, it is revealed that the joint is unmistakably "open".



3... The camera is rotated perpendicular to the joint to observe the joint and measure the gap

Additional Data required

None		

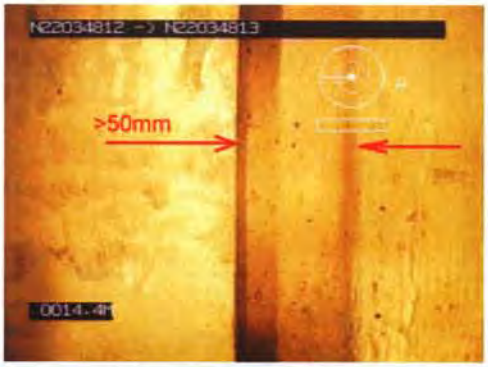
OJL – Large Open Joint (>50mm)

An Open Joint is a defect where 2 adjoining conduits are not butted together. This can be a critical defect if soil is visible and the intrusion of tree roots is present or could occur.

Additional Notes

- For an open joint of >50mm there may be signs of soil or roots between the conduits.
- As the camera is rotated through 360 degrees, check 3, 6, 9, 12 o'clock positions for possible start or finish of Longitudinal Cracks or Fractures
- Select the code that best describes the maximum gap distance.

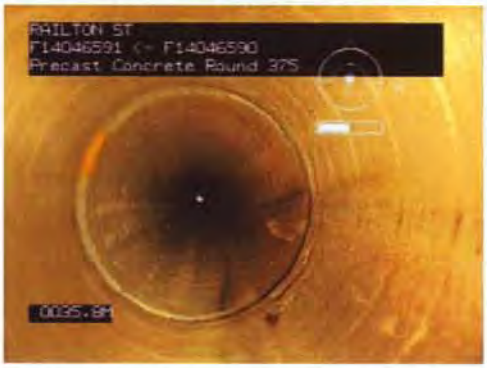
Example



1... The conduit appears to be displaced and therefore this defect is to be recorded.



2... As the camera rotates and focuses on the joint it is also recorded as an Open Joint.





Additional Data required

None		

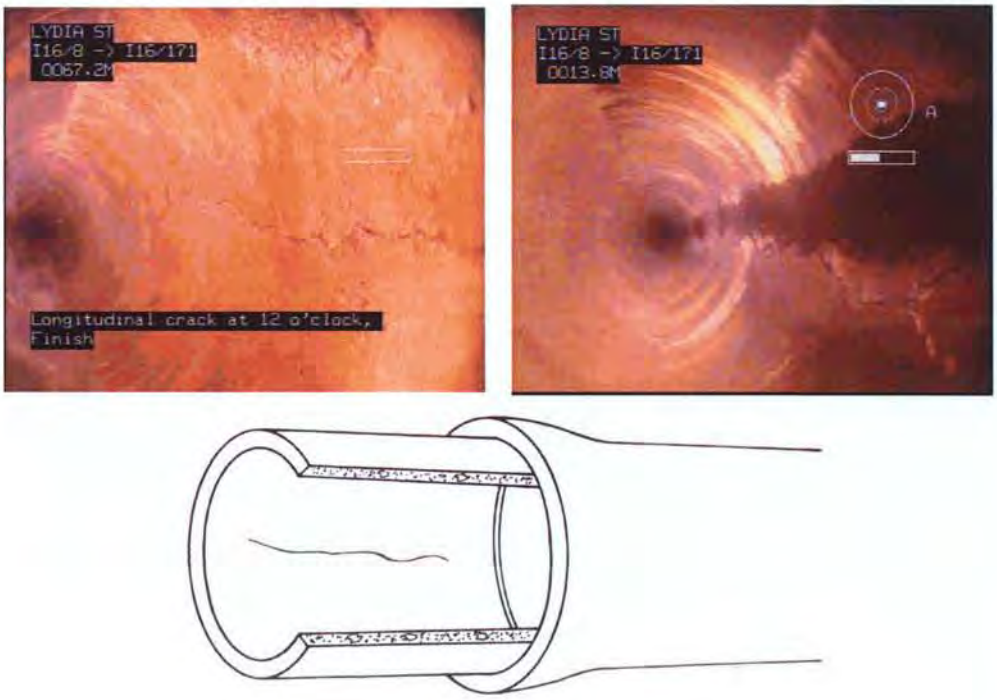
CL – Longitudinal Crack

A crack in the conduit wall parallel to the direction of flow or axis of the conduit that is longer than 2m. A Crack is a defect that is not open and predominantly the width of the crack is less than 2mm. Refer to 5.1 General Information regarding Cracks and Fractures.

Additional Notes

- Pay particular attention to the opposite clock position for another crack, as the defect may be due to poor construction techniques and therefore the pipe may have been slightly crushed.
- For Cracks 2m and less refer to BCC01 – Longitudinal Crack (above).
- If the crack increases in width and becomes a fracture then the fracture and its length must be recorded also.

Example



Additional Data required

Position	Mandatory	__ o'clock
Start/End	Mandatory	Record start and end chainage

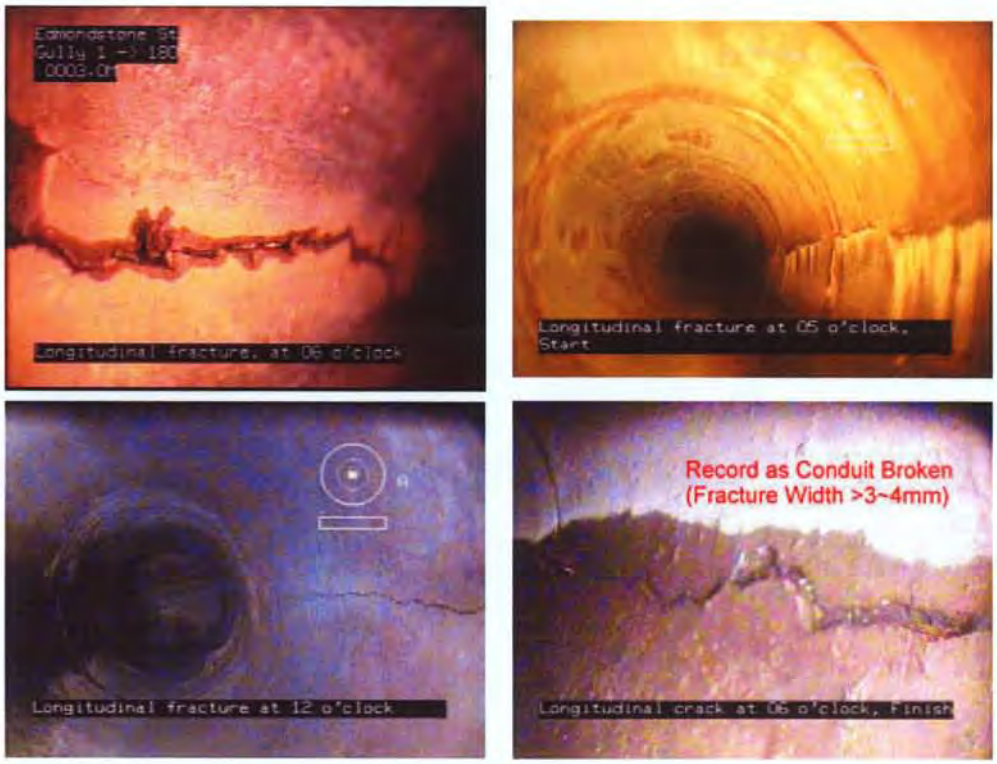
FL – Longitudinal Fracture

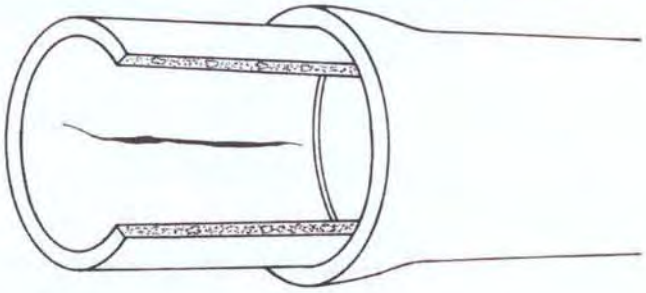
A Fracture in the conduit wall parallel to the direction of flow or axis of the conduit that is longer than 2m. A Fracture is a Crack that appears to be open and predominantly the width of the crack is greater than 2mm but less than 3~4mm. If the fracture is greater than 3~4mm the condition may have to be recorded as Conduit Broken. Refer to 5.1 General Information regarding Cracks and Fractures.

Additional Notes

- Pay particular attention to the opposite clock position for another longitudinal fracture as the defect may be due to poor construction techniques and therefore the pipe may have been crushed.
- If the fracture reduces in width and becomes a crack then the crack and its length must be recorded also.
- If the Fracture is less than 2 metres code as BCC07 – Longitudinal Fracture.

Example





Additional Data required

Position	Mandatory	from __ o'clock to __ o'clock
Start/End	Mandatory	Record start and end chainage

CM – Multiple Cracks

Use this code if two (2) or more cracks are observed in close proximity to each other (within 1 metre) and whose inter-relationship is not easily defined as longitudinal or circumferential. Otherwise record every crack as observed. A Crack is a defect that is not open and predominantly the width of the crack is less than 2mm. Refer to 5.1 General Information regarding Cracks and Fractures.

Additional Notes

- Common in Vitreous Clay pipes
- Cracks may be circumferential and/or longitudinal.
- If the conduit is slightly deformed, then record as FM – Multiple Fractures.

Example







Due to the conduit being slightly deformed and pieces missing, record as Multiple Fractures.



This does **NOT** appear to be multiple cracks but longitudinal cracks at 3, 9, & 12 o'clock with substantial length.

Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

CMJ – Multiple Cracks at Joint

This code is for a number of cracks observed within a one (1) metre length and adjacent to a joint. These Cracks are defects that are not open and predominantly the width of the crack is less than 2mm. Refer to 5.1 General Information regarding Cracks and Fractures.

Additional Notes

- Cracks may be circumferential and/or longitudinal.
- If more than 1m in length record as CM – Multiple Cracks.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock

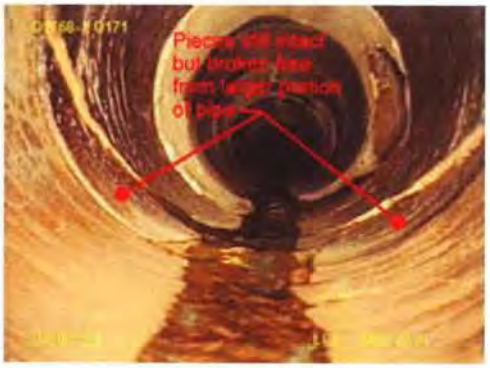
FM – Multiple Fractures

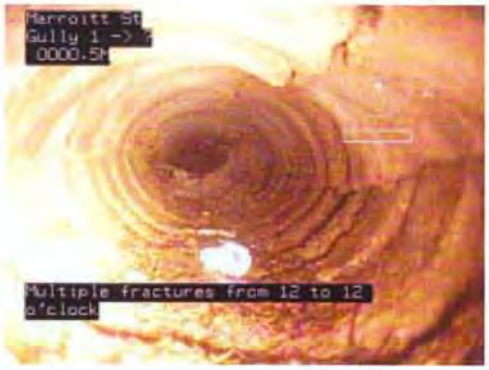
Use this code if two (2) or more Fractures are observed within 1 metre in length; otherwise record every fracture at each metre. Refer to 5.1 General Information regarding Cracks and Fractures.

Additional Notes

- Fractures may be circumferential or longitudinal.
- If the conduit is deformed then record as DH – Horizontally Deformed Conduit or DV – Vertically Deformed Conduit as required.

Example





This should have been recorded as **DV** – Vertically Deformed Conduit

Additional Data required

Position	Mandatory	From __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

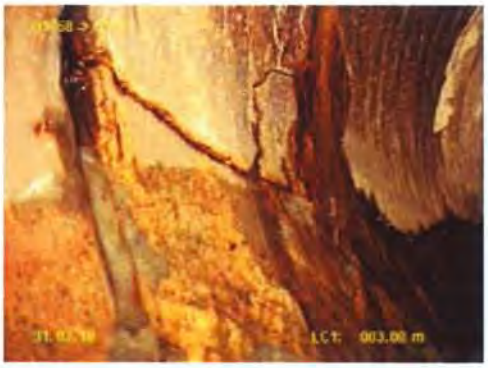
FMJ – Multiple Fractures at Joint

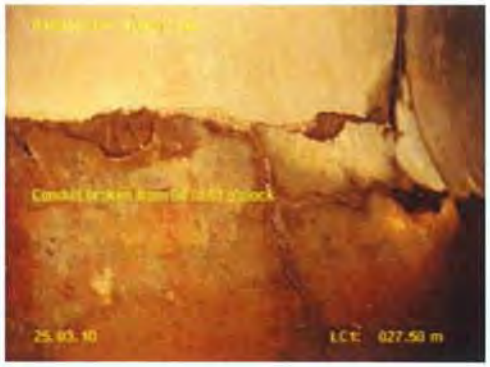
This code is for a number of fractures observed within a one (1) metre length and adjacent to a joint. These Fractures are defects that are open and predominantly the width of the crack is more than 2mm. Refer to 5.1 General Information regarding Cracks and Fractures. Record as FM – Multiple Fractures if more than 1m in length.

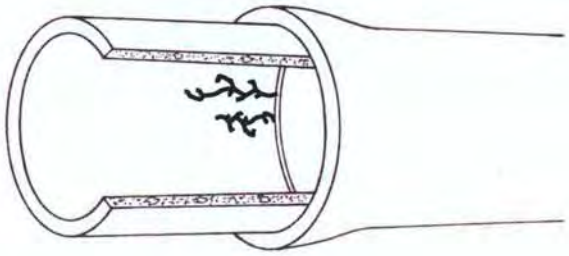
Additional Notes

- This is not a very common defect and may be better recorded as B – Conduit Broken
- Cracks may be circumferential and/or longitudinal.

Example







Additional Data required

Position	Mandatory	From __ o'clock to __ o'clock
Length	Mandatory	in millimetres (mm)

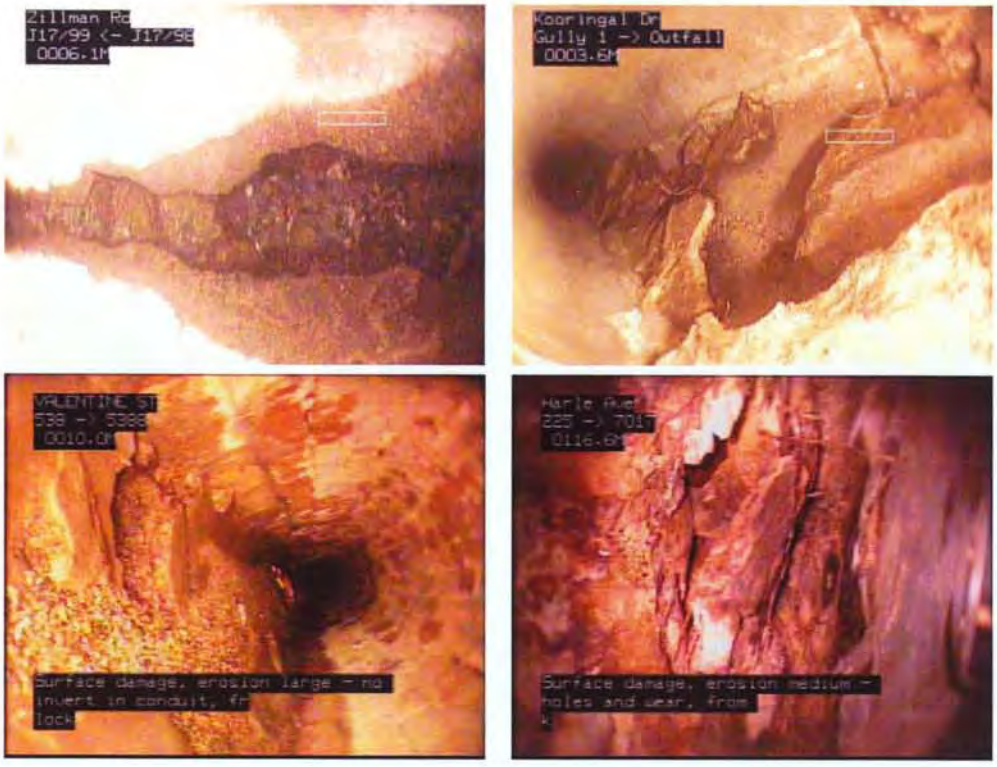
SEL – Large Erosion Surface Damage

Surface erosion or wearing exceeding 50% of the wall thickness and showing major damage.

Additional Notes

- Concrete cover to the reinforcement has been removed showing the steel reinforcement is corroded or missing.
- Large Holes or surface damage has extended right through the wall of the conduit exposing soil.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

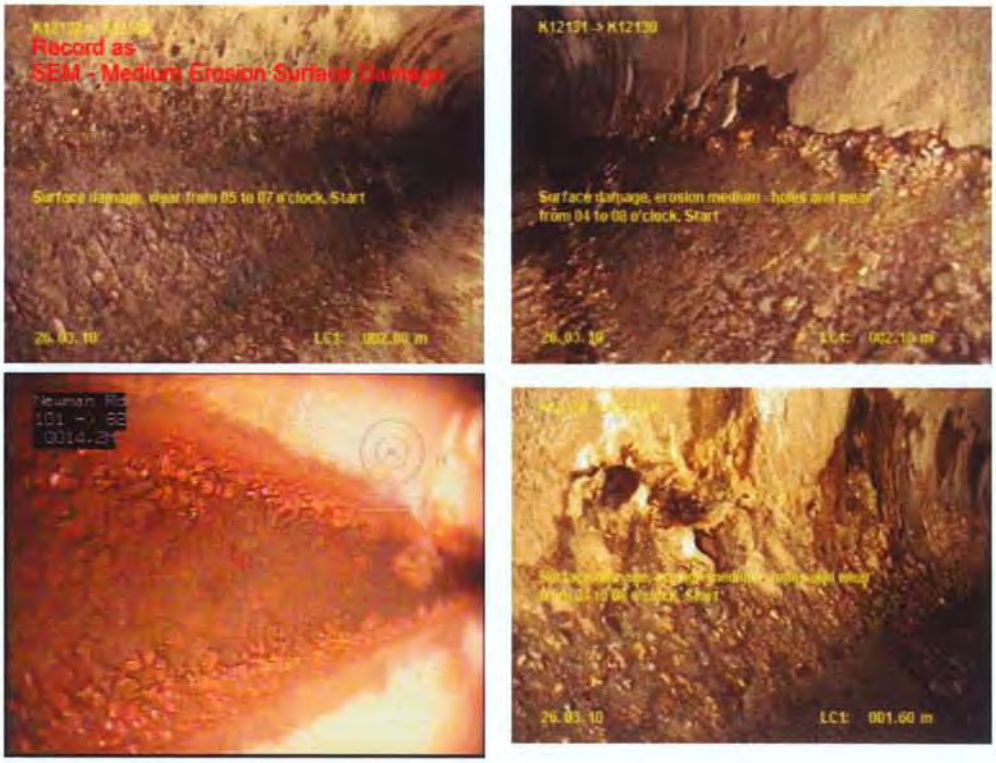
SEM – Medium Erosion Surface Damage

Surface erosion or wearing >25mm but not exceeding 50 percent of the drain wall thickness. Cast-in-situ conduits can have varying wall thickness, therefore for holes greater than 50mm record as SEL – Large Erosion Surface Damage.

Additional Notes

- Concrete cover to the reinforcement has been removed showing the steel reinforcement is exposed
- The damage has extended sufficiently for individual pieces of aggregate to have been removed.
- Holes are present.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

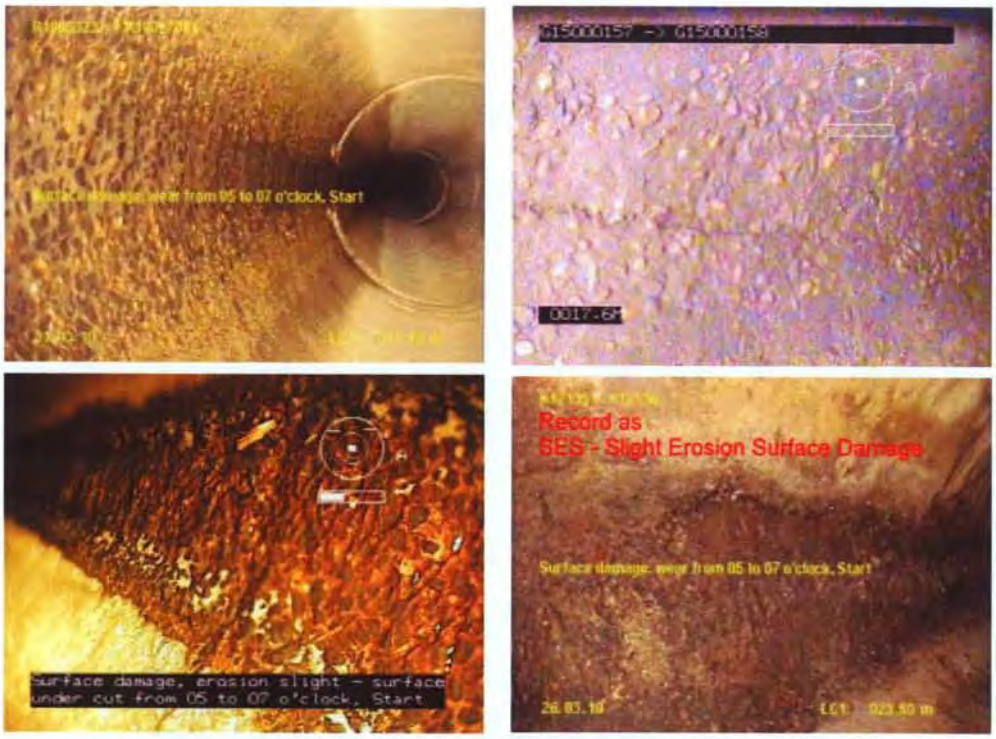
SES – Slight Erosion Surface Damage

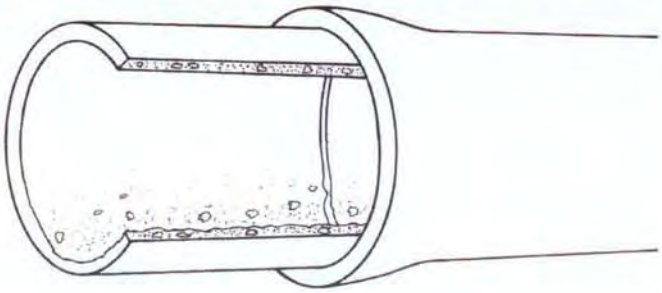
Surface erosion or wearing up to 25mm.

Additional Notes

- The surface of the conduit shows coarse aggregate beginning to be exposed and projecting from the surface.
- Holes have not quite formed.

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

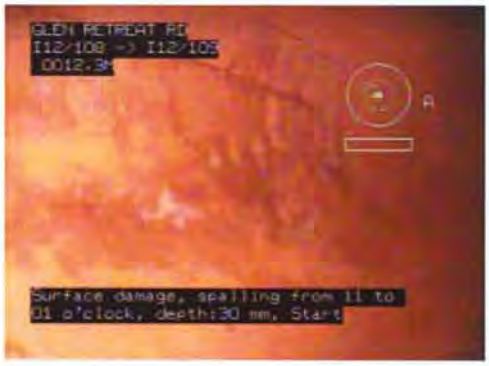
SS – Spalling Surface Damage

Use this code for spalling, chipping or flaking of the interior pipe surface where the length is greater than 1m and appears to be the action of the steel reinforcement corroding. Similar to BCC09, where the steel reinforcement is partially or fully exposed in reinforced concrete pipes or in unreinforced concrete pipes the surface spalling depth exceeds 50 millimetres. This defect is not caused by erosion; refer Surface Damage codes SES, SEM & SEL.

Additional Notes

- For lengths less than 1m, refer BCC08 - Minor Spalling Surface Damage or BCC09 – Major Spalling Surface Damage.
- This defect usually appears on the upper surface of the conduit between the 8 o'clock and 4 o'clock position

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Start/End	Mandatory	Record start and end chainage
Depth	Mandatory	in millimetres (mm)

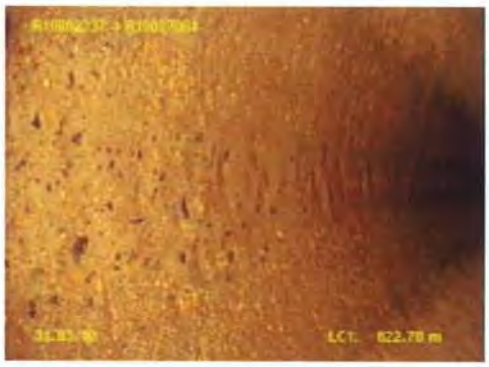
SW – Wear Surface Damage

The surface of the pipe has been damaged by corrosion, wear or other agents. This is a minor defect showing less damage than SES – Slight Erosion Surface Damage

Additional Notes

- Minor roughening of conduit surface in the invert.
- This defect is considered the first stage of surface damage.

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

X – Conduit Collapsed

The conduit has collapsed in that the conduit has changed from its original shape by more then 25%.

Additional Note

- This defect is to be reported immediately for possible urgent maintenance action.

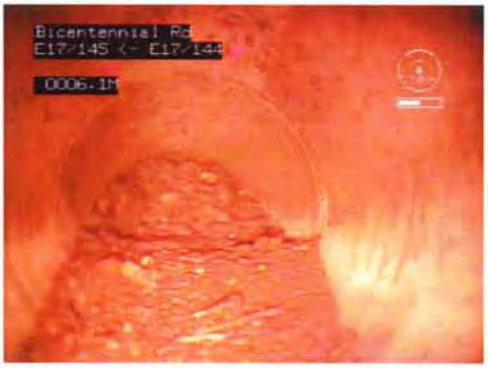
Example



If the conduit is deformed more than 25% then record as X – Conduit Collapsed







Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Percentage	Mandatory	% of cross-section area loss
Start/End	Mandatory	Record start and end chainage

PLB – Bulge in Lining

Any deformities in the lining that would restrict the flow of stormwater.

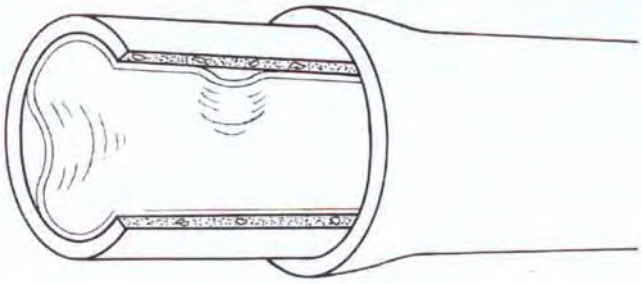
Additional Notes

- This defect is to be reported immediately for possible urgent maintenance action.

Example







Additional Data required

Position.	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

PLM – Lining Missing

The lining has become detached or missing at this particular location. It may be noticeable that the conduit is in need of repair and a liner was installed and is now missing.

Additional Notes

- This defect is to be reported immediately for possible urgent maintenance action.

Example

No photos available at this time

Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

PLS – Lining Separated or Hanging

The lining has become detached or is hanging from the wall of the pipe.

Additional Notes

- The lining may be wrinkled.
- Gaps or breaks at joints in the lining.
- Re-establishment of a connection pipe may have been done incorrectly.
- This defect is to be reported immediately for possible urgent maintenance action.

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

5.3 Structural Condition Codes –Brick Conduits

This section defines the codes used to record the physical condition and structural integrity of conduits constructed in Brick, Masonry or Stone.

Common Structural defects for Brick Drains include:

Defect Code	Description
CCB	Circumferential crack in bricks, (position)
CLB	Longitudinal crack in bricks, (position)
CMB	Multiple cracks in bricks, (position)
FCB	Circumferential fracture in bricks, (position)
FLB	Longitudinal fracture in bricks, (position)
FMB	Multiple fractures in bricks, (position)
DB	Bricks displaced, (position), (length)
MB	Missing bricks, (position), (length)
DI	Dropped invert, (gap) Mainly common in Brick Drains
DHB	Brick conduit deformed, (%) change of horz. dimension
DVB	Brick conduit deformed, (%) change of vert. dimension
SSB	Surface damage, spalling in bricks, (position), (depth)
SWB	Surface damage in bricks, (position)
MS	Mortar missing surface (under 15 mm), (position)
MM	Mortar missing medium (15-50 mm), (position)
MT	Mortar missing total (over 50 mm), (position)
XB	Brick conduit collapsed, (%) cross-sectional area loss

CCB – Circumferential Crack in Bricks

A Circumferential Crack is a crack extending around the circumference of the conduit.

Additional Notes

- Unless the crack is quite wide and the surface around the crack is showing signs of stress, only report cracks that occur when they are clearly visible extending through the brick or masonry units.
- A Crack within a Brick Drain can be wider than cracks in Precast Concrete Conduits due to the construction method and larger wall thickness therefore; a crack in brick drains can be up to 5mm wide before it needs to be reported.
- For Cracks wider than 10mm refer to FCB – Circumferential Fracture in Bricks.

Example



Additional Data required

Position	Mandatory	From __ o'clock to __ o'clock

CLB – Longitudinal Crack in Bricks

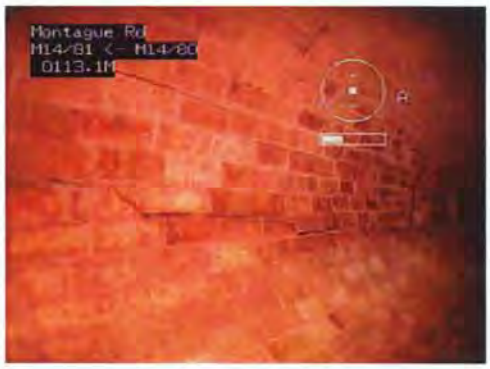
A Longitudinal Crack is a crack in the bricks along the drain wall parallel to the direction of flow or axis of the conduit.

Additional Notes

- Unless the crack is quite wide and the surface around the crack is showing signs of stress, only report cracks that occur when they are clearly visible extending through the brick or masonry units.
- A Crack within a Brick Drain can be wider than cracks in Concrete Conduits due to the construction method and larger wall thickness therefore; a crack in brick drains can be up to 5mm wide before it needs to be reported.
- For Cracks wider than 10mm refer to FLB – Longitudinal Fracture in Bricks.
- Pay particular attention to the opposite clock position for another longitudinal crack.

Example





Additional Data required

Position	Mandatory	__ o'clock
Length	Optional	in millimetres (mm) if <= 2m
Start/End	Mandatory	Record start and end chainage (if > 2m in Length)

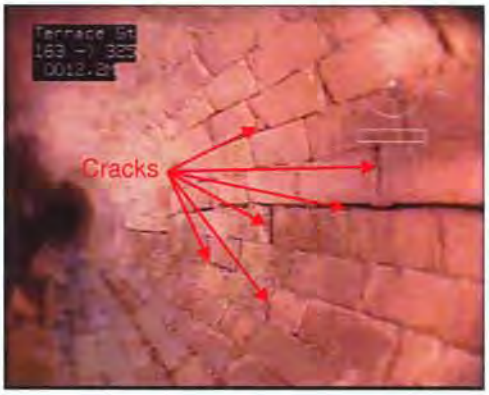
CMB – Multiple Cracks in Bricks

A significant number of cracks which appear to be related to each other and the cross-section of the conduit has retained its original shape.

Additional Notes

- Unless the cracks are quite wide and the surface around the crack is showing signs of stress, only report cracks that occur when they are clearly visible extending through the brick or masonry units.
- A Crack within a Brick Drain can be wider than cracks in Concrete Conduits due to the construction method and larger wall thickness therefore; a crack in brick drains can be up to 5mm wide before it needs to be reported.
- For Cracks wider than 10mm refer to FMB – Multiple Fractures in Bricks.
- Cracks may be circumferential or longitudinal.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 2m
Start/End	Mandatory	Record start and end chainage (if > 2m in Length)

FCB – Circumferential Fracture in Bricks

A Fracture within a Brick Drain can be wider than fractures in Concrete Conduits due to the construction method and wall thickness, therefore a fracture in a brick drain can be up to 15mm wide.

Additional Notes

- Unless the crack is quite wide and showing signs of stress, only report cracks that occur when they are clearly visible extending through the brick or masonry units.
- A fracture larger than 15mm would be a significant defect; therefore check for other conditions of the conduit, e.g. conduit has deformed or bricks are missing.

Example



Additional Data required

Position	Mandatory from __ o'clock to __ o'clock

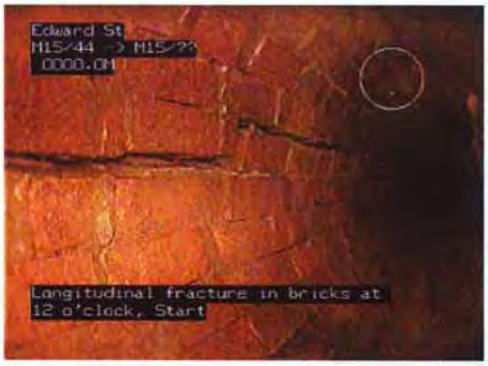
FLB – Longitudinal Fracture in Bricks

A Fracture within a Brick Drain can be wider than fractures in Concrete Conduits due to the construction method and wall thickness, therefore a fracture in a brick drain can be up to 15mm wide.

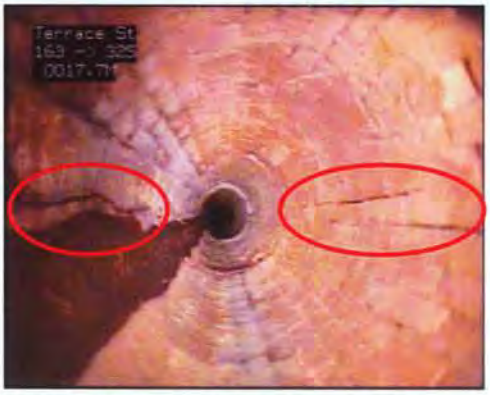
Additional Notes

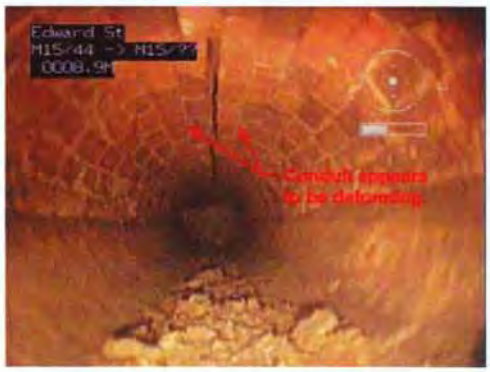
- Unless the crack is quite wide and showing signs of stress, only report cracks that occur when they are clearly visible extending through the brick or masonry units.
- A fracture larger than 15mm would be a significant defect; therefore check for other conditions of the conduit, e.g. conduit has deformed or bricks missing.
- Pay particular attention to the opposite clock position for another longitudinal fracture.

Examples









Note: Fractures at 7 & 1 o'clock (opposite)

Additional Data required

Position	Mandatory	from __ o'clock to __ o'clock
Length	Optional	millimetres (mm) if <= 2m
Start/End	Mandatory	Record start and end chainage (if > 2m in Length)

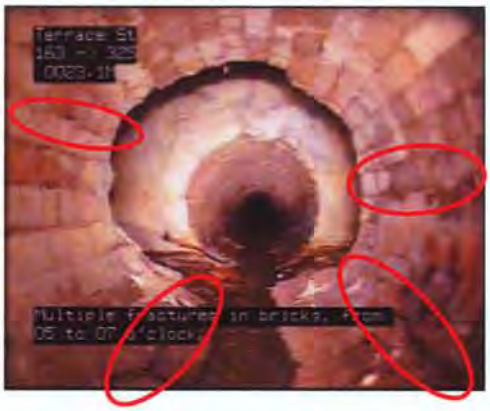
FMB – Multiple Fractures in Bricks

A significant number of cracks and fractures whose inter-relationship is not easily defined, have resulted in the development of a number of smaller segments loosely held in place. The cross-section retains its original shape.

Additional Notes

- Fractures may be circumferential and / or longitudinal.
- A fracture larger than 15mm would be a significant defect; therefore check for other conditions of the conduit, e.g. conduit has deformed or bricks missing.

Example



Additional Data required

Position	Mandatory	From __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 2m
Start/End	Mandatory	Record start and end chainage (if > 2m in Length)

DB – Bricks Displaced

Single bricks or areas of bricks have moved from their original position.

Additional Notes

- If bricks appear to be missing, refer MB – Missing Bricks.

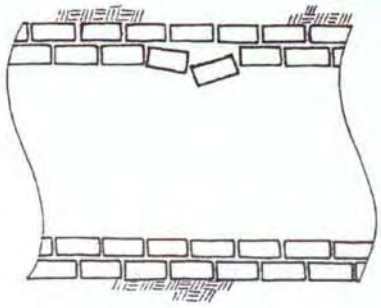
Example













Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

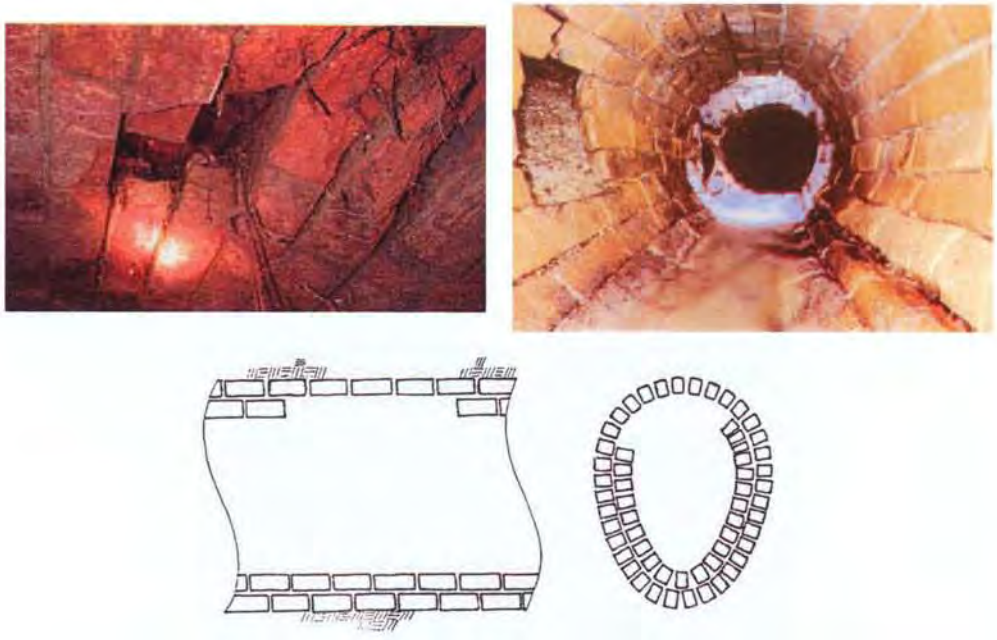
MB – Missing Bricks

Record this condition when bricks are missing from the inner skin of the brick drain. Normally brick drains have more than one skin (usually two or three) and once bricks are missing the rest of the inner skin begins to lose its structural integrity. Also check other conditions, e.g. Deformed Conduit and Mortar Missing.

Additional Notes

- In the photos below, bricks are missing from the innermost layer of the conduit; check the layer behind for other signs of fatigue.
- This condition code does not usually include problems with the invert, i.e. surface wear or erosion.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

DI – Dropped Invert

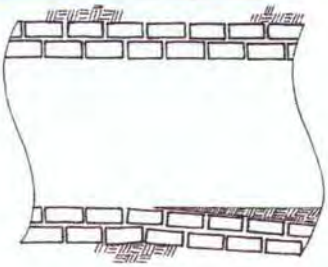
A section of the invert has dropped in relation to the walls leaving a gap of more than 20mm. Record a single clock reference of each of the separated courses that define the dropped area. The illustration below will have two (2) records, i.e. a record for each side.

Additional Notes

- Do not report missing mortar along the separation line. Missing mortar elsewhere in the conduit should be reported as required.
- If the invert appears to be dropped on one side only of the conduit, then it should be recorded as a fracture instead.

Examples







Additional Data required

Position	Mandatory	__ o'clock
Depth of Drop	Mandatory	in millimetres (mm)
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

DHB – Horizontally Deformed Brick Conduit

The original cross section or width of the brick conduit has been reduced or altered.

Due to the existing shape of Egg shape brick conduits, careful observation is required to determine that a conduit is suffering from this condition. If there are large cracks or fractures at the 3 and 9 o'clock positions then the conduit may be deforming horizontally. This is an uncommon defect for all conduits regardless of the material used. Because Brick conduits rely on the ground around the conduit giving it support, if too much soil is removed above the conduit the ground loadings on the side of the conduit may cause this condition.

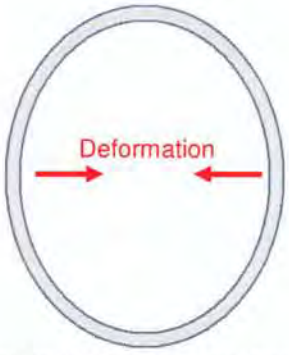
Additional Notes

- This condition code can only be used if the original shape and dimension is known and the deformation can be measured confidently or accurately.
- If greater than 25% and extending >0.5m, record as a collapse.

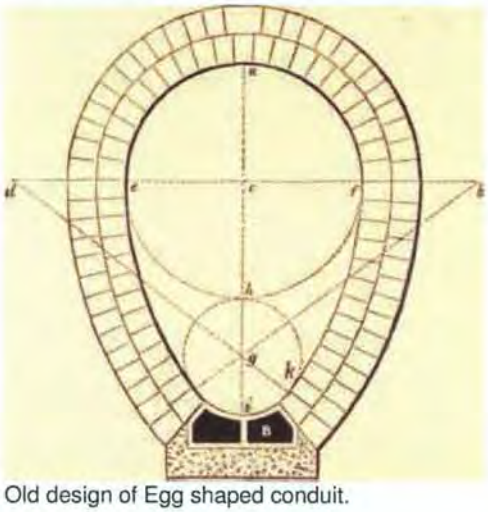
Example



The sides of conduit are collapsing inwards.



The Conduit is deforming inwardly from the sides.


Old design of Egg shaped conduit.

Additional Data required

Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of horizontal width (in %5 increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

DVB – Vertically Deformed Brick Conduit

The original cross section of the brick conduit has been reduced vertically. It is possible to have deformation without the visible loss of structural integrity.

Additional Notes

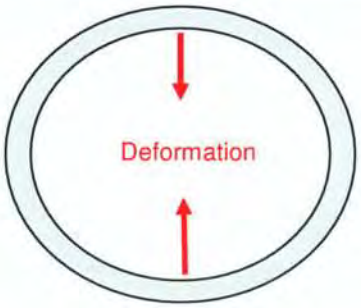
- It is most likely that longitudinal and circumferential fractures have developed at the obvert (ceiling) and the invert.
- If the oval shape is quite distinctive and longitudinal cracks or fractures have not developed in the obvert or the invert, the brick conduit may have been built to the shape observed.
- If greater than 25%, record as a collapse.

Example









Additional Data required

Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of horizontal dimension (in %5 increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

SSB – Surface Damage, Spalling in Bricks

Chipping, scaling or flaking of brick surfaces due to environmental conditions within the drain.

Additional Notes

- As this is not a common defect, the photo below typifies the condition.

Example



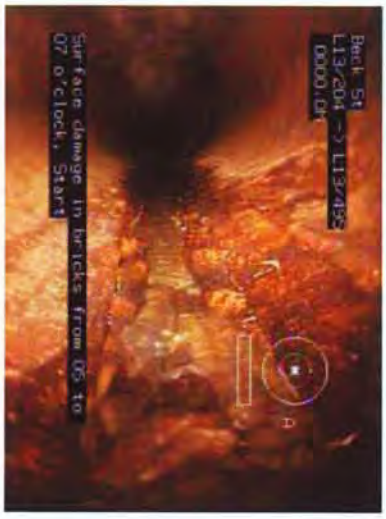
Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Depth	Mandatory	in millimetres (mm)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

SWB – Surface Damage in Bricks

The surface of the bricks have been worn down and roughened by water and debris passing through the conduit.

Example





Damage caused by stormwater entering from a connection pipe on the opposite side of the conduit. Note: that dark brick is the second layer exposed because the top layer has been eroded away.

Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

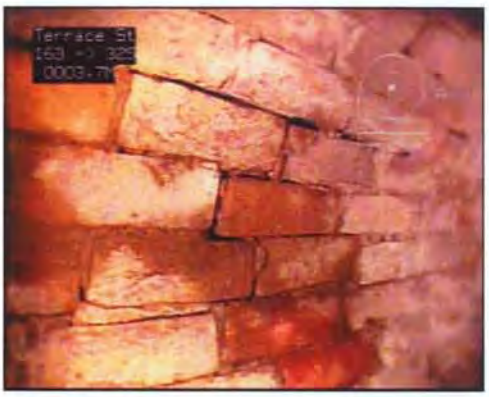
MS – Mortar Missing, Surface

Mortar missing between the brickwork and the bricks are still in place. Depth of mortar missing is less than 15 millimetres from the exposed face.

Additional Notes

- This is a defect condition, if the conduit is predominately grouted to the surface of the brick and it is noticeably missing mortar in places.

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

MM – Mortar Missing, Medium

Mortar missing between the brickwork and the bricks are still in place. Depth of mortar missing is between 15-50mm from the exposed face.

Additional Notes

- This is a defect condition, if the conduit is predominately grouted to the surface of the brick and it is noticeably missing mortar in places.

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

MT – Mortar Missing, Total

Mortar missing between the brickwork, however the bricks are still in place.
Depth of mortar missing is greater than 50 millimetres from the exposed face.

Additional Notes

- This is a defect condition, if the conduit is predominately grouted to the surface of the brick and it is noticeably missing mortar in places.

Example



This is a close-up example of a larger area that has been affected. If there are many isolated small areas with this condition, record using the continuous observation length code.

Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

XB – Brick Conduit Collapsed

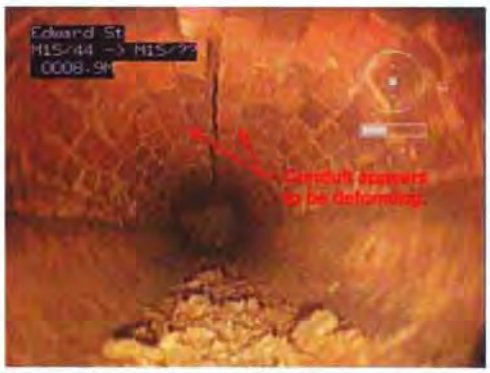
The brick conduit has collapsed in that the internal surface has dropped/deformed/deflected > 25% in the plane of the drop/deformation across the conduit. For deformed conduit less than 25% refer DVB – Vertically Deformed Brick Conduit.

Additional Notes

- Where it is possible to measure or estimate the length of collapse then record the total length of collapsed conduit in m (to nearest 0.1m).
- If the conduit is impassable then record the Survey Abandoned due to collapse.

Example





Obviously in the above photo, the conduit is only showing small signs of deforming, but if the deformation were greater than 25% then it would be recorded as Brick Conduit Collapsed.

Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Percentage	Yes	% of cross-section area loss
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

5.4 Serviceability Condition Codes

This sub-section defines the codes used to record serviceability defects of pipes i.e. various types of pipeline changes, obstacles and objects existing in the pipe that will impede the flow of water.

(See 5.1 General Information regarding Structural Defects for codes used to classify structural defects).

5.4.1 Common Serviceability Defects include:

DE	Debris (not silt/grease), (%) cross-sectional area loss
DEJ	Debris (not silt/grease) at joint, (%) cross-sectional area loss
DES	Debris (silt), (%) cross-sectional area loss
EL	Light encrustation (<5%) (position)
EM	Medium encrustation (5-20%) (position)
ELJ	Light encrustation (<5%) at joint, (position)
EMJ	Medium encrustation (5-20%) at joint, (position)
ID	Infiltration dripper, (position)
IDJ	Infiltration dripper at joint, (position)
IR	Infiltration runner, (position)
IRJ	Infiltration runner at joint, (position)
IS	Infiltration Seeper (Seepage), (position)
ISJ	Infiltration Seeper (Seepage) at joint, (position)
OB	Obstruction, (%) height/diameter loss
OBF	Rock fall
OBJ	Obstruction at joint, (%) height/diameter loss
RF	Fine roots
RFJ	Fine roots at joint
RM	Mass roots, (%) cross-sectional area loss, (position)
RMJ	Mass roots at joint, (%) cross-sectional area loss, (position)
RT	Tap roots
RTJ	Tap roots at joint
WB	Weephole blocked, (position)
WO	Weephole obstructed, (position)

DE – Debris (Not Silt or Grease)

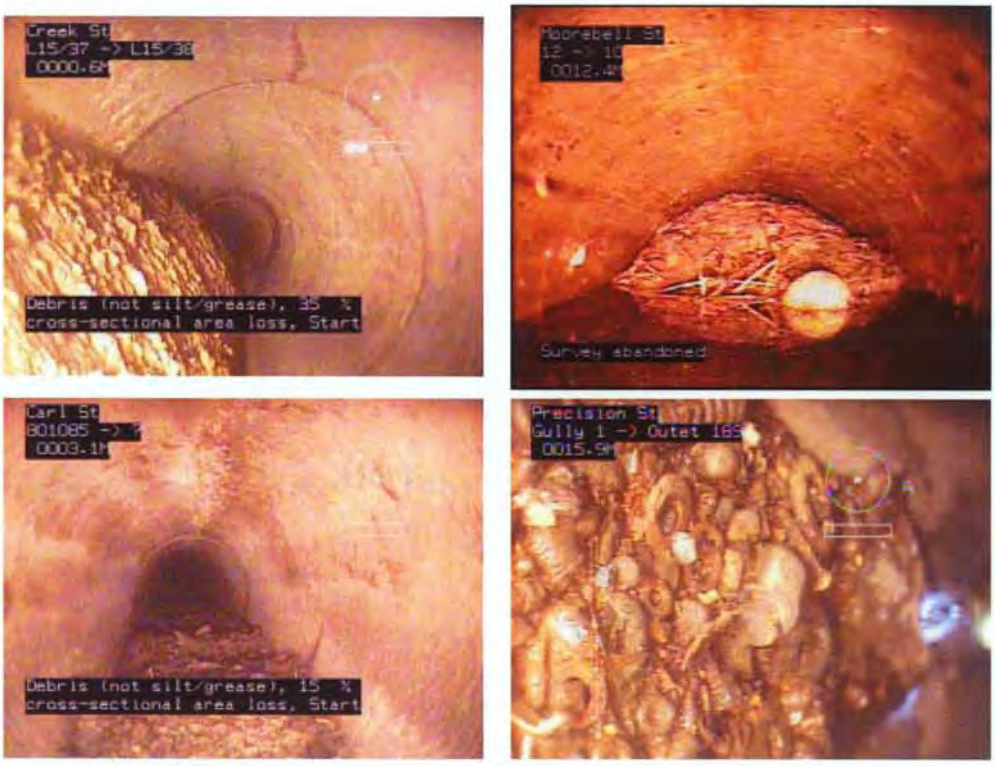
Accumulation of organic / non-organic material (e.g. rubbish, rocks, concrete, heavy soil) that has entered the drain and is restricting the flow capacity by 5% to 100%.

This material is causing a blockage, restricting the flow and could cause flooding to upstream properties. If it is evident that the debris is not likely to be washed out during the next storm event and the blockage is greater than 10% then the debris will require jet-rodding or other equipment to clean the conduit. This defect is to be reported immediately for urgent action.

Additional Notes

- The photos are examples of blockage that will not be easily washed by a storm event and will require further action (jet-rodding) to unblock the conduit and therefore is to be reported immediately.

Example



Additional Data required

Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of cross sectional area (in %5 increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

DEJ – Debris at Joint (Not Silt or Grease)

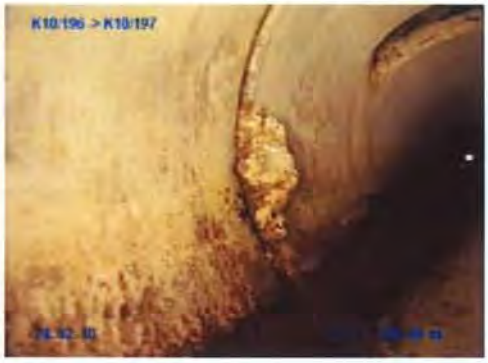
Accumulation of organic/non-organic material (e.g. rubbish, rocks, concrete, soil) that has entered the drain at the joint and is restricting the flow capacity by 5% to 100%.

This condition can cause other debris to accumulate and increase the blockage of the conduit.

Additional Notes

- Blockages greater than 10% are to be reported immediately for possible maintenance action.
- Record the length of any debris build-up upstream of the defect.

Example





Additional Data required

Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of cross sectional area (in %5 increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

DES – Debris (Silt)

Accumulation of dirt, silt or soil that has entered the drain and is restricting the flow capacity from 5% to 100%.

Additional Notes

- This material may be causing a blockage and restricting the flow but if it is likely to be washed out during the next storm event and the blockage is less than 30% then no further action is required. A blockage greater than 30% is to be reported immediately for urgent action.
- If there is evidence that the debris has not been washed by the last storm event (see below, photo: bottom/right) then this defect should be reported for maintenance action.
- Use this code, even if the accumulation of material appears to be entering from a joint, and also record the condition of the joint.

Example

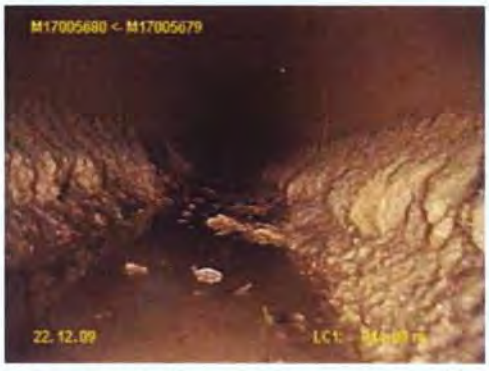




This condition is to be reported immediately for urgent action.



This condition is to be reported immediately for urgent action.



Debris struck to the wall of the conduit should be recorded as DE – Debris (Not Silt or Grease)

Additional Data required

Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of cross sectional area (in %5 increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

EL – Light Encrustation (<5%)

There are deposits left by the partial evaporation of infiltrating groundwater containing dissolved salts. If the encrustation is clearly entering from the joint, then record as ELJ – Light Encrustation (<5%) at Joint.

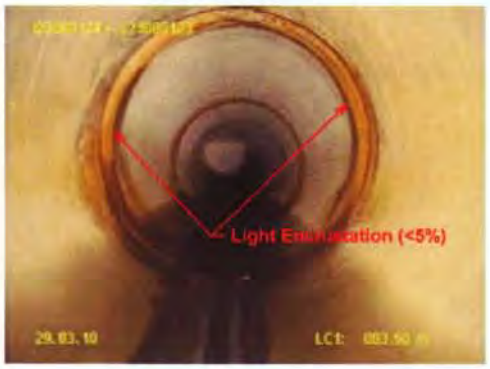
Additional Notes

- As this condition is not a major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.
- This code is for a maximum area loss up to 5%.

Example









The Encrustation may be due a displaced joint. And, if so, should be recorded as ELJ.

Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock

EM – Medium Encrustation (5-20%)

There are deposits left by the partial evaporation of infiltrating groundwater containing dissolved salts. If the encrustation is clearly entering from the joint, then record as EMJ – Medium Encrustation (5-20%) at Joint.

Additional Notes

- As this condition is not a major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.
- Blockages greater than 10% are to be reported immediately for possible maintenance action.
- Record the length of any debris build-up upstream of the defect.

Example



Medium Encrustation (>10%) is to be reported immediately for urgent action.



Additional Data required

Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of cross sectional area (in %5 increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

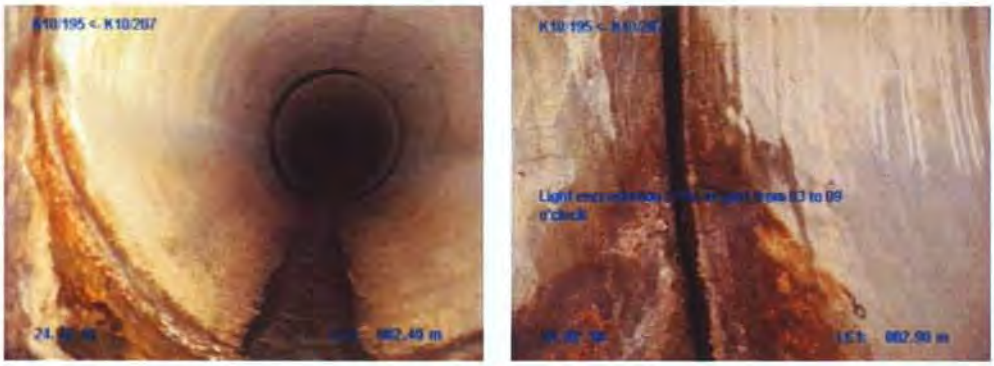
ELJ – Light Encrustation (<5%) at Joint

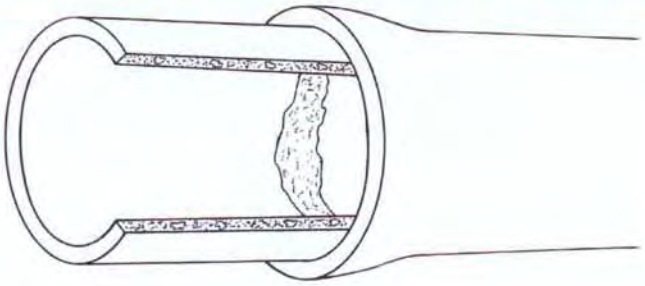
Encrustation is deposits left by the partial evaporation of infiltrating groundwater containing dissolved salts. If the encrustation is NOT clearly entering from the joint, then record as EL – Light Encrustation (<5%).

Additional Notes

- As this condition is not a major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock

EMJ – Medium Encrustation (5-20%) at Joint

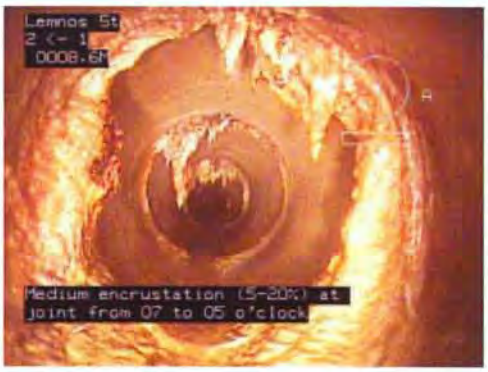
Encrustation is deposits left by the partial evaporation of infiltrating groundwater containing dissolved salts. If the encrustation is NOT clearly entering from the joint, then record as EM – Medium Encrustation (5-20%).

Additional Notes

- As this condition is not a major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.
- Blockages greater than 10% are to be reported immediately for possible maintenance action.
- Record the length of any debris build-up upstream of the defect.

Example







Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

IS – Infiltration Seeper (Seepage)

Infiltration seepage is a slow ingress of groundwater and/or other fine material is seeping into the conduit through a defect.

Additional Notes

- As this condition is not a major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.
- The sides of the conduit may appear to be damp or wet, after long spell of dry weather.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

ISJ – Infiltration Seeper (Seepage) at Joint

Infiltration seepage is a slow ingress of groundwater and/or other fine material is seeping into the conduit through a joint.

Additional Notes

- As this condition is not a major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.
- The joint of the conduit may appear to be damp or wet, after long spell of dry weather.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock

ID – Infiltration Dripper

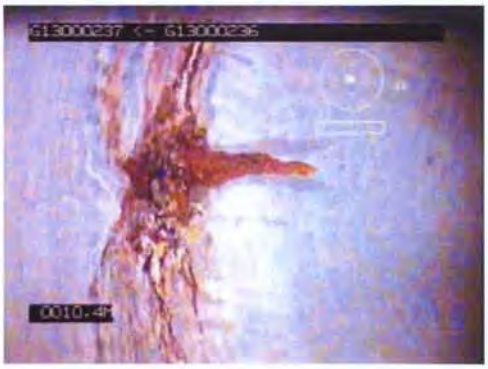
Ingress of groundwater and/or other fine material dripping (not a continuous flow) through a defect.

Additional Notes

- As this condition is not a major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

IDJ – Infiltration Dripper at Joint

Ingress of groundwater and/or other fine material dripping (not a continuous flow) through a joint.

Additional Notes

- As this condition is not a major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.

Example

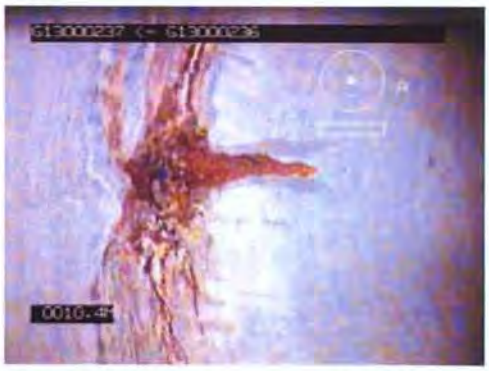


Photo for illustration purposes as condition is not located at a Joint.

Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock

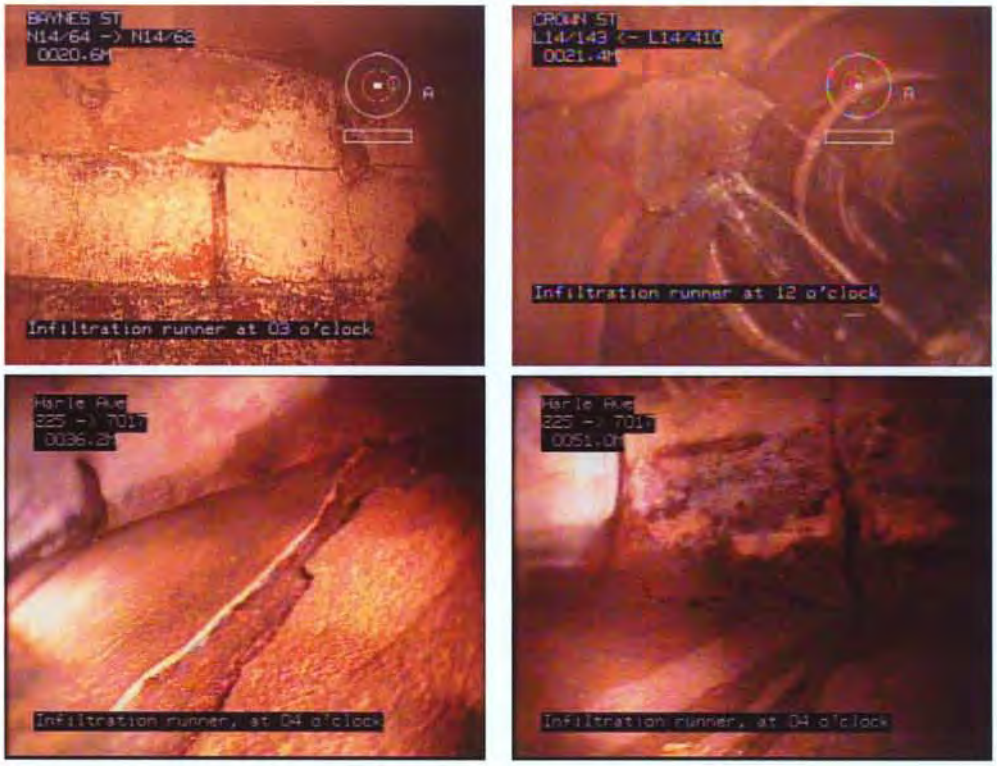
IR – Infiltration Runner

Continuous flow of groundwater and/or other fine material, but not copious amounts (refer IG) running into the conduit through a defect.

Additional Notes

- As this condition is not a major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.

Examples



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

IRJ – Infiltration Runner at Joint

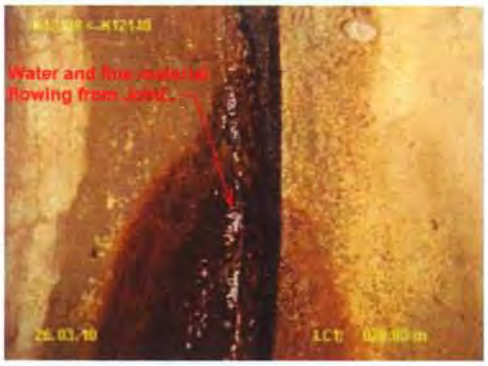
Continuous flow of groundwater and/or other fine material running into the conduit through a joint.

Additional Notes

- As this condition is not a major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock

OB – Obstruction

An object or objects in the conduit obstructing the cross sectional area and usually causes the inspection to be halted. These objects can be removed with relative ease i.e. not solidified concrete etc. Do not use this code for external cables or pipes (services) that are built through the pipe, use BCC10 – Service Pipe Crossing.

Additional Notes

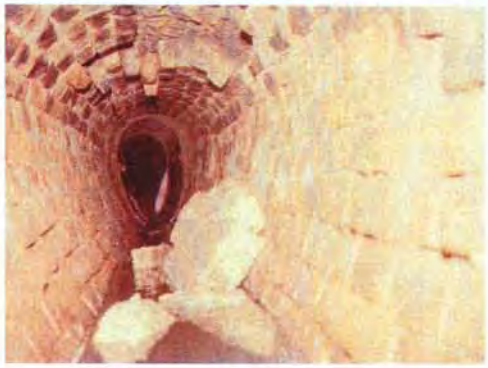
- If it is evident that the debris is not likely to be washed out during the next storm event and the blockage is greater than 10% then the objects will require removal. This condition is to be reported immediately for urgent action.
- This code is usually followed by the SA – Survey Abandoned.

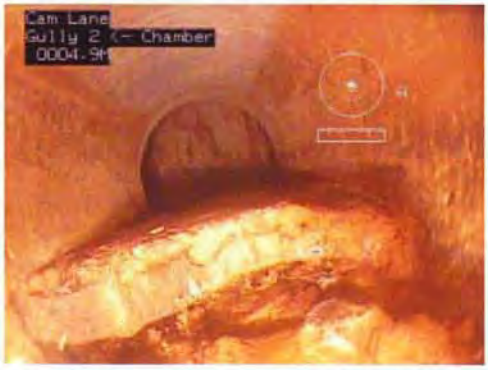
Example



NOTE: Wrong code used (Debris). This is an Obstruction (OB).







This is to be recorded as DE – Debris (Not Silt or Grease) not OB.

Additional Data required

Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of height/diameter dimension (in %5 increments)

OBJ – Obstruction at Joint

A foreign object or objects wedged in the joint that is obstructing the cross sectional area and usually causes the inspection to be halted. The joint may be displaced and/or open.

Additional Notes

- This condition code is mainly to highlight any problems that may arise with the object that is wedged in the joint that will increase the build-up of debris and therefore reduce the flow capacity of the conduit.
- If it is evident that the debris is not likely to be washed out during the next storm event and the blockage is greater than 10% then the object(s) will require removal. This condition is to be reported immediately for possible urgent maintenance action.
- If there is a defect associated with the joint then it is to be recorded e.g. Displaced or Open Joint.
- This condition is not to be confused with Encrustation, which is deposits left by the partial evaporation of infiltrating groundwater containing dissolved salts refer ELJ – Light Encrustation (<5%) at Joint or EMJ – Medium Encrustation (5-20%) at Joint etc.

Example

No example available

Additional Data required

Percentage	Mandatory	% reduction of vertical height (in %5 increments)

RF – Fine Roots

Fine roots or a relatively small number of flexible minor roots growing in the conduit through defects, connections or other entry points.

Additional Notes

- As this defect is not a major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. crack, fracture or hole.
- If the fine roots are clearly entering at the joint, record as RFJ – Fine Roots at Joint.

Examples





Additional Data required

Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of cross sectional area (in %5 increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

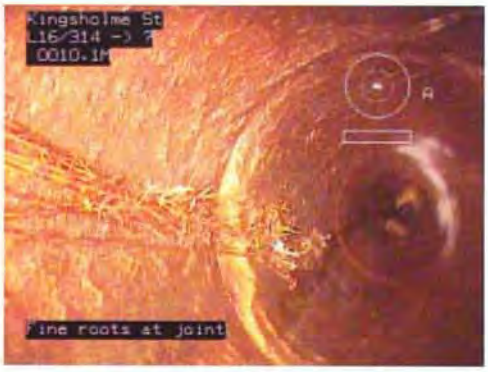
RFJ – Fine Roots at Joint

Fine roots or a relatively small number of flexible minor roots growing in the conduit through the joint.

Additional Notes

- As this defect is not a major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement or hole.
- If the fine roots are clearly entering the conduit from a defect, connections or other entry points and not from the joint, record as RF – Fine Roots.

Examples





Additional Data required

Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of cross sectional area (in %5 increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

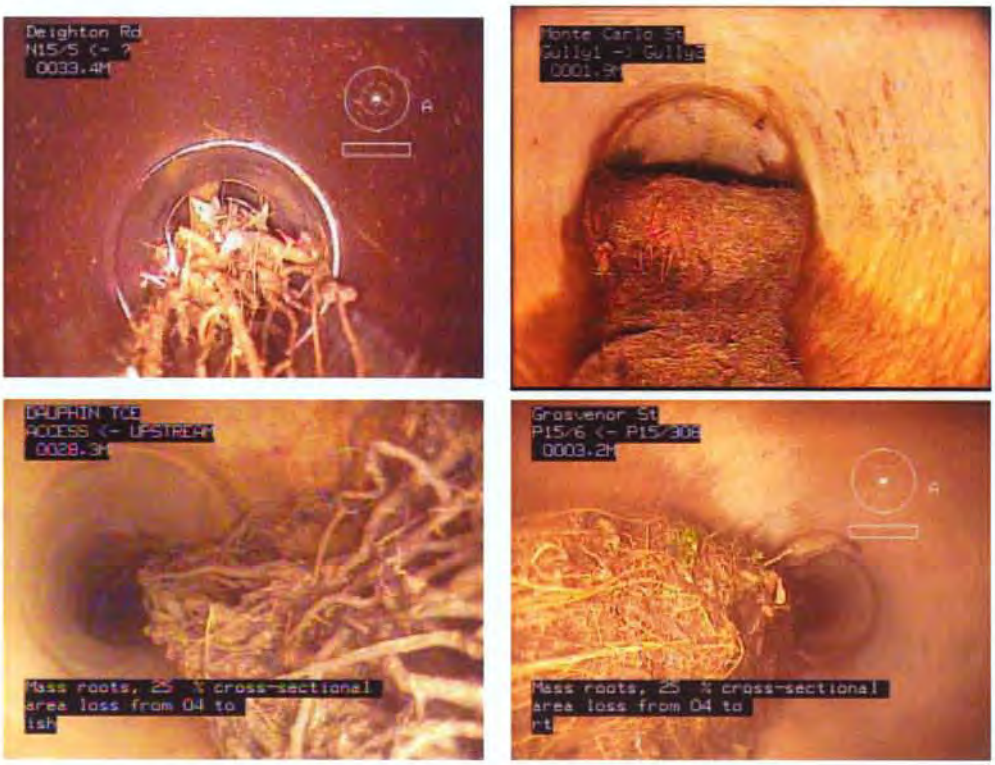
RM – Mass Roots

A mass of mostly fine roots, which has developed into an interwoven clump, which has entered the conduit through defects, connections or other entry points and is blocking a substantial proportion of the sectional area.

Additional Notes

- Complete blockages are also recorded under this code (100% blockage).
- If it is evident that the mass of roots and debris is not likely to be washed out during the next storm event and the blockage is greater than 10% then the objects will require removal. This condition is to be reported immediately for possible urgent maintenance action.
- If the mass of roots are clearly entering at the joint, record as RMJ – Mass Roots at Joint.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of cross sectional area (in %5 increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

RMJ – Mass Roots at Joint

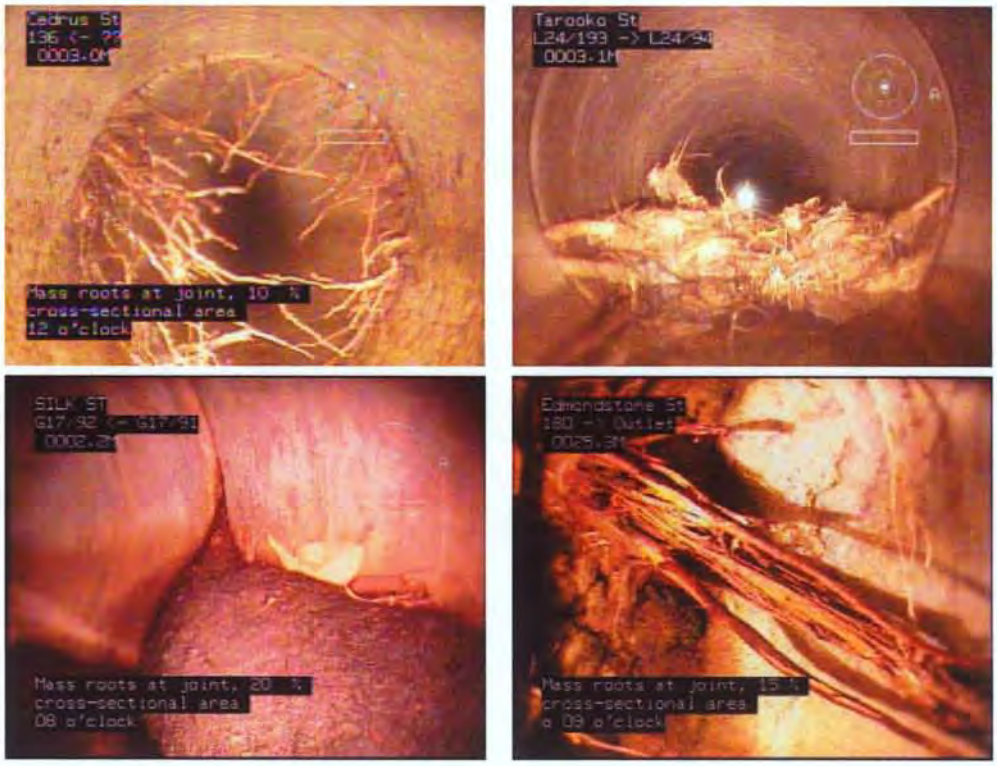
A mass of mostly fine roots, which has developed into an interwoven clump, which has entered the conduit through the Joint and is blocking a substantial proportion of the sectional area.

Generally refers to that have formed a solid density and may contain debris or rubbish, creating a solid obstruction impeding the flow of water to a greater or lesser extent.

Additional Notes

- Complete blockages are also recorded under this code (100% blockage).
- If the blockage is greater than 10% then the roots and associated objects will require removal. This condition is to be reported immediately for possible urgent maintenance action.
- If the mass of roots are clearly entering the conduit from a defect, connections or other entry points and not from the joint, record as RM – Mass Roots.

Examples



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of cross sectional area (in %5 increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

RT – Tap Roots

A tap root is a small number of major roots (10mm or greater in diameter) without a significant mass of fine roots entering the conduit through defects, connections or other entry points.

Additional Notes

- Blockages greater than 10% are to be reported immediately for possible maintenance action.
- If the Tap Root(s) are clearly entering the conduit from the joint, record as RTJ – Tap Roots at Joint.

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

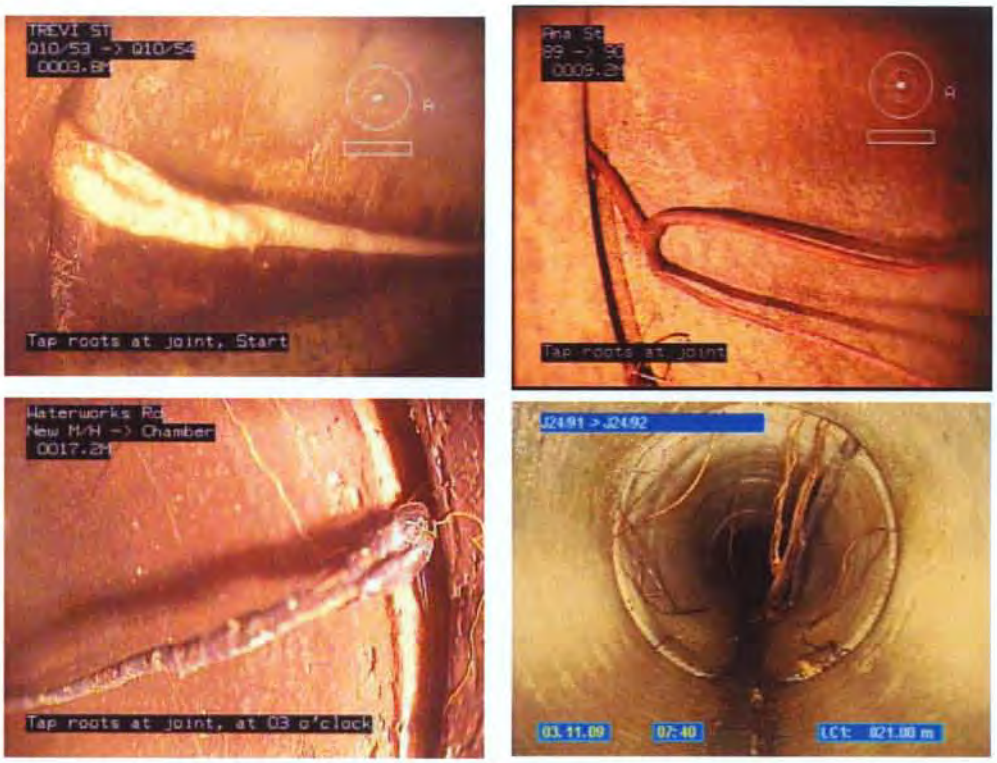
RTJ – Tap Roots at Joint

A tap root is a small number of major roots (10mm or greater in diameter) without a significant mass of fine roots entering the conduit through a joint.

Additional Notes

- Blockages greater than 10% are to be reported immediately for possible maintenance action.
- If the Tap root(s) are clearly entering the conduit from a defect, connections or other entry points and not from the joint, record as RT – Tap Roots.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

5.4.2 Less common Serviceability Defects include:

EH	Heavy encrustation (>20%), (position)
EHJ	Heavy encrustation (>20%) at joint, (position)
ERM	Minor erosion (<200 mm) behind channel wall, (position)
ERS	Significant erosion (>200 mm) behind channel wall, (position)
IG	Infiltration gusher, (position)
IGJ	Infiltration gusher at joint, (position)
OBM	Foreign mechanical object causing structural damage, (position)
OBS	Failing structural support mechanism, (position)
SDM	Minor scour protection damage, (position)
SDS	Significant scour protection damage, (position)

EH – Heavy Encrustation (>20%)

Deposits left by the partial evaporation of infiltrating groundwater containing dissolved salts.

Additional Notes

- > 20% area loss.
- As this condition may not the major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.
- Blockages greater than 10% are to be reported immediately for possible maintenance action.

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

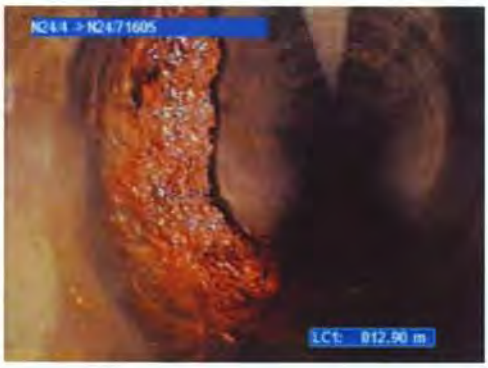
EHJ – Heavy Encrustation (>20%) at Joint

Deposits left by the partial evaporation of infiltrating groundwater containing dissolved salts.

Additional Notes

- > 20% area loss.
- Careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

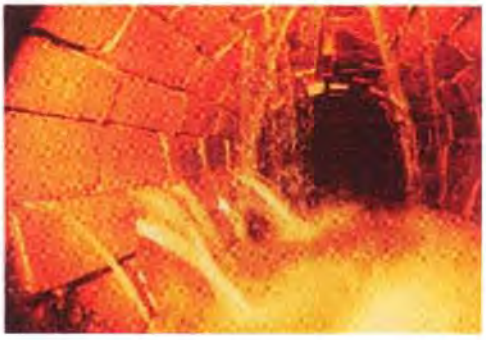
IG – Infiltration Gusher

Copious flow of groundwater and/or other materials are pouring under pressure into the conduit through a defect.

Additional Notes

- As this condition may not the major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

IGJ – Infiltration Gusher at Joint

Copious flow of groundwater and/or other materials are pouring under pressure into the conduit through a joint.

Additional Notes

- As this condition may not the major problem, careful observation is required to determine if the conduit is suffering from a more serious condition e.g. joint displacement, crack, fracture or hole.

Example

No example available

Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock

5.5 Other Common and Useful Codes

BCC02	Cannot Access Pipe
BCC04	Non-standard repair, (position), (width)
BCC05	Sealed chamber, (width)
BCC10	Service pipe crossing, (position), (diameter), (material)
CN	Connection, (position), (diameter), (material)
CNI	Connection, (position), (diameter), (intrusion), (material)
CX	Defective connection, (position), (diameter), (material)
CXI	Defective connection, (position), (diameter), (intrusion), (material)
CS	Camera submerged
DC	Dimension of conduit changes at this point, (new diameter)
FH	Finish of conduit survey length
GC	General comment at this point
GP	General photograph taken at this point
LC	Conduit lining changes (starts) at this point
LD	Line of conduit deviates down
LL	Line of conduit deviates left
LR	Line of conduit deviates right
LU	Line of conduit deviates up
MC	Conduit material changes at this point, (new material)
OBM	Foreign mechanical object causing structural damage, (position)
SA	Survey abandoned
SC	Conduit shape changes at this point
ST	Start of conduit survey length
WL	Water level, (%) height/diameter

BCC02 – Cannot Access Pipe

This is a special BCC code for when the pipe cannot be accessed, then use this code first followed by the GC (General Comment) Code to state the reason.

Additional Notes

Possible reasons for this code.

- Maintenance Hole Lid cannot be lifted. This is a maintenance problem; report to the relevant LAS region for rectification.
- Maintenance Hole is located in private property and access cannot be obtained.
- If the Maintenance Hole is shown in a different location to that found on the site, please report to the Technical Officer Pipe Survey.

Example

Additional Data required

None		

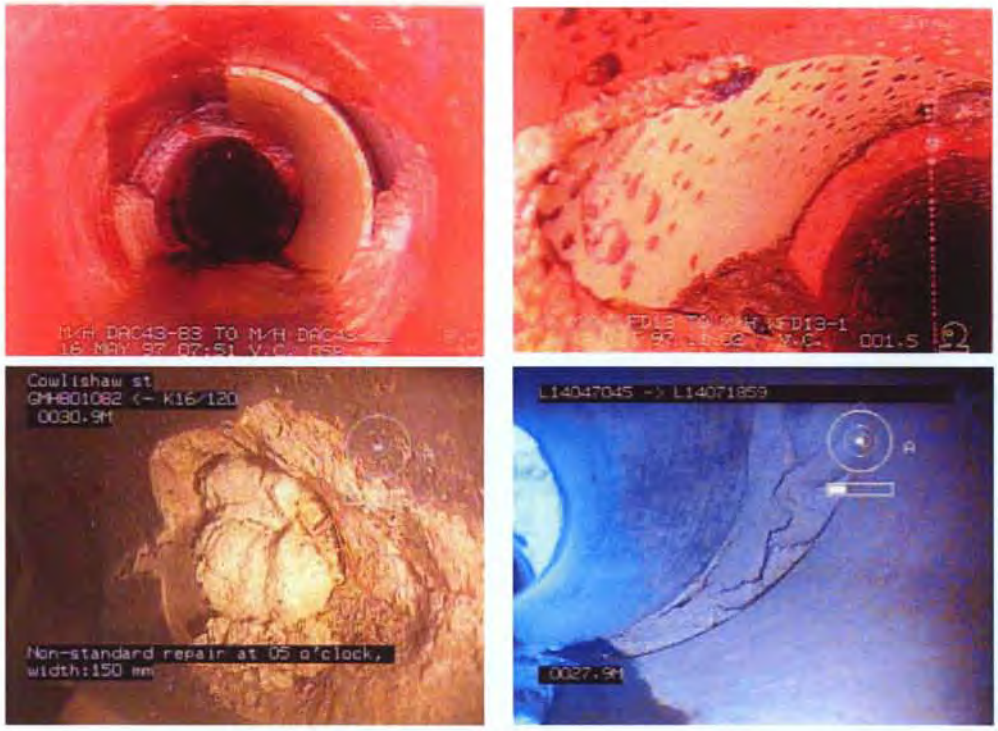
BCC04 – Non-Standard Repair

This is a special BCC code where a repair has been carried out on the pipe but the workmanship involved has been such that a defect has developed.

Additional Notes

- Where other defects are obvious then these should be included in the report, i.e. Broken Pipe, Cracks or Fractures.
- This code is not to be confused with a fault where a conduit that has been repaired with a liner and the liner is faulty, refer PLM – Lining Missing or PLS – Lining separated or hanging.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Width	Mandatory	Gap in mm
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

BCC05 – Sealed Chamber

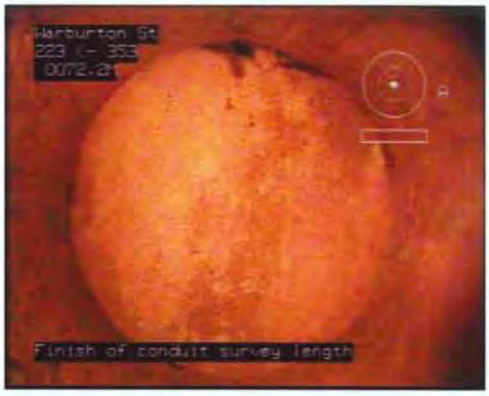
This is a special BCC code. A sealed chamber is a Maintenance Hole (MH) or other structure that may not be visible from the surface and its existence was not known previously.

Additional Notes

- It is necessary to record this structure to enable its entry it the Council equipment register.

Example





Additional Data required

Diameter or Width x Length	Mandatory	in millimetres (mm)

BCC10 – Service Pipe Crossing

This is a special BCC code. Service pipes from other utilities that have been constructed in such a manner that they partially or completely traverse through the drain, restricting the clear flow of water.

Additional Notes

- This is similar to OB - Obstruction code but use this code until further notice.

Example







Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Diameter:	Mandatory	in millimetres (mm)
Material	Mandatory	Material of service pipe

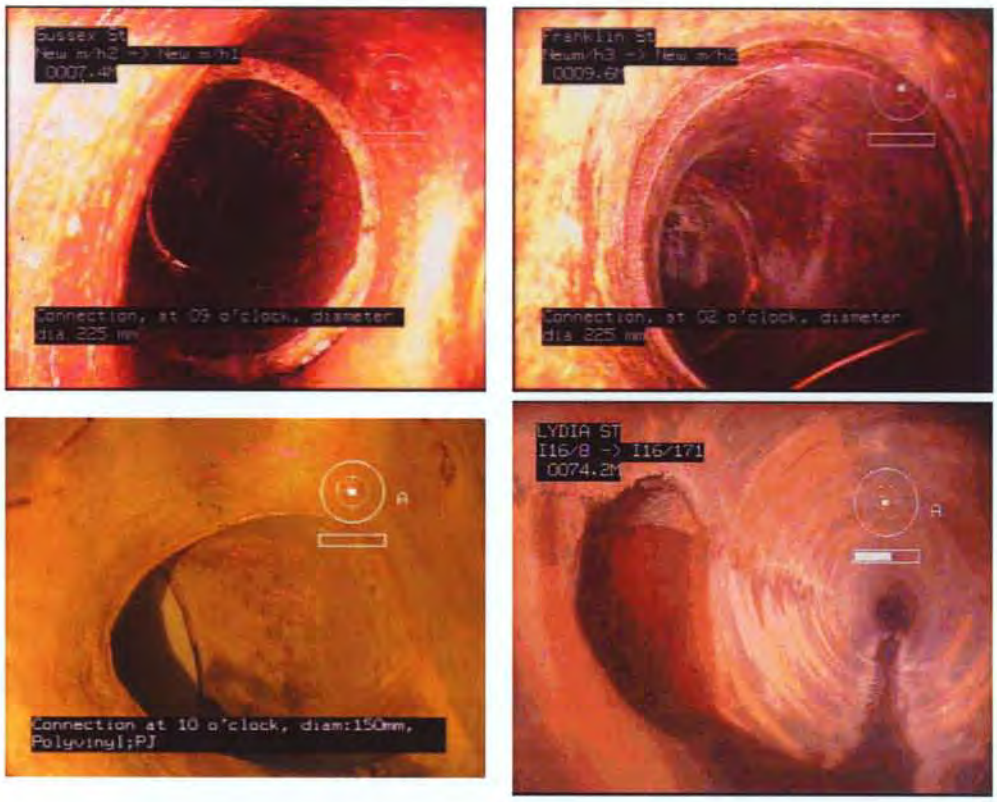
CN – Connection

This is the location of a smaller pipe entering the main conduit. Use this code if the connection pipe is neatly fixed and there are no signs of defects.

Additional Notes

- Use the CNI code to record details of intrusions; refer to CNI – Connection.
- Use the CX code if there are defects present; refer to CX – Defective Connection

Example



Additional Data required

Position	Mandatory	__ o'clock
Diameter:	Mandatory	in millimetres (mm)
Material	Mandatory	Type of material connecting from gully

CNI – Connection

This is the location of a smaller pipe entering the main conduit with a good connection but with an intrusion into the main line.

Additional Notes

- If the intrusion is a faulty connection, use the code CXI – Defective Connection, Intrusion.

Example





Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Diameter:	Mandatory	in millimetres (mm)
Material	Mandatory	Type of material connecting
Intrusion	Mandatory	in millimetres (mm)

CX – Defective Connection

This is the location of a smaller pipe entering the main conduit that is defective but not intruding into the main line.

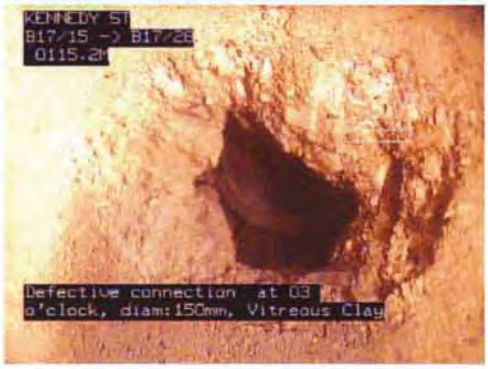
Additional Notes

- Use the CXI code to record details of an intrusion with defects; refer to CXI – Defective Connection, Intrusion.

Examples







Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Diameter:	Mandatory	in millimetres (mm)
Material	Mandatory	type of material connecting from gully

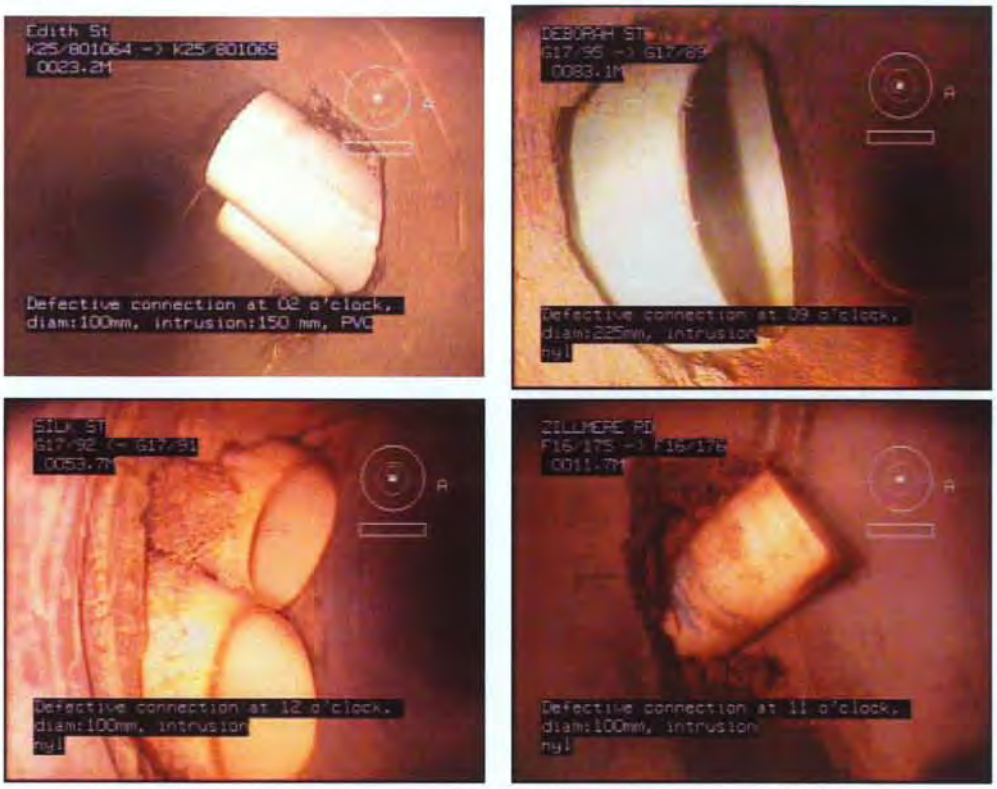
CXI – Defective Connection, Intrusion

This is the location of a smaller pipe entering the main conduit that is defective and is intruding into the main line.

Additional Notes

- Careful inspection is required to determine if the main conduit not is suffering from a more serious defect conditions e.g. cracks, fractures or holes.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Diameter:	Mandatory	in millimetres (mm)
Material	Mandatory	Type of pipe connecting in
Intrusion	Mandatory	in millimetres

CS – Camera Submerged

The survey is to be halted just before the camera is submerged and the water level recorded (WL). The survey is to be abandoned (SA) and a report issued for possible maintenance action.

Additional Notes

- Do not proceed when vision is greatly reduced.
- If for example, the conduit has sagged and the likelihood that the camera will eventually become unsubmerged and is safe to proceed then add the code BCC03 – Sagged Pipe and continue the inspection.

Example





Do not proceed when vision is greatly reduced.

Additional Data required

Percentage	Mandatory	(%) height/diameter

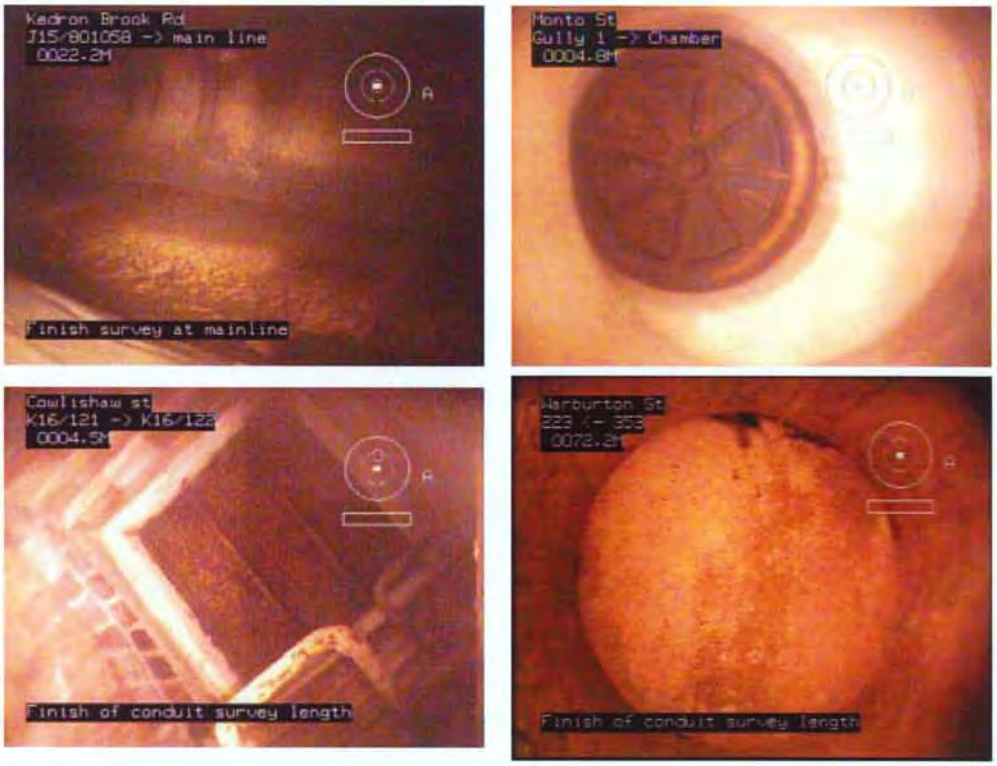
FH – Finish of Conduit Survey Length

This must be the last entry of every survey except where the survey is abandoned in which case "SA – survey Abandoned" must be the last entry.

Additional Notes

- Scan as much of the manhole, node or mainline at the end of the survey as possible with the video camera and note any obvious or suspicious defects.

Example



Additional Data required

None		

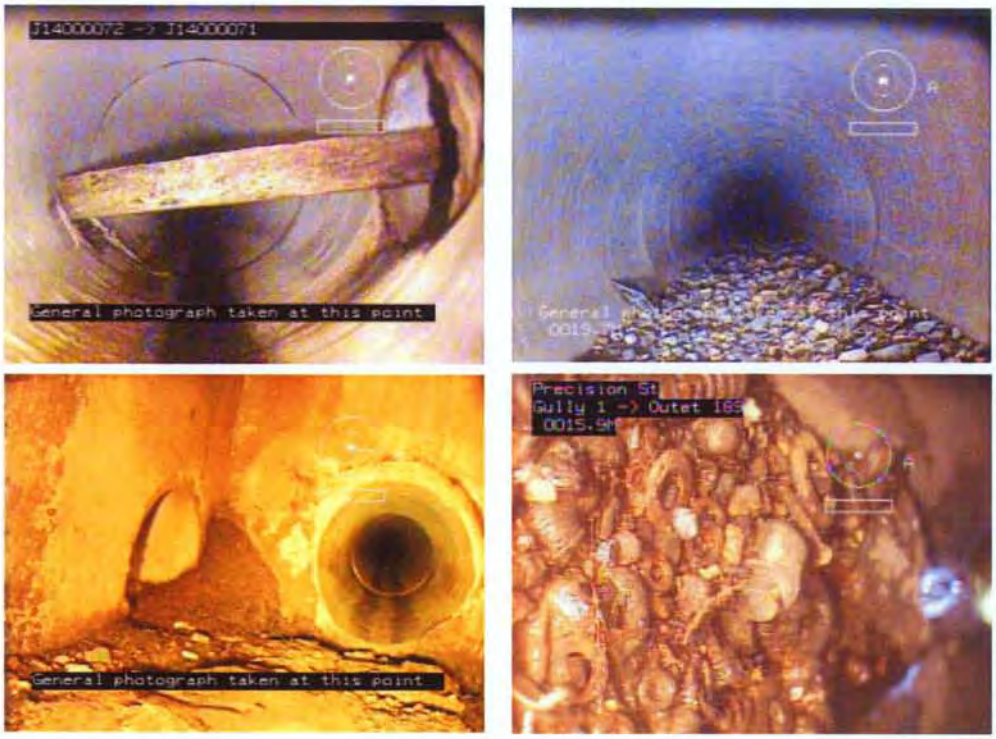
GP – General Photograph taken at this Point

Use this code if a photograph is taken to give clarity to any defects or points of interest.

Additional Notes

- Take the photo from a position to give the overall view of the point of interest as these photos can be automatically added to the Pipe Survey Report.

Example



Additional Data required

None		

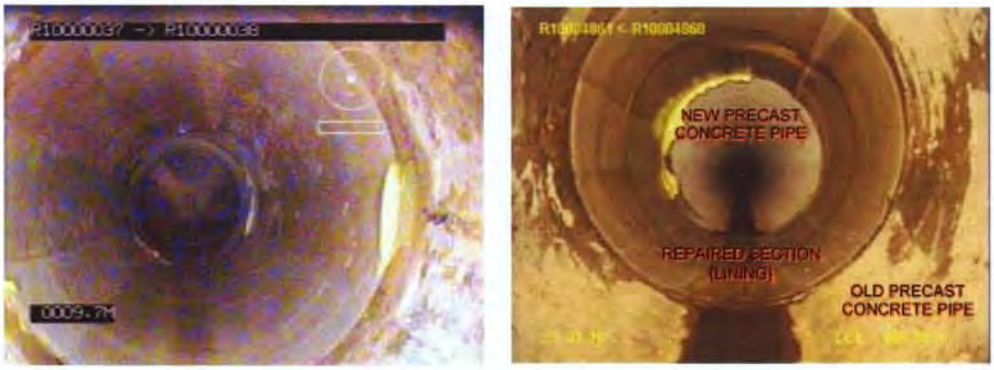
LC – Conduit Lining Change

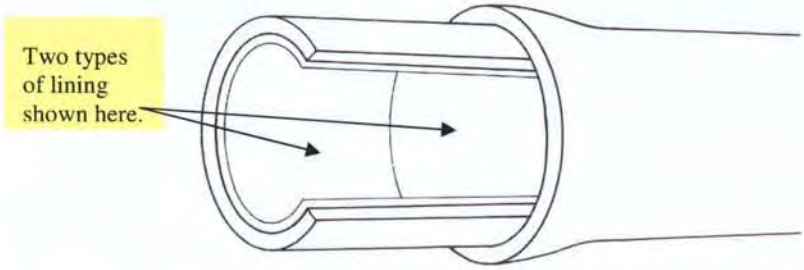
Used when the structural material of the conduit remains the same but a lining has been introduced or lining material changes.

Additional Notes

- Give details of change in Comments field.
- Not to be used for a change in the conduit material – Refer "MC-Material Change".
- Example below right shows a section of repair. Use the lining code for the section in between the older section and the new pipe. Material in this case does not change.

Example





Additional Data required

Start/End	Mandatory	Start and end chainage in metres
Material	Mandatory	Lining Material

LD – Line Deviates Down

A visible divergence downwards in the conduit line where the deviation does not involve angular displacement of the joints between pipes. LD is not defect but as been constructed within specification limits to create a curved conduit.

Additional Notes

- This code is not to be used where the deviation is the cause of a Displaced or Open Joint.

Example





The cause of this angular change in the direction of the conduit is due to a large displaced joint and therefore the LD code is **not** to be used.

Additional Data required

None		

LL – Line Deviates Left

A visible divergence to the left in the conduit line where the deviation does not involve angular displacement of the joints between pipes.

Additional Notes

- It is necessary to record the presence of direction deviation, regardless of condition and defects, to give Council an accurate inventory of installed assets.

Example



Additional Data required

None		

LR – Line Deviates Right

A visible divergence to the right in the conduit line where the deviation does not involve angular displacement of the joints between pipes.

Additional Notes

- It is necessary to record the presence of direction deviation, regardless of condition and defects, to give Council an accurate inventory of installed assets.

Example



Additional Data required

None		

LU – Line Deviates Up

A visible divergence upwards in the conduit line where the deviation does not involve angular displacement of the joints between pipes.

Additional Notes

- It is necessary to record the presence of direction deviation, regardless of condition and defects, to give Council an accurate inventory of installed assets.

Example

Additional Data required

None		

MC – Material Change

Use when the structural material of the conduit changes. Give details of change in Comments field.

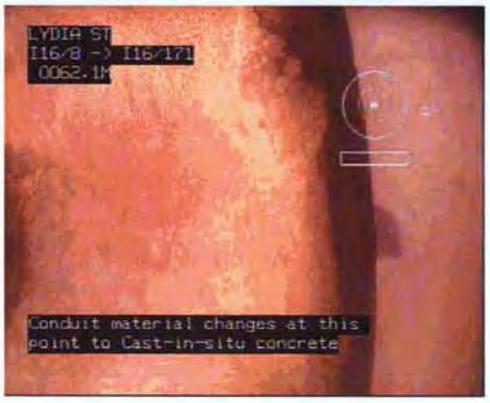
Additional Notes

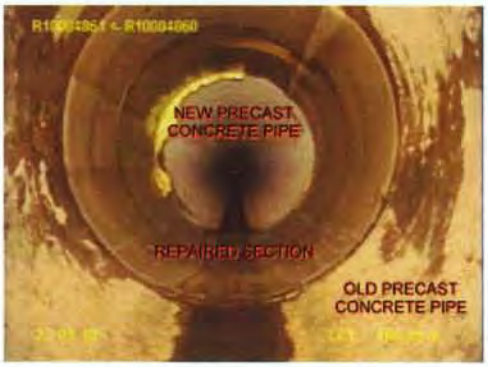
- It is necessary to record the presence of every material change, regardless of condition and defects.
- Not to be used at the start of end chainage for lining or repairs, refer "LC – Conduit Lining Change".

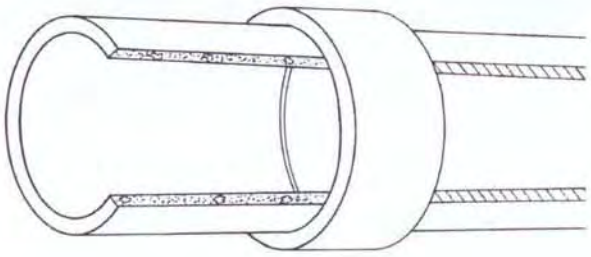
Example











Additional Data required

Material	Mandatory	

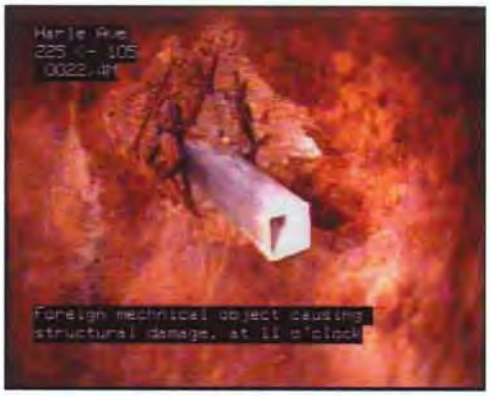
OBM – Foreign Object – Structural Damage

A foreign object partially blocking or protruding into the pipe causing structural damage and possibly restriction to flow may be recorded using this code e.g. timber or steel post, anchor bolt(s).

Additional Notes

- Add a general comment if you can identify the object, refer GC - General comment at this point.

Example



Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock

SA – Survey Abandoned

Use instead of "FH - Finish of conduit Survey Length" to indicate the survey could not be completed, e.g. due to obstruction or camera submerged.

Additional Notes

- Give the reason in the Comments field.

Example





Additional Data required

None		

ST – Start of Conduit Survey Length

To be used for the start of all surveys.

Additional Notes

- The Header information is to be added at the start of the video, refer 3.5 Data Display during Video Playback.

Example





Additional Data required

Start	Mandatory	Start chainage in metres

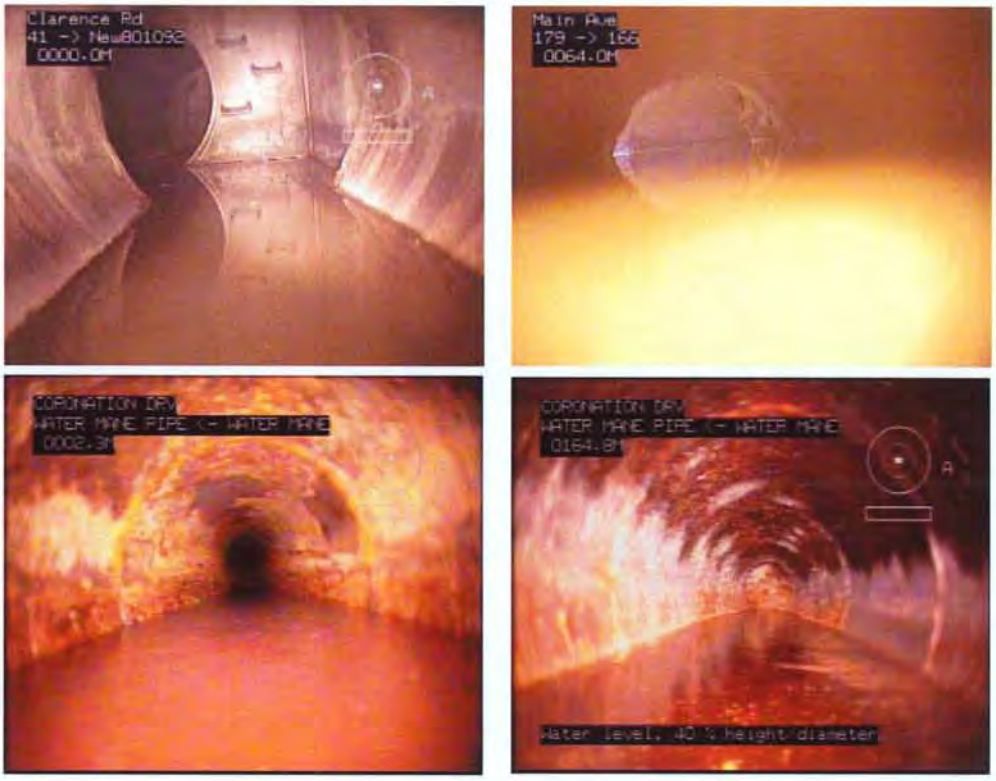
WL – Water level

The depth of water at the observed point in a conduit (includes flowing and stagnant water), i.e. the depth from water surface to invert of conduit.

Additional Notes

- Record the water level at the start of every inspection (from 0% to 100% in increments of 5%) and whenever it changes by more than 10% of diameter or vertical dimension.

Example



Additional Data required

Length	Mandatory	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of vertical height (in 5% increments at start and then 10% increments during inspection)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

5.6 Condition Codes not Required

The following codes are not recommended for use. In the likelihood that there is no option but to use these codes then the Technical Officer Pipe Survey is to be notified.

For example, all Junctions and Maintenance Holes (MH) should be known previously and given an asset number (Plant Number) and the survey should start or stop at these locations. If a MH is discovered during the inspection then it is given the code BCC05 – SEALED CHAMBER not MH – Maintenance Hole/node.

BR	Major branch, (position)
CI	Camera inverted, top of centre line, (position)
CLJ	Longitudinal crack at joint, (position)
DEG	Debris (grease), (%) cross-sectional area loss, (position)
DEGJ	Debris (grease) at joint, (%) cross-sectional area loss, (position)
ESH	Heavy scale, (%) cross-sectional area loss, (position)
ESL	Light scale, (position)
ESM	Medium scale, (%) cross-sectional area loss, (position)
FLJ	Longitudinal fracture joint, (position)
JN	Junction, (position), (diameter)
JX	Defective junction, (position), (diameter)
MH	Maintenance Holes/node
MR	Mortar Missing Repaired
PC	Length of pipes forming conduit changes at this point, (new length)

BR – Major Branch

If a connection appears to be a major line then the location of this junction should have already been established.

Additional Notes

- This code is not to be used.
- The survey is to be terminated (FH) at this point and the location is to be given a temporary Node point or Asset Number (Plant Number).
- Report to the Technical Officer Pipe Survey that a new junction has been located.

CI – Camera Inverted

If a conduit reduces in size during a single survey and the camera becomes positioned above the centre of the conduit then this code can be used along with DC Dimension of conduit changes at this point, (new diameter).

Additional Notes

- This code is not common and may not be necessary.

Additional Data required

Position	Mandatory	__ o'clock

CLJ – Longitudinal Crack at Joint

A crack at the joint, which is parallel to the direction of flow or axis of the drain.

Additional Notes

- This code is not be used as any cracks less than 2 metres long are to be captured using the BCC01 code.

Example



Incorrectly recorded – Record as CCJ – Circumferential Crack at Joint or CMJ – Multiple Cracks at Joint as the crack's direction deviates towards the Joint

Additional Data required

Position	Mandatory	__ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Optional	Record start and end chainage (if > 1m in Length)

DESJ – Silt Debris at Joint

Sediment deposited at the joint, reducing the overall flow area. This code is not necessary.

Additional Notes

- The recorded chainage is enough information to describe the location of a defect or condition, therefore this code is not necessary, use "DES – Debris (Silt)" to record this condition.
- Blockages greater than 10% are to be reported immediately for possible maintenance action.
- Careful inspection of the Joint may be required to determine if the condition has been caused by a defect in the joint.

Example

No example available

Additional Data required

Percentage	Mandatory	% reduction of cross sectional area (in 5% increments)

ESL – Light Scale

Less than 5% cross-sectional area loss caused by hard deposits, which cannot be identified as encrustation, e.g. deposits resulting from corrosion of iron pipes or hardened grout.

Additional Notes

- This code is to be used with caution.
- Cast Iron was used as a material for stormwater in the early 1900's but it is unlikely that there are any conduits in use today. It is very unlikely that Cast Iron will be used in the future. Therefore, care must be taken to ensure that the correct material has been identified.
- If the material has been identified and confirmed as Cast Iron, then this code can be used.

Example

No example available

Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

Between 5% and 20% cross-sectional area loss caused by hard deposits which cannot be identified as encrustation, e.g. deposits resulting from corrosion of iron pipes or hardened grout.

Additional Notes

- This code is to be used with caution.
- Cast Iron was used as a material for stormwater in the early 1900's but it is unlikely that there are any conduits in use today. It is very unlikely that Cast Iron will be used in the future. Therefore, care must be taken to ensure that the correct material has been identified.
- If the material has been identified and confirmed as Cast Iron, then this code can be used.

Example

No example available

Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of cross sectional area (in 5% increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

ESH – Heavy Scale

Greater than 20% cross-sectional area loss caused by hard deposits which cannot be identified as encrustation, e.g. deposits resulting from corrosion of iron pipes or hardened grout.

Additional Notes

- This code is to be used with caution.
- Cast Iron was used as a material for stormwater in the early 1900's but it is unlikely that there are any conduits in use today. It is very unlikely that Cast Iron will be used in the future. Therefore, care must be taken to ensure that the correct material has been identified.
- If the material has been identified and confirmed as Cast Iron, then this code can be used.

Example

No example available

Additional Data required

Position	Mandatory	__ o'clock OR from __ o'clock to __ o'clock
Length	Optional	in millimetres (mm) if <= 1m
Percentage	Mandatory	% reduction of cross sectional area (in 5% increments)
Start/End	Mandatory	Record start and end chainage (if > 1m in Length)

FLJ – Longitudinal Fracture at Joint

A Fracture in the conduit wall parallel to the direction of flow or axis of the conduit.

Additional Notes

- This code is not to be used.
- This code is not be used as any Fractures less than 2 metres long are to be captured using the BCC07 – Longitudinal Fracture code.

Example

No example available

Additional Data required

Position	Mandatory	__ o'clock
Length	Optional	in millimetres (mm) if <= 1000 mm
Start/End	Optional	Start and end chainage in metres

Use CN or other Connection codes as required.

Additional Notes

- This code is not to be used.
- Use the CX or CNI code to record details of defects.
- If the secondary conduit is equal in size or larger than the conduit being inspected, the survey is to be terminated (FH) at this point and the location is to be given a temporary Node point or Asset Number (Plant Number).
- Report to the Technical Officer Pipe Survey that a new junction has been located.
- The survey can be continued as a new survey with the chainage reset (zero chainage) and header information added.



Additional Data required

None		

JX – Defective Junction

Use CN or other Connection codes as required.

Additional Notes

- This code is not to be used.
- Use the CX or CNI code to record details of defects.
- If the secondary conduit is equal in size or larger than the conduit being inspected, the survey is to be terminated (FH) at this point and the location is to be given a temporary Node point or Asset Number (Plant Number).
- Report to the Technical Officer Pipe Survey that a new junction has been located.
- The survey can be continued but the chainage is to be reset (zero chainage) and header information added.

Additional Data required

None		

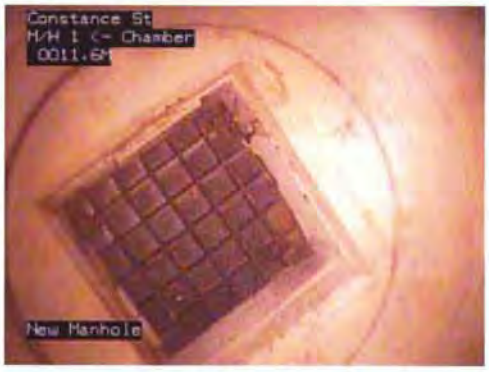
MH – Maintenance Hole (MH)/Node

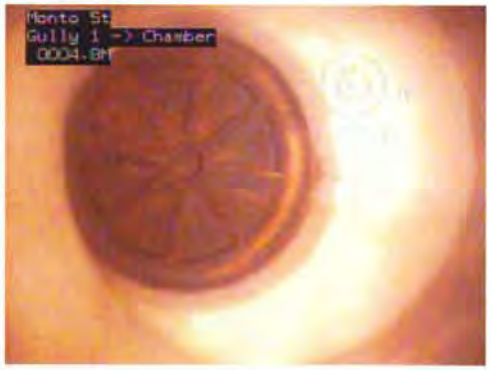
All maintenance holes, inlets structures or nodes should have already been established and given an Asset number (Plant Number).

Additional Notes

- This code is not to be used.
- If a maintenance hole is discovered and therefore does not exist on the asset register, then the survey is to be terminated (FH) at this point and the location is to be given a temporary Node point or Asset Number (Plant Number).
- Report to the Technical Officer Pipe Survey that a new junction has been located.
- If access cannot be gained from the surface at this newly discovered MH, then the survey can be continued as a new survey with the chainage reset (zero chainage) and header information added.

Example





Additional Data required

None		

PC – Length of Pipes forming Conduit Changes at this Point

This code is not to be used.

Additional Notes

- None.

Additional Data required

None		

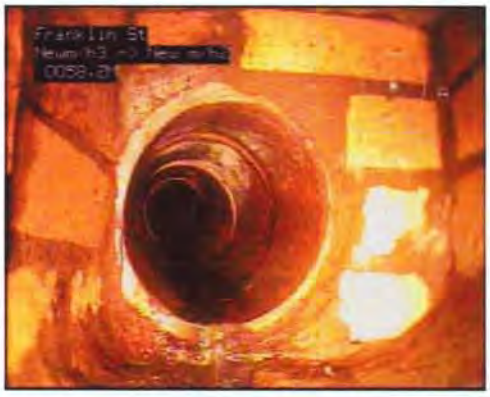
SC – Conduit Shape Changes

Signifies a change of conduit shape. At this location it is expected that a change point is present and therefore should be allocated a Node point or Asset Number (Plant Number).

Additional Notes

- This code is not to be used.
- The survey is to be terminated (FH) at this point and the location is to be given a temporary Node point or Asset Number (Plant Number).
- Report to the Technical Officer Pipe Survey that a new change point has been located.

Example



Additional Data required

None		

6.1 Overview of Maintenance Hole (MH) Inspections

This section is to be used for the visual inspection of the maintenance holes (structures) while entering the system to begin the inspection of the conduit and an inspection of the maintenance hole at the end of the conduit inspection.

There are no grading charts or diagrams so only a visual judgement on the condition of the components of the maintenance hole is required. Therefore this section is only used to highlight any concerns that may be observed during a pipe inspection and therefore maintenance can be directed where needed.

There are five general categories for Maintenance Inspections and are as follows:

1. General Access Observations
2. MH Cover Observations
3. General MH Observations
4. General MH Condition Observations
5. Step Iron or Ladder Observations
6. Pipe Connection Observations

6.1.1 General Access Observations

Method of Inspection

The MH that is accessed for the start of the pipe survey can be observed from the surface standing over the MH opening i.e. Manual (Direct Inspection). The manhole at the finish of the pipe survey can be observed either from the surface or from within the MH using the camera i.e. CCTV which ever is most convenient. Both of these methods are acceptable for either MH depending on circumstances at the site.

MH Accessibility

If there are no problems accessing the MH then record as "Good". If the MH is being observed using the CCTV then record as "Unknown".

General Location

This record is to generalise the location of the maintenance holes to establish its status if defects are present. This observation may not be possible from inside the MH using the CCTV and if it cannot be defined from the surface then record as "unknown".

The table below gives all possible responses:

General Access Observations		
Method of Inspection	**MH Accessibility**	**General Location**
Manual (Direct Inspection)	Buried	Bushland or Parkland
CCTV	Lid Jammed	Footpath - Asphalt
Other - See Comments	N/A	Footpath - Concrete
None	Good	Footpath - Other
	Other - See Comments	Other - See Comments
	Unknown	Private
		Road - Restricted Access
		Road - Unrestricted Access
		Structure
		Unformed Road
		Unknown

6.1.2 MH Cover Observations

MH Cover Shape

The basic shape is to be recorded.

MH Cover Type

There are only two types, either a Lid (enclosed cover) or Grate.

MH Cover Material

The most common material for Lids is Cast Iron and for Grates is Steel. Some Lids can be Concrete In-Fill on a Steel or Cast Iron base, record as Concrete In-Fill.

MH Cover Diameter

The standard diameter has changed over the years from 500mm to 600mm but other sizes may be present. Using a tape measure, record to the nearest 25mm. If the lid is being observed using the CCTV then record as 500mm as this is the general standard size on average.

Lifting Type

This item describes the method used to lift the lid and gain access to the MH. See the table below for descriptions.

MH Cover Condition

Record the condition of the Lid. If the Lid is broken or missing, record as "Other - See Comments" and state that the Lid needs to be replaced. If the Lid is being observed from inside the MH using the CCTV and it looks OK i.e. it is not broken or missing, then record as "Fair".

The table below gives all possible responses:

MH Cover Observations					
MH Cover Shape	**MH Cover Type**	**MH Cover Material**	**MH Cover Diameter**	**Lifting Type**	**MH Cover Condition**
Square	Lid	Concrete In-fill	From 450 to 1000mm (to nearest 25mm i.e. 850)	Heavy Duty Lifting Frame	Good
Round	Grate	Concrete		Lifting Hook	Fair
Rectangle	Other - See comments	Cast Iron		Lifting Key	Poor
Other - See comments		Unknown		Other - See Comments	Other - See Comments
		Steel		Pick	N/A

6.1.3 General MH Observations

MH Type

A normal MH is recorded as "Standard". "Non-Access Chamber" is used for Change Points or other obvious situations. "Gully-MH" is to be used if the access chamber is a gully with a standard gully grate.

Chamber Shape

Record the obvious shapes as Round, Square or Rectangular as observed and for a MH where the angles of some of the internal corners are not 90 degrees as "Irregular".

MH Diameter (Length)

Record the Diameter for Round MH and Length for Rectangular MH.

MH Width

If the MH is square, rectangular or another shape, record the width otherwise leave this field blank.

MH Material

Common materials are Cast in-situ Concrete or Concrete, Precast Concrete, Brick or Stone.

Benching Type

Benching is recorded as Full Height if it is as deep as the diameter of the main connecting pipes. Half Height is if it is as deep as half the diameter of the connecting pipes.

Drop Depth

Record the distance or drop between the inverts of main pipes to the nearest 100mm.

The table below gives all possible responses:

General MH Observations						
MH Type	**Chamber Shape**	**MH Diameter (Length)**	**MH Width**	**MH Material**	**Benching Type**	**Drop Depth**
Gully MH	Irregular	Diameter for Circular MH and Length for Rectangular MH. From 900mm (to nearest 100mm e.g. 2100)	Width is to be used for Rectangular MH only. From 900mm (to nearest 100mm e.g. 2100)	Brick	Full Height	In millimetres (to nearest 100mm) e.g. 2100
Non-Access Chamber	Rectangle			Cast-in-situ Concrete	Half Height	
Other - See Comments	Round			Precast Concrete	None	
Standard	Square			Stone	Not Applicable	
	Unknown			Unknown		

6.1.4 General MH Condition Observations

Floor Condition (Includes Benching)

Record the general observation of the condition of the MH Floor as follows:

Good – No signs of cracks or defects.

Fair – Some signs of cracks, surface wear or erosion.

Poor – Significant signs of surface wear or erosion, holes and/or large cracks.

Roof Condition

Record the general observation of the condition of the MH Roof as follows:

Good – No signs of cracks or defects.

Fair – Some signs of cracks.

Poor – Significant signs of cracks or spalling.

Wall Condition

Record the general observation of the condition of the MH Walls as follows:

Good – No signs of cracks or defects.

Fair – Some signs of cracks.

Poor – Significant signs of cracks or spalling.

The table below gives all possible responses:

General MH Condition Observations		
Floor Condition (Includes Benching)	**Roof Condition**	**Wall Condition**
Good	Good	Good
Fair	Fair	Fair
Poor	Poor	Poor
Other - See Comments	Other - See Comments	Other - See Comments
N/A	N/A	N/A

6.1.5 Step Iron or Ladder Observations

Step Iron Type

Record the type of step, step irons or ladder in the MH. If it is not obvious if the step iron is plastic or plastic coated, record as Plastic.

Step Iron Condition

Record the general observation of the condition of the Steps or Ladder:

Good – No signs of rust or defects.

Fair – Some signs of rust or defects (e.g. flakes of rust).

Poor – Significant signs of rust or defects (cross section of steel/cast iron units greatly reduced) or Steps missing.

The table below gives all possible responses:

Step Iron or Ladder Observations	
Step Iron Type	**Step Iron Condition**
Aluminium Alloy	Good
Galvanised Iron	Fair
Cast Iron	Poor
None	Other - See Comments
Other - See Comments	N/A
Plastic	
Plastic Coated Steel	
Stainless Steel	
Steel Ladder	
Steel Lugs	
Timber	
Unknown	

6.1.6 Pipe Connection Observations

Pipe Connection Type

Record a description that best describes each pipe that enters of exists the MH.

Pipe Shape

Record the obvious shapes as Round, Box, Egg etc as per Section **4. PIPE ATTRIBUTES**

Pipe Diameter

Measure or estimate the diameter for a circular pipe or the Height for Box and Egg shape pipes to the nearest 25mm.

Width

Measure or estimate the Width for a Box and Egg shape pipes to the nearest 25mm.

Pipe Material

Common materials are Cast-in-situ Concrete or Concrete, Precast Concrete, Plastic, Fibre Reinforced Concrete, Brick or Stone.

Clock Position

Record the position of each connection in clock face notation where the 12 o'clock position is the centre of main outlet pipe(s) looking down to the floor of the MH.

Connection Condition

Record the condition of each connection into the MH.

Good – No signs of cracks or defects.

Fair – Some signs of cracks.

Poor – Significant signs of cracks, holes or spalling.

The table below gives other possible responses:

Pipe Connection Observations

Pipe Connection Type	Pipe Shape	Pipe Diameter	Width	Pipe Material	Clock Position	Connection Condition
Gully Connection	Round	Diameter for Circular Pipes and Height for Rectangular or Egg Shape etc, Pipes (to nearest 25mm e.g. 825)	Width is used for Rectangular or Egg Shape etc, Pipes only, (to nearest 25mm e.g. 1225)	Brick	From 1 to 12 o'clock	Good
Main In	Box			Cast-in-situ Concrete		Fair
Main Out	Egg			Precast Concrete		Poor
Other In				Stone		Other - See Comments
Other Out				Unknown		N/A
Other (direction of flow unknown)	For all shapes refer Section **4. PIPE ATTRIBUTES**			For all materials refer Section **4. PIPE ATTRIBUTES**		

Dedicated to a better Brisbane

ASSET SERVICES FLOOD RECOVERY SITREP

TO: [redacted]
Manager Asset Services

FROM: [redacted]
Flood Recovery Manager

EVENT NAME:	January 2011 Flood Event	**SITREP NUMBER:**	026
EVENT TYPE:	River and Tidal Creek Flooding	**DATE:**	3 August 2011

KEY ISSUES UPDATE

1. Drainage

451.3km of the enclosed stormwater network was initially mapped as inundated in the flood event. As at 28 July 2011, 62% of the inundated network has been surveyed and 53.1% confirmed as clean. Cleaning of (and confirmed as clean) affected lines has a target completion of 95% by 31 August 2011.

As at 28 July 2011, 13 kms has been identified as inaccessible (please refer to Note 1) and 7.1 kms of stormwater line being listed as major projects (please refer to Note 2). The identification and mapping of inaccessible lines, means that until September 2011, there will be no further work in Sector A, D, G, J, Q, R and T.

The program of surveying and eduction is now focused on the remaining 431.2 kms of which 65.1% has been surveyed and 55.6% has been confirmed clean.

Note 1: Inaccessible pipes relate to maintenance holes being buried. These areas of the network will be mapped and addressed as a project in September 2011.

Note 2: Major projects are stormwater lines where significant resources have been used to remove debris and clean the lines. These lines have utilised large quantities of contractors time and resources however do not contribute significantly to kilometre progress.

Table 1.1 - summary of CCTV surveying of the stormwater network

Sector	Suburbs	Total Amount of Inundated Line (kms)	Surveyed Stormwater Network (kms)	Percentage Completed Surveyed	Percentage confirmed clean (to 95% by 31 Aug)
A	Chelmer / Graceville	15.6	13.3	85.0%	85.3%
B	Corinda / Graceville / Oxley / Sherwood	11.0	9.0	82.0%	72.7%
C	Corinda / Inala / Oxley	10.9	8.0	73.0%	67.0%
D	Jindalee / Seventeen Mile Rocks / Sinnamon Park	11.2	10.4	93.0%	92.9%

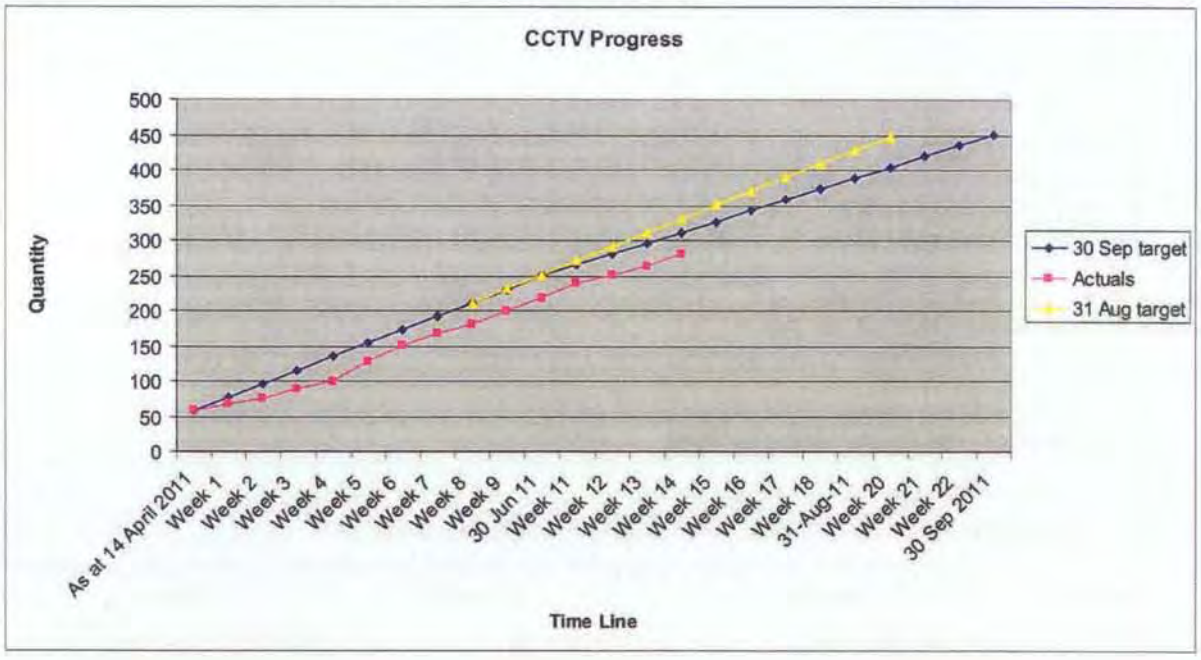
Sector	Suburbs	Total Amount of Inundated Line (kms)	Surveyed Stormwater Network (kms)	Percentage Completed Surveyed	Percentage confirmed clean (to 95% by 31 Aug)
E	Jamboree Heights / Jindalee / Middle Park / Mt Ommaney / Westlake	24.8	18.8	76.0%	71.8%
F	Darra / Riverhills / Sumner & Sumner Park / Wacol / Westlake	14.7	11.7	80.0%	68.0%
G	Acacia Ridge / Durack / Pallara / Willawong	6.9	7.0	101.0%	98.6%
H	Archerfield / Coopers Plains / Moorooka / Rocklea / Salisbury / Tennyson / Yeerongpilly	32.5	23.3	72.0%	56.9%
I	Fairfield / Moorooka / Tennyson / Yeerongpilly / Yeronga	26.4	22.6	86.0%	70.1%
J	Dutton Park / Highgate Hill / South Brisbane / West End	25.5	16.9	66.0%	52.5%
K	Coorparoo / East Brisbane / Greenslopes / Kangaroo Point / Norman Park / Woolloongabba	33.5	20.3	61.0%	50.1%
L	Balmoral / Bulimba / Hawthorne / Morningside	21.2	9.1	43.0%	35.4%
M	Carina / Hemmant / Lytton / Murarrie / Port of Brisbane / Tingalpa / Wynnum West	20.1	4.4	22.0%	17.9%
N	Eagle Farm / Pinkenba	17.4	7.7	44.0%	30.5%
O	Albion / Bowen Hills / Hamilton / Herston / Kelvin Grove / Newmarket / Newstead / Wilston / Windsor	34.5	5.9	17.0%	10.1%
P	Brisbane / Fortitude Valley / New Farm / Newstead	41.5	27.8	67.0%	47.7%
Q	Auchenflower / Milton / Paddington / Taringa / Toowong	27.2	25.3	93.0%	82.0%

Sector	Suburbs	Total Amount of Inundated Line (kms)	Surveyed Stormwater Network (kms)	Percentage Completed Surveyed	Percentage confirmed clean (to 95% by 31 Aug)
R	Chapel Hill / Fig Tree Pocket / Indooroopilly / St Lucia / Taringa / Toowong	20.3	18.0	89.0%	81.3%
S	Anstead / Bellbowrie / Brookfield / Fig Tree Pocket / Kenmore / Kenmore Hills / Pinjarra Hills / Pullenvale	9.7	7.4	76.0%	71.1%
T	Anstead / Bellbowrie / Moggill / Mt Crosby / Pullenvale	5.7	5.4	95.0%	87.7%
Non Sector		40.7	8.5	21.0%	20.9%
TOTALS		**451.3 kms**	**280.3**	**62%**	**53.1%**

Please Note: 961 kilolitres of sludge has been removed to 28 July 2011. To date 8,839.5 kilolitres of sludge has been removed.

Table 1.2	**Quantity to be completed (kms)**	**Completed (kms)**	**Percentage Completed**	**Previously listed percentage**
Total Quantity to be surveyed by 31 August 2011	428 kms	280.8	66%	4% Increase
Total Quantity to be surveyed by 30 September 2011	451 kms	280.8	62%	4% Increase

Graph 1.1 – CCTV survey progress against the 31 August 2011 and original 30 September 2011 AS target.



Graph 1.2 - CCTV Weekly Output progress against the weekly target to reach 95% by 31 August 2011.

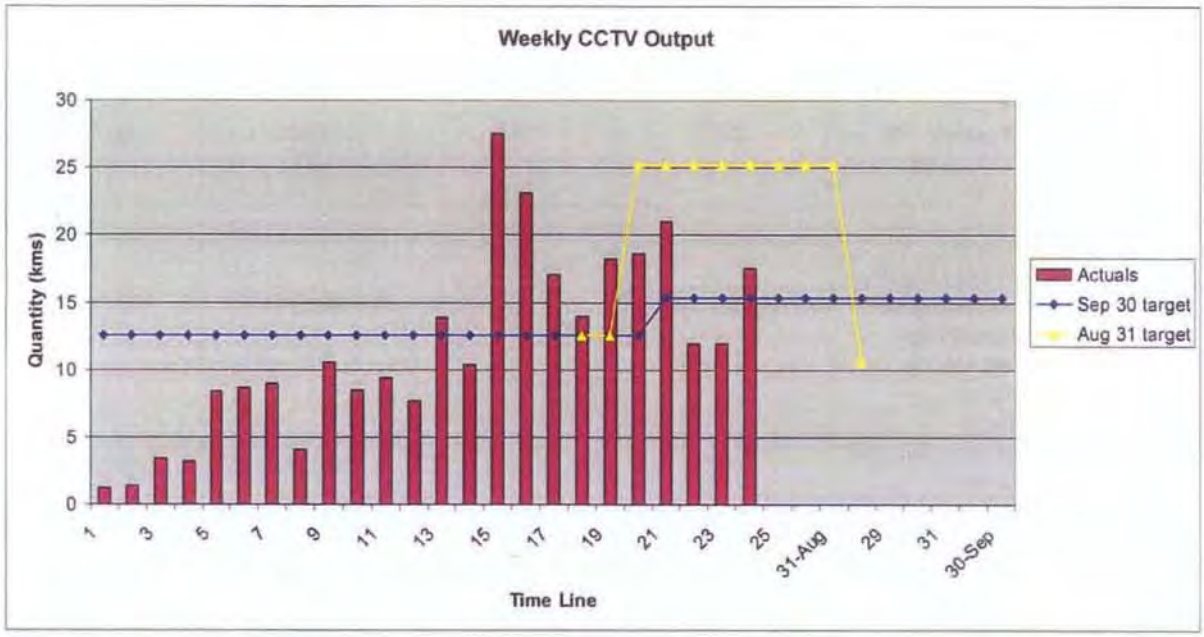


Table 1.3 - progress update on cleansing efforts on the high priority lines (most of which are in highly populated areas near the Brisbane River)

	Total Quantities (kms)	Completed (kms)	Percentage Completed	Previously listed percentage
High Priority Stormwater Lines Pipes in excess of *900mm diameter located in Residential, Multi-purpose major centres or other significant locations eg New Farm Park, Lang Park, Milton Drain and the catchment down Melbourne St through the Southbank Precinct.	47	35.9	76%	3% Increase
Medium Priority Stormwater Lines Pipes in excess of *900mm diameter located in areas outside those specified in the high priority sites.	94	59.6	63%	3% Increase
Low Priority Stormwater Lines Pipes less than 900mm diameter in areas outside those specified in the high and medium priority sites.	310	185.3	60%	4% Increase

**900mm diameter stormwater pipes were chosen as they carry a greater flow and are presenting higher inundation rates than smaller diameter pipes.*

The following stormwater lines were identified this week requiring rehabilitation:

Sector	Street	Suburb	Damage
K	St Leondards St	Coorparoo	Conduit deformed
O	Rees St	Kelvin Grove	Conduit broken

Rehabilitation of these lines will be referred to AS Regions for further assessment and listing within the capital program.

2. *Parks*

The target for completion of parks restoration is to have 100% of parks fully open by 30 June 2012. Status against this target is currently 93%.

As at 29 July 2011, there are still 3 parks still fully closed.

As at 29 July 2011, 25 parks have some aspect of their facility/amenity closed (41 nodes).

The following two parks have re-opened fully:

1. Hercules Street Park, Hamilton
2. Brisbane Corso Park (Nos. 55 & 59), Fairfield

Two parks have been removed from the partially closed list. Flood recovery works have been completed in these parks, the remaining works are not associated with flood recovery.

1. Guyatt Park, St Lucia
2. Biambi Yumba Park, Fig Tree Pocket

Please refer to **Appendix A** for the complete list of the 3 fully closed parks and 25 partially closed parks.

Parks recovery works are remaining at 63 parks. The following is a summary of anticipated completion of the works:

Timeframe	Number of Parks
August 2011	1
September 2011	43
October 2011	8
November 2011	1
December 2011	7
September 2012	1
Timeframe to be advised	2

3. *Roads*

Restoration works have been completed for gully reconstruction, unpaved road surface, footpath restoration / construction and kerb & channel.

Table 3.1 - summary of civil restoration works:

Sub-activity	Total Quantity over All Sectors	Quantity Completed for All Sectors	Percentage Completed	Previously listed percentage	30 Sept Target 100%
Paved Road Surfaces (m^2)	14,244	12,599.1	88.5%	6.8% Increase	11.5% below
Fences (m)	90	88.5	98.3%	Nil change	1.7% below
Footpath Restoration – Grassed (m^2)	33,563	33,563	100%	Nil change	Achieved
Footpath construction – Concrete (m^2) **Point B	1,063	1,063	100%	Nil change	Achieved
Kerb & Channel (m^2)	655	655	100%	Nil change	Achieved
Enclosed drainage (gully	14	14	100%	Nil change	Achieved

Sub-activity	Total Quantity over All Sectors	Quantity Completed for All Sectors	Percentage Completed	Previously listed percentage	30 Sept Target 100%
reconstruction)					
Unpaved Road Surface (m^2)	5,738	5,738	100%	Nil change	Achieved
		Percentage Complete	**98.1%**	**1.0% Increase**	**1.9% below**

** *Please Note:* *Due to on-going audit of works, the amount of footpath construction – concrete works associated with January 2011 flood and rain event has reduced.*

3.1 Major Roads projects

3.1.1 Kholo Rd (approach to bridge)

Construction works commenced on 1 August 2011, estimated construction period of 14 weeks (weather permitting).

3.1.2 Brisbane Corso

Construction works have been completed. Project finalisation activities are underway.

4. Stormwater Outlets

Stormwater outlet assessment works have been completed and analysis is underway of restoration requirements. SITREP 027 will provide information on the restoration program for these sites.

5. Queensland Reconstruction Authority (QRA)

Table 5.1 - claims submitted to QRA.

Type of Claim	Description	Claim Amount
Counter Disaster Operations – Claim 1	Counter Disaster Operations costs	$860,947
Counter Disaster Operations – Claim 2w	Debris removal and consumable costs associated with initial disaster response and kerbside cleanup in Brisbane flood affected suburbs – January to February 2011 West Region. Costs incurred to end February 2011. Part 1 claim	$22,789
Counter Disaster Operations – Claim 3w	Debris removal and consumable costs associated with initial disaster response and kerbside cleanup in Brisbane flood affected suburbs – January to February 2011 West Region. Costs incurred to end February 2011. Part 2 claim	$60,204
Counter Disaster Operations – Claim 4w	Debris removal and consumable costs associated with initial disaster response and kerbside cleanup in Brisbane flood affected suburbs – January to February 2011 West Region. Costs incurred to end February 2011. Part 3 claim	$32,426
Counter Disaster Operations – Claim 5	Consumables for cleanup – Stores	$31,791
Counter Disaster Operations – Claim 6	Debris removal and consumable costs associated with initial disaster response and kerbside cleanup in Brisbane flood affected suburbs – January to February 2011 North, East and Central Region. Costs incurred to end February 2011. Part 1 claim	$17,324

Type of Claim	Description	Claim Amount
Counter Disaster Operations – Claim 7s	Debris removal and consumable costs associated with initial disaster response and kerbside cleanup in Brisbane flood affected suburbs – January to February 2011 South Region. Costs incurred to end February 2011.	$146,982
Counter Disaster Operations – Claim 8s	Debris removal and consumable costs associated with initial disaster response and kerbside cleanup in Brisbane flood affected suburbs – January to February 2011 South Region. Costs incurred to end February 2011. Part 2 claim	$176,883
Counter Disaster Operations – Claim 9	Debris removal and consumable costs associated with initial disaster response and kerbside cleanup in Brisbane flood affected suburbs – January to February 2011 North, East and Central Region. Costs incurred to end February 2011. Part 2 claim	$81,638
Counter Disaster Operations – Claim 10w	Clean up activities, West Region. Costs incurred to end March 2011. ** *Please Note:* *This claim was reduced by $9,490 as emergent works were identified within the initial claim.*	$38,630
Counter Disaster Operations – Claim 11s	Clean up activities, South Region. Costs incurred to end March 2011.	$190,380
Counter Disaster Operations – Claim 12s	Clean up activities, South Region. Costs incurred to end March 2011.	$150,558
Counter Disaster Operations – Claim 13s	Clean up activities, South Region. Costs incurred to end March 2011.	$270,537
Counter Disaster Operations – Claim 14s	Clean up activities, South Region. Costs incurred to end March 2011.	$273,300
Counter Disaster Operations – Claim 15w	Clean up activities, West Region. Costs incurred to end March 2011. ** *Please Note:* *As reported in SITREP 015, this claim was reduced by $166,796 as emergent works were identified within the initial claim.*	$179,155
Counter Disaster Operations – Claim 16	Clean up activities, all regions. Costs incurred to end March 2011.	$131,005
Counter Disaster Operations – Claim 17	Clean up activities, all regions. Costs incurred to end March 2011.	$270,232
Counter Disaster Operations – Claim 18	Clean up activities, all regions. Costs incurred to end March 2011. ** *Please Note:* *This claim was reduced by $23,027 as emergent works were identified within the initial claim.*	$92,108
Counter Disaster Operations – Claim 19	AS overtime, penalties flood cleanup.	$84,230
Counter Disaster Operations – Claim 20	Cleanup all regions	$21,644
Counter Disaster Operations – Claim 21	Cleanup South Region	$193,023
Emergent Works – LAS01w	Debris removal, traffic control, minor repairs, temporary fencing in West Region. Costs to 28 February 2011	$672,508
Emergent Works – LAS02	Emergent works for Central, North, East Regions (all types across all assets in Council areas). Re-submitted to Grants Team for review.	$90,303
Emergent Works – LAS03s	Debris removal, traffic control, minor repairs in South Region. Costs for March 2011.	$293,943
Emergent Works – LAS04w	Debris removal, traffic control, minor repairs in West Region. Costs for March 2011.	$65,494
Emergent Works – LAS05w	Debris removal, traffic control, minor repairs in West Region. Costs for March 2011.	$71,598
Emergent Works – LAS06	Debris removal, traffic control, minor repairs in North, East and Central Regions, stormwater pipe eduction works in Sector A. Costs for March 2011.	$178,024

Type of Claim	Description	Claim Amount
Emergent Works – LAS07s	March debris removal, traffic control, minor repairs in West Region	$90,085
Emergent Works – LAS08w	March debris removal, traffic control, minor repairs in West Region	$206,356
Emergent Works – LAS09	Emergent works component of CDO claims 1 to 15	$677,458
Emergent Works – LAS10	Emergent works to mid April for debris removal, traffic control and minor repairs	$569,127
Emergent Works – LAS11	Clean up in flood affected suburbs. Estimated 20% as emergent works asset based cleansing	$56,238
Emergent Works – LAS12	Debris removal, traffic control and minor repairs. Costs till mid April 2011.	$255,729
Emergent Works – LAS13	Debris removal, traffic control and minor repairs. Costs till mid April 2011.	$116,267
Emergent Works – LAS14s	Debris removal, traffic control and minor repairs. Costs till mid April 2011.	$117,023
Emergent Works – LAS15w	Debris removal, traffic control and minor repairs. Costs till mid April 2011.	$181,205
Emergent Works – LAS16w	Debris removal, traffic control and minor repairs. Costs till mid April 2011.	$170,422
Emergent Works – LAS17	Emergent works component of CDO claims 18 to 20.	$49,496
Emergent Works – LAS18	Emergent works to mid April debris removal, traffic control, minor repairs	$319,788
Emergent Works – LAS19	Emergent Work – cleansing of and repairs to various assets prior to 19 April 2011	$167,589
Emergent Works – LAS21	Emergent Works – CCTV survey and eduction works undertaken of the stormwater network that was inundated during the Brisbane January 2011 flood repairs.	$250,109
	TOTAL CLAIMS TO DATE	**$7,924,548**

Please Note: The amount of claims submitted to QRA since the last SITREP has increased by $610,720.

6. *Community Service Announcements*

- Nil.

7. *General Observations*

- Approximately 421m³ of kerbside rubbish and approximately 1,800m³ of mud and silt from parks has been removed this week.

AUTHORISATION:

[redacted]

Name:
Position: **Flood Recovery Manager**
Date: **3 August 2011**

Appendix A

Flood Affected Parks January 2011 Flood and Rain Event
Fully Closed

Ward	Suburb	Park D number	Park Name	Extent of Park Flooding Jan 2011	Status 22 Jul 2011	Status 29 Jul 2011
TENNYSON	CHELMER	D0707	TAYLOR BRIDGE RESERVE	MAJOR	NOT OPEN	NOT OPEN
PULLENVALE	MOGGILL	D0271	MOGGILL FERRY RESERVE	MAJOR	NOT OPEN	NOT OPEN
WALTER TAYLOR	FIG TREE POCKET	D0258	SPINKBRAE STREET PARK	MAJOR	NOT OPEN	NOT OPEN

Flood Affected Parks January 2011 Flood and Rain Event
Partially Closed

Ward	Suburb	Park D number	Park Name	Extent of Park Flooding Jan 2011	Status 29 July 2011
THE GABBA	KANGAROO POINT	D0680	RIVER TERRACE PARK (aka Kangaroo Point Cliffs - lower)	SIGNIFICANT	Open - exception - night climbing
'E GABBA	WEST END	D0346	ORLEIGH PARK	MAJOR	Open - exception - HILL END TCE TOILET
THE GABBA	WEST END	D0347	DAVIES PARK	SIGNIFICANT	Open - exception - GAS STRIPPING TOWER PRECINCT
TENNYSON	CHELMER	D0297	GORDON THOMSON PARK	MAJOR	Open - exception - PLAYGROUND
TENNYSON	CHELMER	D0299	CHELMER RECREATION	MAJOR	Open - exception - PLAYGROUND
TENNYSON	FAIRFIELD	D0375	FAIRFIELD PARK	SIGNIFICANT	Open - exception - PLAYGROUND
TENNYSON	GRACEVILLE	D0010	FAULKNER PARK	MAJOR	Open - exception -
TENNYSON	GRACEVILLE	D0304	STRICKLAND TERRACE PARK	MAJOR	Open - exception - PLAYGROUND
TENNYSON	GRACEVILLE	D0824	GRACEVILLE RIVERSIDE PARKLANDS	MAJOR	Open - exception - SIMPSONS PLAYGROUND
TENNYSON	SHERWOOD	D0305	SHERWOOD FOREST PARK	MAJOR	Open - exception FRIENDS OF SHERWOOD ARBORETUM RESTORATION SITES CENTRAL & JOLIMONT ST PLAYGROUNDS SHERWOOD FOREST RIVER BOARDWALK
TENNYSON	YERONGA	D0373	BRISBANE CORSO PARK	SIGNIFICANT	Open - exception - CENTRAL PLAYGROUND
'NNYSON	YERONGA	D0984	ESPLANADE PARK	MAJOR	Open - exception - PLAYGROUND
JAMBOREE	CORINDA	D0307	HORACE WINDOW RESERVE	MAJOR	Open - exception - HILDA ST PLAYGROUND (to be replaced with picnic facilities)
JAMBOREE	JINDALEE	D0338	JINDALEE BOAT RAMP PARK	MAJOR	Open - exception DOG OFF LEASH AREA
JAMBOREE	SINNAMON PARK	D1224	MCPHERSON ROAD PARK	SIGNIFICANT	Open - exception - BARKLYA CRES PLAYGROUND
JAMBOREE	RIVERHILLS	D1102	TIGRIS STREET PARK	MAJOR	Open - exception - PLAYGROUND
JAMBOREE	SVTN MILE ROCKS	D1845	ROCKS RIVERSIDE PARK	MODERATE	Open - exception - ROCKS RIVERSIDE PK COMMUNITY GARDEN
PULLENVALE	KARANA DOWNS	D1886	KOOKABURRA PARK - WEST	MAJOR	Park is closed - exception - PERFORMANCE SPACE
TOOWONG	AUCHENFLOWER	D0474	MOORLANDS PARK	MAJOR	Open - exception - PLAYGROUND
TOOWONG	MILTON	D0477	MILTON PARK	MAJOR	Open - exception - PLAYGROUND & PICNIC AREA
WALTER TAYLOR	FIG TREE POCKET	D0255	CLIVEDEN PARK	MAJOR	Open - exception - PLAYGROUND
WALTER TAYLOR	FIG TREE POCKET	D0260	FIG TREE POCKET RIVERSIDE RESERVE	MAJOR	OPEN - exception - BRISBANE RIVER WALKING TRACK NETWORK FIG TREE POCKET BOAT RAMP

Flood Affected Parks January 2011 Flood and Rain Event Partially Closed					
Ward	**Suburb**	**Park D number**	**Park Name**	**Extent of Park Flooding Jan 2011**	**Status 29 July 2011**
WALTER TAYLOR	ST LUCIA	D0405	ROTARY INTERNATIONAL PRESIDENTS PARK	MAJOR	Open - exception - PLAYGROUND
WALTER TAYLOR	TOOWONG	D0480	PERRIN PARK	MAJOR	Open - exception - PLAYGROUND
WALTER TAYLOR	INDOOROOPILLY	D0420	SIR JOHN CHANDLER PARK	MAJOR	Open - exception - MEIERS RD BOATING FACILITY

Dedicated to a better Brisbane

ASSET SERVICES FLOOD RECOVERY SITREP

TO: [redacted]
Manager Asset Services

FROM: [redacted]
Flood Recovery Manager

EVENT NAME:	January 2011 Flood Event	**SITREP NUMBER:**	030
EVENT TYPE:	River and Tidal Creek Flooding	**DATE:**	31 August 2011

KEY ISSUES UPDATE

1. Drainage

451.3km of the enclosed stormwater network was initially mapped as inundated in the flood event, adjusted to 450.5km. As at 25 August 2011, 77.1% of the inundated network has been surveyed and 61.2% confirmed as clean. Cleaning of affected lines has a target completion of 95% by 30 September 2011.

As at 25 August 2011, 18.2 kms has been identified as inaccessible (please refer to Note 1) and 7.1 kms of stormwater line being listed as major projects (please refer to Note 2). The identification and mapping of inaccessible lines, means that until September 2011, there will be no further CCTV in Sector A, D, E, F, G, H, I, P, Q, R and T.

The program of surveying is now focused on the remaining 425.2 kms of which 81.7% has been surveyed and 68.8% has been confirmed clean.

Extra eduction units will be deployed in the Rocklea area week beginning 29 August 2011 reducing the work to be done on medium priority lines.

Note 1: Inaccessible pipes relate to maintenance holes being buried. These areas of the network will be mapped and addressed as a project in September 2011.

Note 2: Major projects are stormwater lines where significant resources have been used to remove debris and clean the lines. These lines have utilised large quantities of contractor's time and resources however do not contribute significantly to kilometre progress.

Note 3: Lines in tidal areas can consistently have debris of 20%. Lines can still be functional in the event of rain.

Table 1.1
January 2011 Flood Event – Recovery – Stormwater culverts/pipes – inspection and eduction
Target – 95% of inundated network clean by 30 September 2011

As at 25 August 2011	Total Amount of Inundated Line (adj) (kms)	Inaccessible Lines Major Projects		Inspected or surveyed via CCTV		Clean (initial inspection); educted	
		Locations	kms	Surveyed Stormwater Network kms	Surveyed Stormwater Network %	Clean stormwater network kms	Clean stormwater network %
All Sectors (BCC)	450.5		25.3	347.2	77.10%	292.5	61.20%
All sectors (Contractors Report)				361.5	80.24%	318.0	70.54%
High Priority Stormwater Lines Pipes in excess of *900mm diameter located in Residential, Multi-purpose major centres or other significant locations eg New Farm Park, Lang Park, Milton Drain and the catchment down Melbourne St through the Southbank Precinct.	47.0	1. Land St, Toowong 2. Stratton Drain, Newstead 3. Rasey Park, Herston 4. Black / Castlemaine St, Milton 5. Southbank	7.1 1. 1.098 kms 2. 2.500 kms 3. 1.375 kms 4. 1.316 kms 5. 0.800 km	40.5	86.20%	33.0	70.20%
Medium Priority Stormwater Lines Pipes in excess of *900mm diameter located in areas outside those specified in the high priority sites.	93.8	1. Rocklea 2. Hyde Rd, Fairfield	6.0	84.2	89.80%	60.0	63.97%
Low Priority Stormwater Lines Pipes less than 900mm diameter in areas outside those specified in the high and medium priority sites.	310.0		12.2	222.3	71.70%	199.5	64.35%

The average number of CCTV units per working day is 13 and the average number of eduction units per working day is 35.

Please Note: 1,470 kilolitres of sludge has been removed to 25 August 2011. To date, 12,579.5 kilolitres of sludge has been removed.

2. *Parks*

The target for completion of parks restoration is to have 100% of parks fully open by 30 June 2012. Status against this target is currently 94.8%.

As at 26 August 2011, there are still 3 parks still fully closed.

As at 26 August 2011, 18 parks have some aspect of their facility/amenity closed (34 nodes).

Please refer to **Appendix A** for the complete list of the 3 fully closed parks and 18 partially closed parks.

Parks recovery works are remaining at 50 parks. The following is a summary of anticipated completion of the works:

Table 2.1

Timeframe	Number of Parks
August 2011	1
September 2011	31
October 2011	7
November 2011	1
December 2011	7
September 2012	1
Timeframe to be advised	2

3. *Roads*

Restoration works have been completed for all immediate and emergent minor civil (gully reconstruction, fences, unpaved road surface, footpath restoration / construction and kerb & channel), exception is small amount of paved road repairs (0.3%).

3.1 *Major Roads projects*

3.1.1 *Kholo Rd (approach to bridge)*

The pour for the downstream cut off wall and the downstream rock armour works have been completed. Excavation has commenced on the upstream cut off wall chainage 90 to chainage 70. It is anticipated that these works will be completed by 2 September 2011.

3.1.2 *Road Resurfacing*

The Program Efficiency Group (PEG) approved Pensar Pty Ltd to deliver the $6M Asphalt Schedule 939 works. $5M of works is to be completed within the 2011 / 2012 financial year. The remaining program is to be completed within the 2012 / 2013 financial year.

Asset Services and Pensar Pty Ltd are undertaking joint scoping and developing a program schedule to deliver 70% by 31 January 2012.

4. *Emergent Works*

Asset Services will be commissioning Minor Civil Restoration Works Phase 2 program under existing contract to Pensar Pty Ltd.

A schedule of works has been provided to PEG seeking approval to award the additional nominated works to Pensar within the current contract. The program value is $220,000 (including GST). Please refer to **Appendix B** for schedule of works.

5. *Temporary Waste Sites*

For status of restoration works at all temporary waste sites please refer to **Appendix C.**

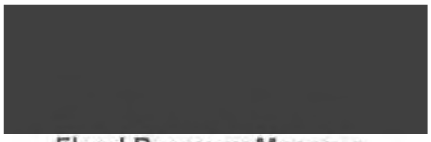
6. *Queensland Reconstruction Authority (QRA)*

As at 26 August 2011, total claims submit to QRA equal $8,747,827. No additional claims have been submitted to QRA since SITREP 029.

7. *General Observations*

Approximately 356m³ of kerbside rubbish and approximately 1,790m³ of mud and silt from parks has been removed this week.

AUTHORISATION:



Name:
Position: **Flood Recovery Manager**
Date: **31 August 2011**

Appendix A

Flood Affected Parks January 2011 Flood and Rain Event
Fully Closed

Ward	Suburb	Park D number	Park Name	Extent of Park Flooding Jan 2011	Status 15 Aug 2011	Status 26 Aug 2011
TENNYSON	CHELMER	D0707	TAYLOR BRIDGE RESERVE	MAJOR	NOT OPEN	NOT OPEN
PULLENVALE	MOGGILL	D0271	MOGGILL FERRY RESERVE	MAJOR	NOT OPEN	NOT OPEN
WALTER TAYLOR	FIG TREE POCKET	D0258	SPINKBRAE STREET PARK	MAJOR	NOT OPEN	NOT OPEN

Flood Affected Parks January 2011 Flood and Rain Event
Partially Closed

Ward	Suburb	Park D number	Park Name	Extent of Park Flooding Jan 2011	Status 26 Aug 2011
THE GABBA	KANGAROO POINT	D0680	RIVER TERRACE PARK (aka Kangaroo Point Cliffs - lower)	SIGNIFICANT	Open - exception - night climbing
THE GABBA	WEST END	D0346	ORLEIGH PARK	MAJOR	Open - exception - HILL END TCE TOILET
THE GABBA	WEST END	D0347	DAVIES PARK	SIGNIFICANT	Open - exception - GAS STRIPPING TOWER PRECINCT
TENNYSON	GRACEVILLE	D0010	FAULKNER PARK	MAJOR	Open - exception - LEYBOURNE ST PLAYGROUND
TENNYSON	GRACEVILLE	D0824	GRACEVILLE RIVERSIDE PARKLANDS	MAJOR	Open - exception - SIMPSONS PLAYGROUND
TENNYSON	SHERWOOD	D0305	SHERWOOD FOREST PARK	MAJOR	Open - exception FRIENDS OF SHERWOOD ARBORETUM RESTORATION SITES CENTRAL & JOLIMONT ST PLAYGROUNDS SHERWOOD FOREST RIVER BOARDWALK
TENNYSON	YERONGA	D0373	BRISBANE CORSO PARK	SIGNIFICANT	Open - exception - CENTRAL PLAYGROUND
TENNYSON	YERONGA	D0984	ESPLANADE PARK	MAJOR	Open - exception - PLAYGROUND
JAMBOREE	CORINDA	D0307	HORACE WINDOW RESERVE	MAJOR	Open - exception - HILDA ST PLAYGROUND (to be replaced with picnic facilities)
JAMBOREE	JINDALEE	D0338	JINDALEE BOAT RAMP PARK	MAJOR	Open - exception DOG OFF LEASH AREA PICNIC AREA PLAYGROUND BOAT RAMP
JAMBOREE	SINNAMON PARK	D1224	MCPHERSON ROAD PARK	SIGNIFICANT	Open - exception - BARKLYA CRES PLAYGROUND
JAMBOREE	RIVERHILLS	D1102	TIGRIS STREET PARK	MAJOR	Open - exception - PLAYGROUND
JAMBOREE	SVTN MILE ROCKS	D1845	ROCKS RIVERSIDE PARK	MODERATE	Open - exception - ROCKS RIVERSIDE PK COMMUNITY GARDEN INDUSTRIAL PLAZA CENTRAL PLAZA CORAL MOUND GREAT LAWN EVENT SPACE COMMUNITY BUILDING & TOILET RIVERBANK PICNIC AREA AMPHITHEATRE OXLEY WHARF
PULLENVALE	KARANA DOWNS	D1886	KOOKABURRA PARK - WEST	MAJOR	Park is closed - exception - PERFORMANCE SPACE
TOOWONG	AUCHENFLOWER	D0474	MOORLANDS PARK	MAJOR	Open - exception - PLAYGROUND

Appendix A

Flood Affected Parks January 2011 Flood and Rain Event Partially Closed					
Ward	Suburb	Park D number	Park Name	Extent of Park Flooding Jan 2011	Status 15 Aug 2011
WALTER TAYLOR	FIG TREE POCKET	D0260	FIG TREE POCKET RIVERSIDE RESERVE	MAJOR	OPEN - exception - BRISBANE RIVER WALKING TRACK NETWORK FIG TREE POCKET BOAT RAMP
WALTER TAYLOR	TOOWONG	D0480	PERRIN PARK	MAJOR	Open - exception - PLAYGROUND
WALTER TAYLOR	INDOOROOPILLY	D0420	SIR JOHN CHANDLER PARK	MAJOR	Open - exception - MEIERS RD BOATING FACILITY PEDESTRIAN ACCESS ONLY TO PARK

Appendix B

2011 January Flood-Asset Damage Survey

Quantities Total				4	0	0	55	50	43	0	22	2	0	0	110301	67500	13001	0	0	0				
Industry rate - average				$264	$404	13	$261	30	205	18	100	270	3965	$100	1	1	1							
Count / Locations				1	0	0	8	1	5	0	1	1	0	0	6	6	5	0	0	0				
Cost Total - using industry sector G				$1,056.00	$0.00	$0.00	$14,355.00	$1,500.00	$8,815.00	$0.00	$2,000.00	$540.00	$0.00	$0.00	$113,501.00	$67,500.00	$13,001.00	$0.00	$0.00	$264.00				$222,632.00
Parent/ Group Project				11S12FA		11S12FA	11S12FA	11S12FA	11S12FA	11S12FA	11S12FA	11S12FA			11S74FA	11S74FA	11S13FA							$17,655.00
Schedule Number				12F		12F	12F	12F	12F	12F	12F	12F			74F	74F	12F							GL Code 1043386874320000
Project ID				12F74E11		12FFEN11	12FFPA11	12FFPA18	12FFPA11	12FFPA11	12FBKE11	12FLAN11			74FED11	74FCD11	12SWAL11							GL Code 1043386787320000

Asset Type Quantities

Sector	Suburb	Street	Region	Date Inspected	Paved Roads-failure repairs (m2) PR Minor - Band 3 (022001)	Paved Roads-failure repairs (m2) PR Major - Band 8	Unpaved Roads- (m2)	Kerb & Channel-reconst (m)	Fences (m)	Footpaths-reconst conc (m2)	Footpaths-Supply and spread 175dll (m2)	Footpaths-Landscape Supply and LayTurf (m2)	Footpaths-dkway adjust conc (m2)	Bikeways-reconst conc (m2)	Landscape (m2)	Miscellaneous Item	open dgn Item	enclosed dgn (Item)				Priority (H, M & L)	Description of Work Required (ie, Appel St: 10m ckc @ #10, 2m2 footpath @ #12, 30m2 p/failure @ #31 & 600m2 footpath restoration full length)
SECTOR P	Brisbane	71 Eagle St	C	18/08/2011				20					2										Storm event flood - footpath uplifted by ground swelling. Raise 20m kerb blocks to match new footpath levels. Associated work includes recon of concrete pavement and subsided access ramp
SECTOR A	Chelmer	71 Queenscroft St	S	18/07/2011				4															Storm flood event KC- reconstruct grid crossing at #71
SECTOR A	Chelmer	91 Roseberry St	S	15/07/2011				1															Storm flood event KC- replace kerb taper either side of driveway at #91, damaged by clean up
SECTOR A	Chelmer	Wharf St	S	28/03/2011													4000	1000					Storm flood event ED - Eroded SW outlet and disjointed 375mm conduit at riverbank under Jack Pesch bridge. Not ID under GHD brief. Restore pipe and outlet channel/ batter with restoration work at Taylor Bridge reserve
SECTOR A	Graceville	opp 17 Waratah St	S	3/08/2011	4																		Storm Flood event - PR- 4m2 outside #17
SECTOR A	Graceville	66 Strickland Tce	S	6/07/2011				5				20											Storm Flood event - KC- reconstruct damaged grid crossing, adjacent driveway track, 2 household SW outlets and top drains and turf sunken footpath
SECTOR C	Oxley	Ipswich Rd	S	20/07/2011					50														Storm flood event FE - replace 48m chain wire fencing along service rd near Ansett over top of culvert.
SECTOR F	Sumner	42 Neon st	S	22/07/2011						4													Storm Flood event FP- reconstruct 4m2 concrete footpath. Damaged Telstra pit reported 24/8/11 case ID 141295825
SECTOR Q	Toowong	Coronation Dve	W	28/04/2011													8000						Storm flood event ED - outlets onto river adjacent bikeway opposite Land St. Flowable fill and rock armouring
SECTOR R	St Lucia	Macquarie St	W	5/05/2011														3000					Storm flood event OD - Clean out and resurf swale drain blocked with mud opposite Keith St
SECTOR R	Toowong	27 Campbell st	W	19/04/2011	1												40000						Storm flood Event ED - Headwall around outlet at #21, requires underpinning and stabilisation
SECTOR S	Fig Tree Pocket	Ningana St	W	18/08/2011													500	4500					Storm flood event OD - Reshaping table drain and turf, removal of water tank and tree debris from creek bank. Damage caused by contractor's vehicles undertaking house renovation
SECTOR S	Fig Tree Pocket	456 Jesmond Rd (Aminga St frontage)	W	28/04/2011														4500					Storm flood event OD - Table drain and vehicle pipe crossing blocked with soil build. Re cut table drain approx 10m below pipe crossover
SECTOR S	Fig Tree Pocket	18 Michelangelo St	W	4/05/2011				1															repair 2 kerb stormwater outlets damaged by clean up operations at No 18
SECTOR S	Fig Tree Pocket	Cubberla St	W	10/05/2011														3000	6000				excavation of mud deposits in open channel located in Jesmond Rd frontage of Fig Tree Pocket state school. Removal of mud from roadside. Repair to subsided stormwater pipe damaged by clean up vehicles on Jesmond Rd and Ningana St
SECTOR S	Fig Tree Pocket	22 Botticelli St	W	19/05/2011															5000				Storm flood event ED - repair to stormwater outlet, damaged by clean up vehicles. Located in riverside park behind No. 22 identified in GHD brief. No other work in area.
SECTOR I	Fairfield	Turner Ave	S	18/05/2011				6															Storm flood Event CKC - corner Brisbane Corso, replace 6m ckc damaged by clean up vehicles
SECTOR I	Fairfield	50 Turner Ave	S	19/05/2011						6													Storm flood Event FP - #50 damaged footpath partially by building construction made worse by clean up operations
SECTOR I	Fairfield	11 Stimpson St	S	5/08/2011				14															Storm flood Event FP - #11 damaged footpath & kerb by clean up operations made worse by building demolition
SECTOR I	Fairfield	11 Stimpson St	S	8/08/2011						5													Storm flood Event FP - #11 damaged footpath & kerb by clean up operations made worse by building demolition
SECTOR I	Fairfield	9 Hefferan St	S	12/07/2011				4															Storm flood Event CKC - Reconstruct damaged inlet crossing #6 damaged by clean up vehicles
SECTOR I	Fairfield	1 Hefferan St	S	8/08/2011						4													Storm flood Event FP- damaged concrete footpath by clean up vehicles
SECTOR I	Fairfield	1 William st (Brougham st frontage)	S	3/05/2011													1						Storm flood Event FP- replace private roofwater pipe across footpath, damaged by clean up operations
SECTOR I	Yeronga	9 Yvonne St	S	31/01/2011															1				Storm flood event ED- replace stormwater manhole cover/ frame damaged by clean up operations
SECTOR H	Rocklea	32-34 Sunstated st	S	1/07/2011															1000				Storm flood event ED- replace dameged precast SW outlet and apron
SECTOR H	Rocklea	110 Dunn Rd	S	28/06/2011						24													Storm flood event FP- damaged concrete footpath by clean up vehicles near cnr Oxlade Rd
SECTOR X	Brookfield	Gold Ck Rd	W	1/05/2011														5000					removal of AC washed into creek and rock filling of crocked bank adjacent to culvert
SECTOR X	Brookfield	Upr Brookfield Rd including Pacey Rd	W	1/05/2011													25000						Storm flood event ED - Misc repairs to flood damaged (many locations) inlets/ outlets and kerbs at low level creek crossings (approx 5 days)
SECTOR X	Karana Downs	Allinson Dve	W	1/05/2011													40000						Storm flood event ED - Construct gabions at stormwater outlet. Soils eroded as result of pre flood rain event.
SECTOR X	Chermside	Downfall Ck- Murphy Rd	N	5/05/2011														17500					Storm Flood event OD - Construct rock armouring of banks and reveg incl establishment. Site affected by local flash flooding 9-12 January 2011
SECTOR X	Chermside	Downfall Ck- 7th Brigade Pk	N	5/05/2011														25000					Storm Flood event OD - Construct rock armouring of banks and reveg incl establishment. Site affected by local flash flooding 9-12 January 2011

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Appendix C

Temporary Waste Sites

Location Name	Street Address	Suburb	Phase
Crosby Park Netball Courts	Fox St	Albion	Scoping
Anstead Bush Reserve	Hawkesbury Rd	Anstead	Scoping
Balmoral Park Depot / RSL Carpark	Jean Howie Dr	Morningside	Completed
Booker Park Car Park	Birkin Rd	Bellbowrie	Completed
Bellbowrie Shopping Plaza Car Park	Birkin Rd	Bellbowrie	Completed
AS Yard	Telegraph Rd	Bracken Ridge	Scoping
White Hill Reserve	Boundary Rd	Camp Hill	Completed
Not Applicable	Cnr Creek Rd and Old Cleveland Road	Carindale	Confirmed location not used.
Carindale Regional Office Hardstand/Carpark	2 Millennium Blvd	Carindale	Scoping
Green Hill Reservoir	Russell Tce	Chapel Hill	Completed
Queenscroft Street Park	Queenscroft St	Chelmer	Completed
Chelmer Park and Ride	Halsbury S	Chelmer	Completed
Not Applicable	Cliveden Ave	Oxley	Confirmed location not used.
Not Applicable	Hughes Lane	Corinda	Confirmed location not used.
Monier Road Park	Monier Rd	Darra	Scoping
Not Applicable	Venner Road (both ends) Dead end into Fehlberg	Fairfield	Completed
Fairview Street Park	Fairview Street Park	Fairfield	Completed
Goodwin Park	Brisbane Corso	Fairfield	Completed
Not Applicable	78 William Street	Fairfield	Completed
Not Applicable	Cnr of Turner Street and Brougham	Fairfield	Completed
Cubberla Creek Reserve, Fig Tree Pocket Reserve	Fig Tree Pocket Rd	Fig Tree Pocket	Confirmed location not used.
Mactier Street Park	Mactier Street	Fig Tree Pocket	Completed
Western District Netball Club, Faulkner Park	Leybourne St	Graceville	Completed
Souths Graceville Rugby League Club -Graceville Avenue Park	247 Graceville Ave	Graceville	Completed
Not Applicable	Appel Street	Graceville	Completed
Giraween Park	Cnr White and Lorna Sts	Graceville	Completed
Hawthorne Park Car Park	Oak St	Hawthorne	Completed
Victoria Park	Gilchrest Ave	Herston	The site will be used as car parking during the construction of Legacy Way. The site will be restored after completion of Legacy Way.
Robertson Park	Indooroopilly Road	Indooroopilly	Completed
Sir John Chandler Park	Meiers Road	Indooroopilly	Due to damage sustained to Meiers Rd, access to site is not available.
Not Applicable	Lower River Tce	Kangaroo Point	Confirmed location not used.
Anthony Short Oval, Illawong Reserve	College Rd	Karana Downs	Completed
Not Applicable	20 Distribution St	Larapinta	Confirmed location not used.
Mt Coot-tha Botanical Gardens	Mt Coot-tha Rd	Mt Coot-tha	Confirmed location not used.
Mt Coot-tha Botanical Gardens	Mt Coot-tha Rd	Mt Coot-tha	Completed
Mt Coot-tha Helipad	Mt Coot-tha Rd	Mt Coot-tha	The site will be used as car parking during the construction of Legacy Way. The site will be restored after completion of Legacy Way.
Slaughter Falls and Simpson Picnic Reserve	Mt Coot-tha Rd	Mt Coot-tha	Completed
Car Park	Nudgee Road	Nudgee	Completed
Not Applicable	Oxley Avenue	Oxley	Confirmed location not used.
Not Applicable	Oxley Station road	Oxley	Confirmed location not used.

Temporary Waste Sites			
Location Name	Street Address	Suburb	Phase
Not Applicable	120A and 112A Progress Rd	Richlands	Confirmed location not used.
Not Applicable	295 Archerfield Rd	Richlands	Completed
Not Applicable	63 Melbourne St	Rocklea	Scoping
Not Applicable	Heaton St	Rocklea	Confirmed location not used.
Not Applicable	Tramore St	Rocklea	Completed
Not Applicable	Leeds St	Rocklea	Confirmed location not used.
Not Applicable	Goburra St	Rocklea	Confirmed location not used.
Not Applicable	Elmes St	Rocklea	Confirmed location not used.
Bus Depot site	Sherwood Rd	Rocklea	Completed
Not Applicable	Jennifier Street	Seventeen mile Rocks	Completed
Not Applicable	Counihan Street	Seventeen mile Rocks	Completed
Sherwood Forest Park	Jolimont Street	Sherwood	Whole of park restoration, Not commenced
Curlew Park Car Park	Curlew St	Shorncliffe	Completed
Guyatt Park	Macquarie St	St Lucia	Completed
Orleigh Park	Orleigh St	West End	Confirmed location not used.
	Riverside Dr	West End	Confirmed location not used.
Musgrave Park	Cordelia St	West End	Completed
Former LAS Parks Depot	McDonald Rd	Windsor	Completed
Not Applicable	187 Hyde Road	Yeronga	Confirmed location not used.
Goodwin Park	Cnr Cansdale St and Brisbane Cso	Yeronga	Completed
Yeronga Park and Ride	Fairfield Rd	Yeronga	Completed
El Salvadore Soccer Club, Leyshon Park	Cansdale St	Yeronga	Completed
Oxley Golf Course	Oxley Rd	Oxley	Completed

Brisbane City Council

Asset Management Plan

Bridges and Culverts



Dedicated to a better Brisbane

Prepared by Strategic Asset Management – Structures

Asset Management Branch

26 July 2011

Development Control and Assessment

Prepared by:

Name and Title	Date	Signature
[redacted]	26/07/11	
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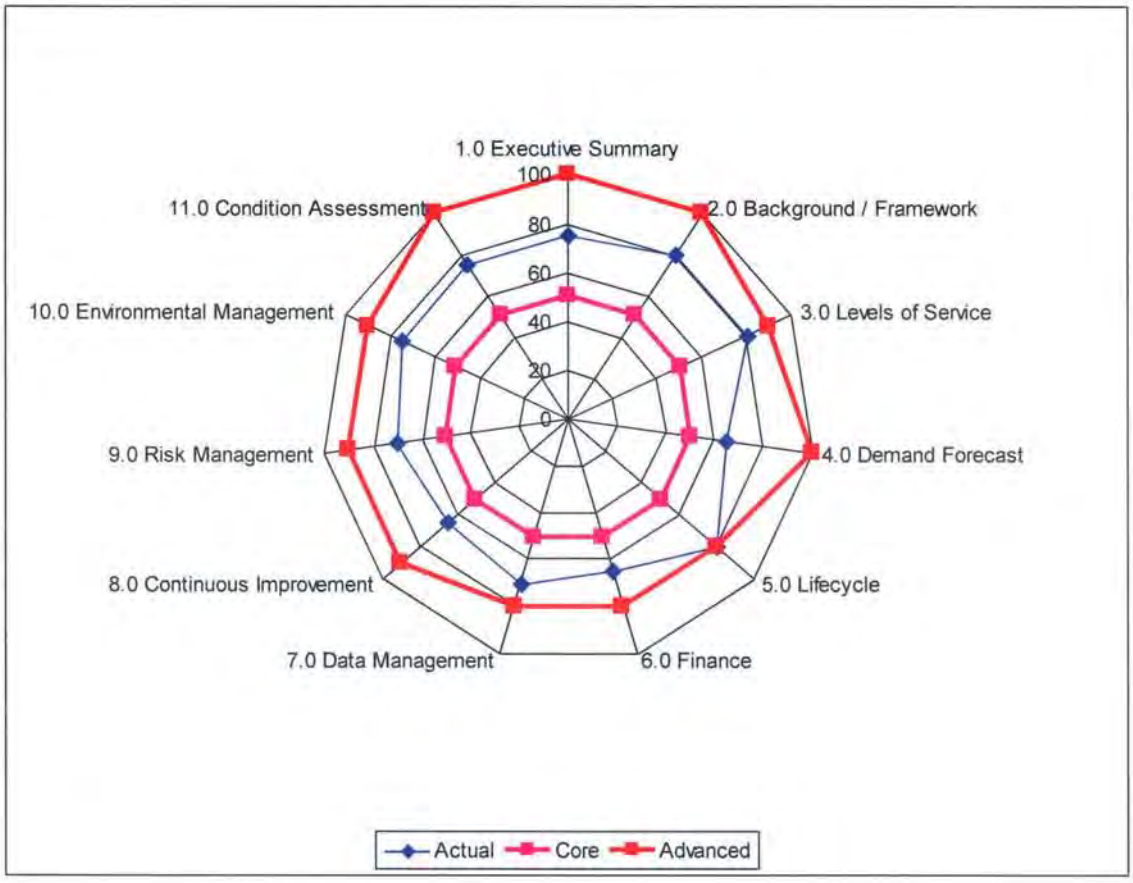


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1.0 - Executive Summary

Purpose

This Asset Management Plan (AMP) is a forward-focused asset lifecycle strategy for Council's bridges and culverts. These assets provide drainage under the road, bicycle and pedestrian path networks, to facilitate an effective transportation network supporting Council's Moving Brisbane Program, and aligning with the Living in Brisbane 2026 shared vision for the city's future.

Asset Description

This AMP covers all bridge and culvert assets including road bridges, cross-river bridges, pedestrian bridges, boardwalks and culverts located within Brisbane City Council and managed by Asset Management Branch (AM) on behalf of the asset owners. The assets are summarised in the following tables and grouped by the asset owner. There are only seven timber bridges in the 240 vehicular bridges in council's road networks.

Table { SEQ Table * ARABIC } - Brisbane Infrastructure (BI) – Transport & Traffic Program (T&T) Assets

Structure Type	Number
Road bridges	240
Cross river bridges	7
Pedestrian bridges	280
Road culverts	1,456
Boardwalks	29
Total	{ =SUM(ABOVE) }

Table { SEQ Table * ARABIC } - City Planning & Sustainability (CP&S) - Natural Environment & Sustainability (NES)

Structure Type	Number
Park bridges	232
Culverts	311
Total	{ =SUM(ABOVE) }

Network and Costs

The replacement and written down values of the assets covered by this AMP is $1.562 b and $1.007 b respectively and the replacement value represents 7.8% of Council's total asset portfolio.

Revaluation

The physical revaluation takes place every five years and in the intervening years, a desktop revaluation takes place. The physical revaluation for all structures took place during 2009/2010. It is likely that future bridge replacement costs will continue to escalate. It is possible the remaining lives will also be extended and this is based upon the latest condition

assessments currently under way. If both events occur, it is unlikely to have a major depreciation impact.

Future Demand

Significant events that occurred during the 2009/10 and 2010/11 financial years were the opening of the CLEM 7 tunnel and the Gateway Duplication Bridge which will reduce the traffic flow on some bridges within the CBD. Although this rerouting will have little impact on the bridge degradation, it will facilitate a longer window of opportunity to progress maintenance activities on those bridges. The large take-up of public transport and cycle ways has arrested some traffic flow over all bridges, but this has been largely offset by an increasing population and resulting traffic volume.

Funding

The summary of approved capital (rehabilitation and reconstruction) and recurrent (inspections and general maintenance) expenditure in the budget delivered in June 2011 for 2011/12 and forecast expenditure up to 2020/21 financial year are given below ($million). Details are given in Appendix 2.

Owner - BI

	11/12	12/13	13/14	14/15	15/16	17/18	18/19	19/20	20/21	21/22
Recurrent	4.482	11.438	11.438	11.438	11.438	11.438	11.438	11.438	11.438	11.438
Capital	8.099	11.862	12.744	12.784	15.448	15.448	15.448	15.448	15.448	15.448

Owner – TP&S

	11/12	12/13	13/14	14/15	15/16	17/18	18/19	19/20	20/21	21/22
Recurrent	0.260	0.460	0.460	0.460	0.460	0.460	0.460	0.460	0.460	0.460
Capital	0.536	0.215	0.300	0.325	0.325	0.325	0.325	0.325	0.325	0.325

The rehabilitation and maintenance expenditure over the past five years has averaged $6 and $6.5 million p.a. respectively. Additional investment will be allocated to condition assessments from 2011 due to the increasing average and median ages of the bridges. It is expected that maintenance and rehabilitation costs will also rise to address maintenance and rehabilitation works which will be identified through the increased volume of inspections.

Levels of Service

In 2007/2008, the results of Council's community engagement processes indicated the community wanted a road and bridge network that:

- Is safe to use in all weather conditions
- Has enclosed meshing on pedestrian overbridges over roads
- Has a smooth ride including the approaches to bridges
- Provides accessibility for pedestrians and bicycles
- Is well line-marked with night lighting
- Is structurally sound

Council's design standards have been updated to incorporate all requests and a retrofit program is in its second year and is being implemented according to budgetary priorities. Performance and monitoring levels have been jointly set with T&T Branch.

Condition Assessments

Level 1, 2 and 3 inspections are carried out at predetermined intervals for all bridges, culverts and boardwalks to comply with industry standards. A rating system of 1 to 5 is applied with 1 being as new and 5 being unserviceable. The percentages of bridges by number in the five categories are 5%, 60%, 28%, 7% and 0. About 90% of road bridges are performing below their required current level of services because their designed loadings are smaller than the current standard loadings.
At present the priorities for maintenance works are assessed via Level 2 inspections. The standard risk approach (probability of failure versus consequences of failure) is used to determine the priority of maintenance works and an asset risk plan for bridges and culverts has been developed and is being implemented.

Funding Gap

A backlog of rehabilitation works has existed over recent years due to the low frequency of Level 1 and Level 2 inspections as a result of budgetary constraints and affordability. However this is being addressed through the implementation of a structured inspection and maintenance program and requesting an increase in reconstruction and rehabilitation funding levels in future years.

Data Management

Each structure is assigned an identification number and a number plate is physically attached to the structure. Relevant statistical data and financial data are stored in the Ellipse database which is maintained by the Finance team in the AM branch. A structures data base is being developed by Asset Information Management (AIM) to record inspections and conditions, future inspection dates, future maintenance, maintenance history and data in the Ellipse. Presently inspection data and maintenance data are maintained by Field Services (FS).

Maintenance

Maintenance works including lighting and graffiti removal is carried out by FS with an annual budget of $12.5 million. The maintenance programme is administered from the Story Bridge depot of FS which is located at 234 Main Street, Kangaroo Point.

Climate change

In addition to actions or loads from vehicles, bridges are designed for climatic changes taking into account variations in wind, rain and temperature. Discussions have commenced on the likely impact these changes may have on the asset performance. The outcomes will be included in the future revisions of Council development guidelines.

Overall

Generally the bridges, culverts and boardwalks are in a good condition.

2.0 - Background / Framework

2.1 - Background

2.1.1 - Purpose of the Plan

Council's bridge, culvert and boardwalk network provides road, river, creek and waterway crossings for vehicles, cyclists and pedestrians to facilitate an effective transportation network supporting Council's Moving Brisbane Program, and aligning with the Living in Brisbane 2026 shared vision for the City's future.

This AMP is a forward-focused asset lifecycle strategy for Council's bridges and culverts which are providing drainage under the road, bicycle and pedestrian path network.

The AMP has been prepared with an aim to:

- Demonstrate to the community and stakeholders that bridges and culverts are being managed sustainably and uninterrupted transport services are delivered effectively and efficiently to the travelling public.
- Ensure continuity of the services by managing the social, environmental and financial risks associated with these critical assets.
- Ensure that effective, reliable and comprehensive operational processes are in place for recording hazard and defect inspections, maintenance programs, repairs and follow-up actions to meet the minimum levels of service defined by Brisbane City Council.
- Meet the requirements of Department of Local Government and Planning for completion of a 'Core asset management plans' by 30 September 2011.
- Forecast future funding requirements for budgeting purposes.

2.1.2 - Relationship with other Planning Documents

The following planning documents should be read in conjunction with this AMP:

- Brisbane City Plan 2000 (modified July 2010).
- Organisation 2014 Strategy.
- Corporate Plan 2008-2012 (updated 2009).
- Our Shared Vision – Living in Brisbane 2026
- Brisbane Long Term Infrastructure Plan (2007)
- TransApex
- *City Centre Master Plan 2006*
- Climate Change and Energy Taskforce Final Report: AAMII for Action

Also, please refer to section 3.2.1 of this AMP which includes Council's strategic and corporate goals.

The AMP for Brisbane's asset portfolio are one of a number of plans, policies and strategies that shape Council's approach to managing a complex city and achieving the Living in Brisbane 2026 Vision.

The relationship between the AMP and other planning documents are shown in the Figure 1 Total Asset Management diagram and Figure 3.

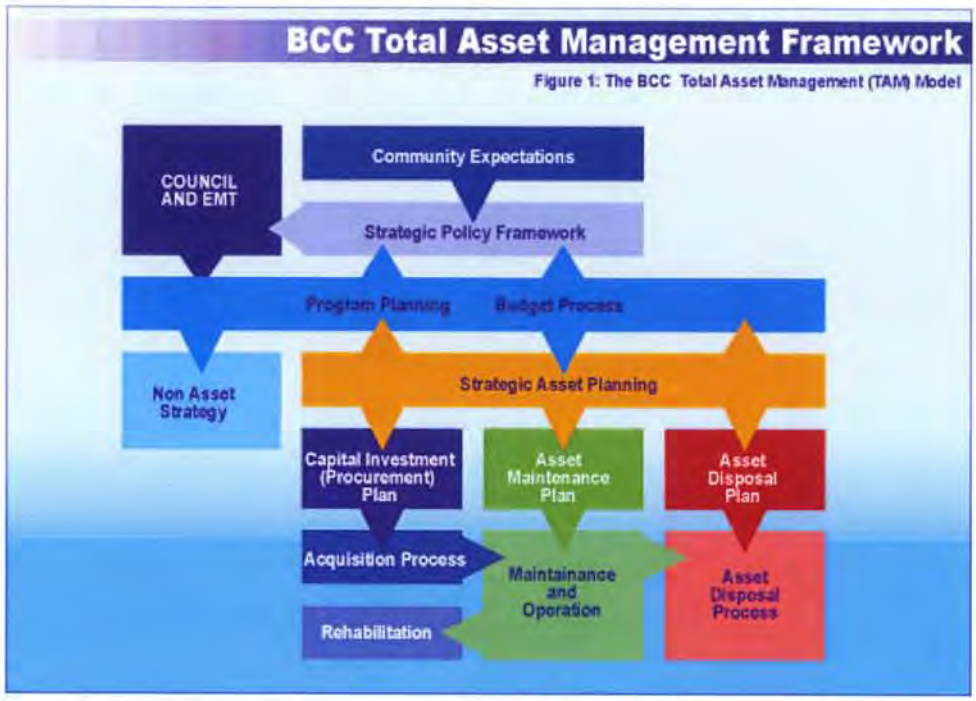


Figure { SEQ Figure * ARABIC }- Total Asset Management diagram

2.1.3 - Infrastructure assets included in the Plan

The assets included in the Bridge and Culvert AMP are:

The Program Sponsor - Transport and Traffic Program, Brisbane Infrastructure

- Vehicle bridges and culverts over roads, railways, rivers and waterways
- Pedestrian and cycle footbridges and culverts over roads, rivers and waterways
- Vehicle and pedestrian tunnels under roadways and railways
- Boardwalks
- Road Surfaces of bridge structures jointly shared responsibilities with QR
- Bridges and culverts jointly owned with other Local Government Authorities

The Program Sponsor - NES Program, City Planning & Sustainability

- Park bridges and culverts. These bridges are mainly pedestrian bridges

This plan does not include items attached to bridges and culverts by service providers such as Queensland Urban Utilities (QUU), Energex, Telstra, Optus, Gas suppliers.

2.1.4 - Key Stakeholders included in the Plan

The key stakeholders in asset management planning for bridges and culverts are:

Internal

- Program Manager Transport & Trafifc (T&T)
- Program Manager Natural Environment & Sustainability (NES)
- Lord Mayor and Councillors
- Field Services
- City Planning & Design
- Active Transport

External

- Ratepayers
- Residents of Brisbane and Visitors
- Service Providers
    - QUU
    - Telstra
    - Optus
    - Energex
    - Gas Suppliers
- Consultants and Contractors
- State Government Departments including Department of Local Government and Planning, Department of Transport & Main Roads, Queensland Rail
- Police Services, Ambulance Services, State Emergency Services (SES), Queensland Fire Brigade

2.1.5 - Organisation Structure

T&T has program ownership of all bridges, culverts and boardwalks on dedicated roads and on the Council's bikeway network. NES has program ownership of all bridges and culverts within Council parklands which are not on designated bikeways.

The organisational structure for the asset management of bridge, culvert & boardwalk assets is as follows:



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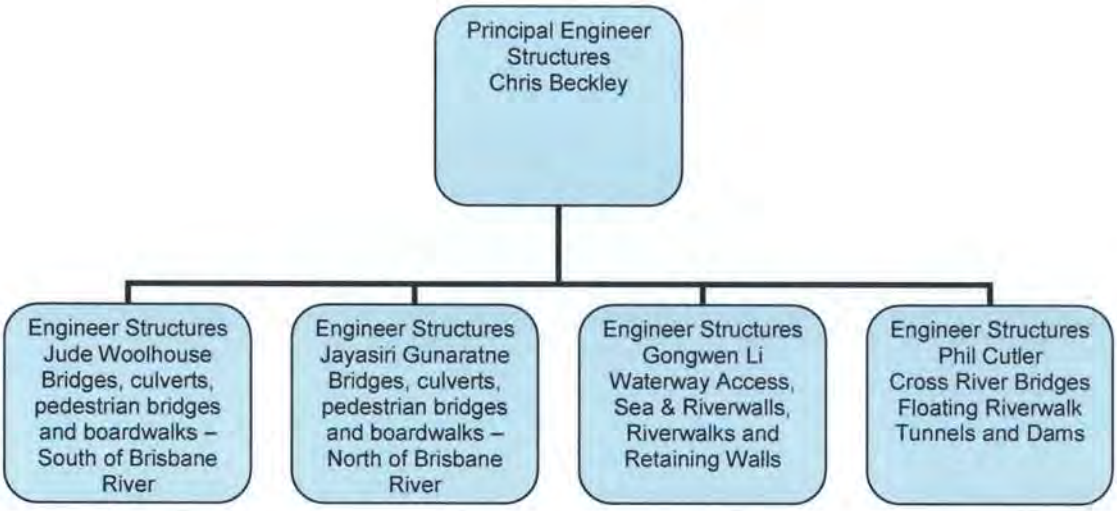


Figure { SEQ Figure * ARABIC }- Organisational Structure for Bridge & Culvert Management

On behalf of T&T and NES, Asset Management – Structures team provides strategic asset management direction and coordination and delivery of the annual rehabilitation programs. Asset Management Branch has responsibility for the development and dissemination of Specifications and Standards.

Asset Management Branch also provides operational maintenance management in terms of reactive and programmed maintenance, including project listing, estimating and coordinating design. FS manage operational maintenance of the bridges and culverts (i.e. cleansing and aesthetic issues) in conjunction with the overall parks and roads management.

City Planning & Design and FS are internal service providers. City Planning & Design provides bridge, culvert and boardwalks design services while FS provides bridge, culvert and boardwalks construction, repairs and maintenance services. In addition, a range of external service providers are used as required.

2.2 - Goals and Objectives of Asset Ownership

2.2.1 - Reasons and Justification for Asset Ownership

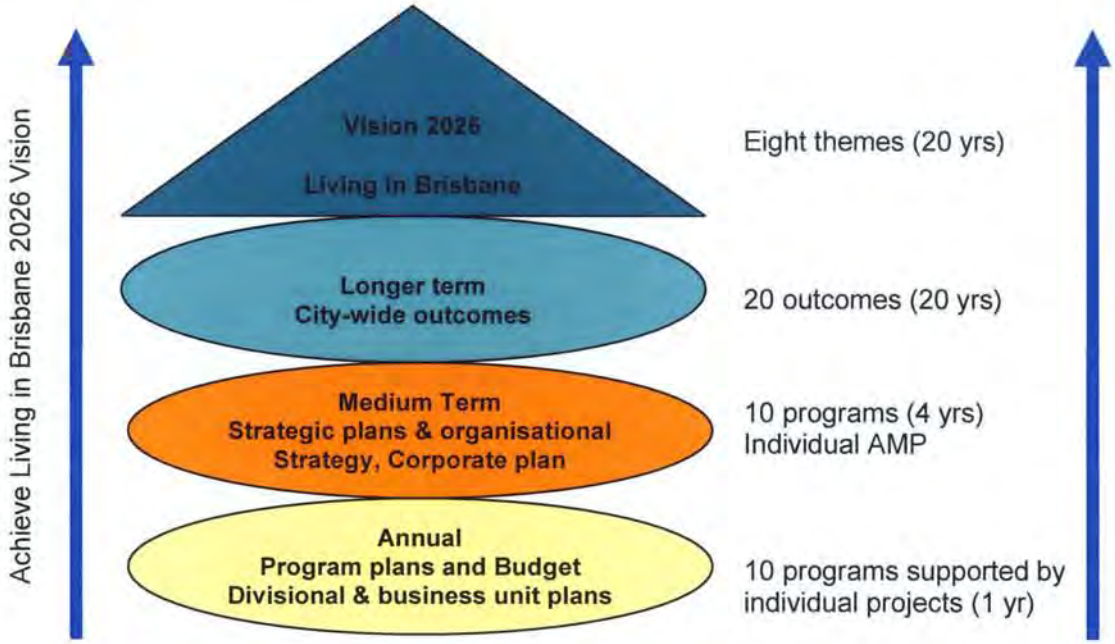
Under the City of Brisbane Act 2010, council has control of all roads in Brisbane except a State-controlled road, or a road, or that part of a road within an airport site under the Airports Act 1996 or a public thoroughfare easement. This control includes being able to construct, maintain and improve roads. A footpath or bicycle path, or a bridge, culvert, ferry, ford, punt, tunnel or viaducts have been defined as roads in the Act.

Council recognises the responsibilities imposed by the Act and creates, maintains and replaces Council's bridge, culvert and boardwalk assets which provide road, river, and creek and waterway crossings for vehicles, cyclists and pedestrians in order to provide an efficient transport network and maintain effective access across the city.

In some cases such as the Inner City Bypass, third party organisations (eg. Leighton Contractors) maintain the road, bridge and tunnel structures but ownership vests with council.

2.2.2 - Links to Organisation Vision, Mission, Goals and Objectives

Brisbane City Council (BCC) has produced a visionary document titled "Living in Brisbane 2026" which contains eight themes and twenty City-Wide Outcomes as part of a comprehensive, shared vision for Brisbane's development to 2026. It is a central component to BCC' s strategic planning framework, providing guidance on how BCC' s various services and activities integrate to support the city's future. The vision for 2026 is supported by Council's medium term and annual plans and sub-plans. The AMPs operationalise Council's AM policy and AM strategy.



2.3 - Plan Framework

2.3.1 - Key Elements of the Plan

The asset management plan consists of the following elements:

- Levels of Service – specifies the services and levels of service to be provided by council.
- Future Demand – how this will impact on future service delivery and how this is to be met.
- Lifecycle management Plan – how Council will manage its existing and future assets throughout their lifecycle including design, acquisition, operations, maintenance and disposal to provide the required services.
- Financial Summary - what funding are required to provide future services.
- Asset Management Practices such as inspections and maintenance activities.
- Condition Assessment.
- Plan Improvement and Monitoring.
- Risk Management.
- Impact of Climate Change and Environment.

Each area is broken down into several related elements and these follow within this document. The elements address strategic and operational issues existing in the internal and external environments. Issues that were identified during the preparation of this plan, but could not be resolved before the AMP due date; have been recorded as action items and included in Appendix 1.

2.4 - Core and Advanced Asset Management

2.4.1 - Outline the Core to the Advanced Approach

Asset management planning may be undertaken initially to meet minimum legislative and organisational requirements for financial planning and reporting. This is referred to as the 'core' approach to asset management. Enhancements may seek to strengthen asset management outputs by using an 'advanced' approach for gathering asset information for individual assets to support the optimisation of activities and programs to meet agreed service standards.
This AMP is prepared as a 'core' AMP using the International Infrastructure Management Manual guide. It is prepared to meet minimum legislative and organisational requirements for sustainable service delivery and long term financial planning and reporting. Core asset management is a 'top down' approach where analysis is applied at the 'system' or 'network' level. Future revisions of this asset management plan will move towards 'advanced' asset management using a 'bottom up' approach for gathering asset information for individual assets to support the optimisation of activities and programs to meet agreed service levels. This AMP has a mix of core and advanced asset practices as follows:

Capability	Description	Core	Advanced
Knowledge of Levels of Service	Understanding of Levels of Service is at an advanced level		X
Ability to Predict Future Demand from Customers	A core understanding is known as future demand is based on user and Councillor request	X	
Knowledge of Ownership	Knowledge of Ownership is at an advanced level	X	
Knowledge of Physical Condition	A core level of the Knowledge of Physical condition is known and will be improved upon the completion of Level 2 inspections	X	
Knowledge of Performance (Reliability)	A Knowledge of the Performance of the asset is known at an advanced level		X
Knowledge of Current Utilisation and capacity	Knowledge of Current Utilisation and capacity is based on user and Councillor complaints		X
Ability to Predict Failure Modes	The Ability to Predict Failure Modes of the asset is at an advanced level		X
Ability to Analyse Alternative Treatment Options	The Ability to Analyse Alternative Treatment Options for an asset is at an advanced level		X
Ability to Rank Works Based on Economic Analysis	A core level of Ability to Rank Works Based on Economic Analysis is known and will be improved upon the completion of Appendix 1	X	
Ability to Rationalise Works to Suit Budget	The Ability to Rationalise Works to Suit Budget is at an advanced level		X
Ability to Optimise Operations and	A core level of Ability to Optimise Operations and Maintenance Activities is known and will	X	

Maintenance Activities	be improved upon the completion of Appendix 1 action items		

2.4.2 - Sophistication / Limitations of this Asset Management Plan

The level of asset management sophistication adopted (core versus advanced AM planning) needs to reflect the strategic business objectives of the organisation as well as meeting legal requirements, community needs and available resources.

This AMP aims at least at a core approach to asset management, which provides basic technical management outputs such as statements on current levels of service, forward replacement programs and associated cash flow projections. Based on this core approach, decisions are made at a systems level using simple analysis processes.

Some limitations of this plan include the following:

- Although critical assets are identified, a complete risk register is yet to be developed. However a risk assessment is attached in Appendix 11.
- Asset condition information is not linked to Ellipse system at this stage.
- Prioritising of future capital project is based on Level 2 & 3 inspections not on cost benefit analysis.
- Levels of service is based on historical performance and will be expanded upon and complement Service Level Agreements.

3.0 - Levels of Service

3.1 - Customer Research and Expectations

3.1.1 - Background and Customer Research Undertaken

In 2007/2008, the results of Council's community engagement processes indicated the community wanted a road and bridge network that was

- Safe to use in all weather conditions.
- Enclosed meshing on pedestrian overbridges over roads.
- Smooth ride including the approaches to bridges.
- Accessibility for pedestrians and bicycles.
- Line marked with night lighting.
- Structurally sound.

Council currently uses general forms of contact (telephone and counter discussion and correspondence) in relation to public enquiry and complaint.

3.1.2 - Details of how Research translates into Levels of Service

Council's design standards have been updated to incorporate all requests and a retrofit program is in its second year, implemented according to budgetary priorities. Performance and monitoring levels have been jointly set with T&T. This will be further investigated for future updates of the AMP.

3.2 - Strategic and Corporate Goals

3.2.1 - Organisation Strategic Goals and impacts on the Asset Management Plan

In late 2006 Council developed *Our shared vision - Living in Brisbane 2026*, a strategic document which outlines the council's vision and future direction. Council's strategic goals associated with bridges are evident in the following vision theme:

- "Accessible, connected city - Layers of diverse transport networks interconnecting at centres and urban villages"
- A diversity of private (cars, bikes, walking) and public (trains, buses, ferries) transport using many pathways and networks, interconnecting at mixed use centres and urban villages.

Council's Corporate Plan supports the *Living in Brisbane 2016* vision through the development and implementation of programs and strategies that are incorporated into the AMP. Program 3 "Moving Brisbane" within Corporate Plan 2008 -12 manages Brisbane's road and transport network to facilitate efficient movement of people and freight.

Figure 3 which follows, details the asset management planning framework within a national, state, regional and city context, providing a high level overview among the different levels of Government.

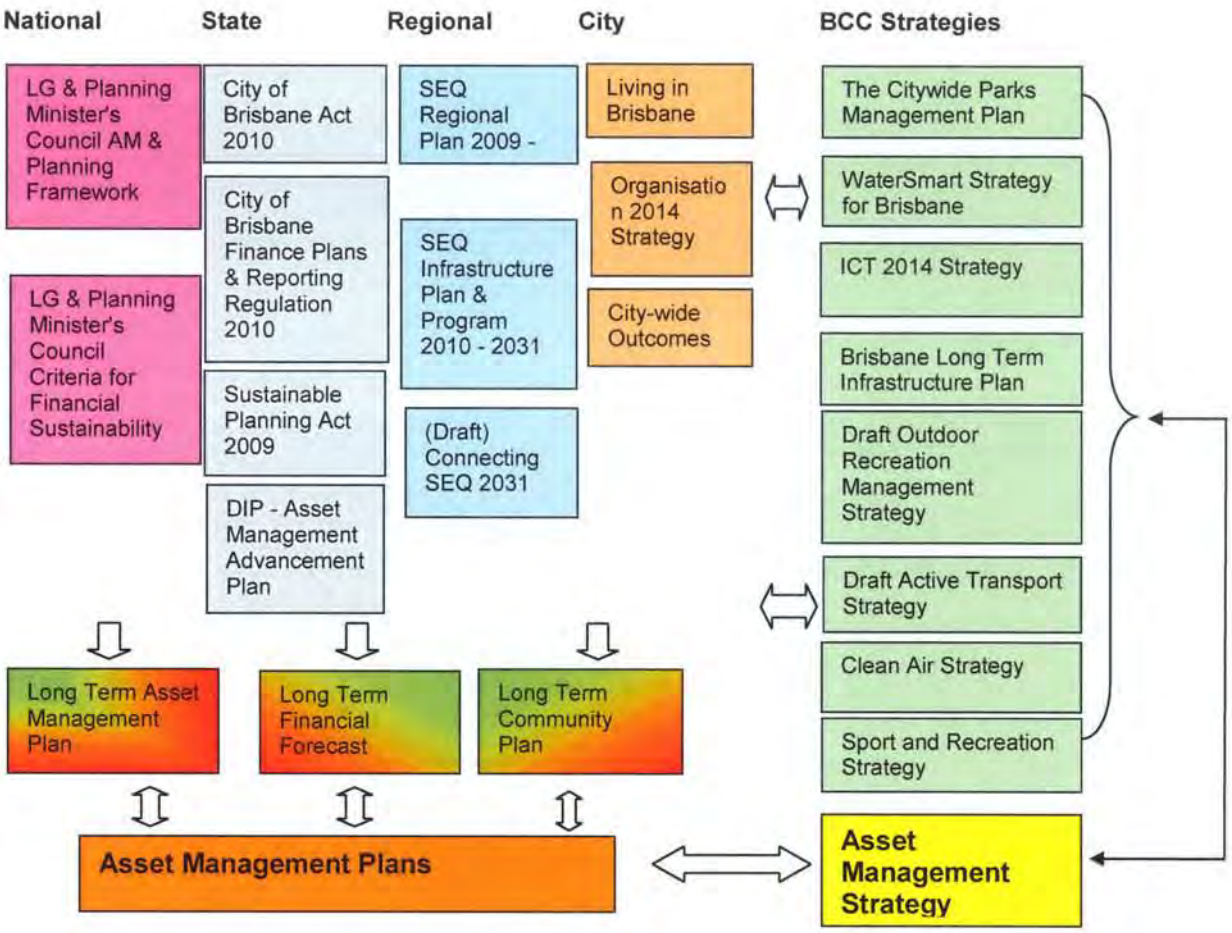


Figure { SEQ Figure * ARABIC } – Interactions with other planning documents

3.3 - Legislative Requirements

3.3.1 - Background Legislation or Regulations which affect Asset Operation or require certain Levels of Service

Prior to the abolition of the common law rule of nonfeasance (Highway rule) by the High Court in May 2001, road authorities in Queensland were protected from the findings of negligence associated with condition of their road network (include bridges and culverts) due to any failures to carry out maintenance or improvement works proactively. Now, road authorities in Australia can be held negligent for both carrying out substandard work on and for failing to maintain roads.

However, like some other states in Australia, Queensland has reinstated nonfeasance immunity through section 37 of the Civil Liability Act 2003. The section seeks to limit the liability of road authorities in Queensland, but it usually only applies if an authority did not have knowledge of a hazard that had a causal role in an incident. Where an authority did

have knowledge, it would need to rely on "policy defence" principles to demonstrate it had acted reasonably. To show that the Council has exercised its duty of care to the bridge users, it needs to demonstrate that there is a reasonable inspection regime to identify/record defects and a reasonable planning and repair regime to arrest those defects.

New assets, and asset enhancements, are to be designed by a Registered Professional Engineer, Queensland (RPEQ) to satisfy the following State and BCC legislative requirements and Australian Standards.

- Development Guidelines of Brisbane City Council.
- The Australian Standards AS 5100 - Bridge Design.
- Precast Reinforced Concrete Box Culverts –Small Culverts – AS 1597.1.
- Precast Reinforced Concrete Box Culverts –Large Culverts – AS 1597. 2.
- Design for Installation of Buried Concrete Pipes – AS 3725.
- Austroads Publication – Guide to Road Design.
- Transport Infrastructure Act [which retains Section 86 of the Harbours Act].
- The requirements or approvals which arise under the Sustainable Planning Act 2009 (SPA) via Council's planning scheme or other legislative requirements linked to the SPA by Schedule 3 of the Sustainable Planning Regulation.
  Note: Strategic permits & policies may exempt Council from the need to seek approvals for certain categories of work – seek advice from environmental specialists.
- Water Act, particularly Section 266 relating to destruction of vegetation, excavation or filling in non-tidal waterways
- Cultural Record (Landscapes Queensland and Queensland Estate) Act relating to Aboriginal and historic sites
- Environmental Protection and Biodiversity Conservation Act, particularly Section 68 relating to wetlands, nationally threatened species and ecological communities, migratory species, and Commonwealth Marine Areas

3.4 - Current Levels of Service

3.4.1 - Define Current Levels of Service being provided by the Asset

The current Level of Service to be provided may be classified into two categories:

- Customer Level of Service - It relates to how customer receives the service in terms of Customer Satisfaction and safety of road surface and walking surface.
- Technical Level of Service - Measures of performance developed to ensure to ensure minimum customer levels of service are met. The measures relate to service criteria – Reliability, Condition and Responsiveness.

Customer Level of Service

New Assets

- New assets are constructed as a result of increasing traffic needs, resident or Councillor request, or are donated to Council as a result of private development or the state Government.
- The future demand for new assets is managed by T&T. The delivery of these new assets is the responsibility of Principal Transport Infrastructure Projects and for the larger projects the Major Infrastructure Projects Office (MIPO).
- Future demand for new assets in parklands is managed by NES. The responsibility for the delivery of these new assets is delegated to LAS or City Project Office.
- Replacement of existing assets is managed by Manager, Asset Management, in consultation with the relevant program sponsor.

Existing Assets

Customer satisfaction and safety is achieved by attending to the customer request within a specified time.

Technical Level of Service

Asset Management branch Assets manages the maintenance and rehabilitation of existing assets and is responsible for the replacement of those assets which cannot be economically maintained or rehabilitated. There are no KPI or performance indicators to monitor level of services and has been included in Action Item Plan (Appendix 1).

Structural adequacy

The assets are maintained in a safe structural condition. That is, they remain capable of supporting the design traffic loads without failure. Loss of structural strength may occur over time if the structure is allowed to deteriorate through, for example,

- Corrosion of steel structures
- Termite or fungal attack of timber structures
- Deterioration of concrete structures from various causes, resulting in the corrosion of embedded structural reinforcement.

Assets experiencing losses in structural adequacy are listed for works in either a capital or recurrent maintenance work schedule.
Asset Management branch manages the strategic management of pedestrian and bikeway bridges in parklands and are integrating these assets into the inspection, maintenance and upgrade programs under which the T&T assets are being managed.

Serviceability Requirements

Serviceability requirements include aspects such as:

- Deflection under live load
- Vibration
- Crack control especially in concrete structures
- Hydraulic capacity and flood immunity

Serviceability requirements are generally satisfactory for most road bridges. However, some deficiencies may be found in pedestrian structures in parkland. Some park bridges have been constructed without proper engineering design so hydraulic capacity and flood immunity of those structures are not satisfactory.
Asset enhancement to cater for changing traffic needs (e.g. bridge widening etc) is managed by T&T. Asset enhancement for hydraulic purposes is managed collaboratively by Water Resources and T&T.

Safety

Safety of the asset involves all elements that contribute to the safety of users of the asset and includes, but are not limited to:

- Maintenance of pedestrian and traffic railings/barriers
- Maintenance of pavement (road and walking surfaces)

T&T assets found to be in an unsafe condition are repaired within the recurrent maintenance work schedule. Due to high safety standards introduced in to current Australian Standards

related to bridges and culverts, most of old structures that were designed to comply with old standards need upgrading. Therefore an increase in the recurrent funding for maintenance of bridges and culverts is needed in these instances.

Achievement of design service life

Generally, the design life of bridges and culverts assets is 100 years but most of the structures will not reach the life span due to degradation of components under the environmental impacts without appropriate intervention. Concrete structures have good service life compared to timber and steel structures but need one or more significant rehabilitation interventions during its lifetime.

The useful life of steel structures and steel elements is highly variable as it depends on the environment and the location and can be improved by a quality coating system and a well designed maintenance plan.

The useful life of timber structures varies around fifty years. Timber bridges require frequent and extensive maintenance if longer service lives are required. The Asset Management branch strategy is to replace timber road bridges at the end of their service life with more durable concrete and fibre composite bridges. More timber pedestrian bridges and boardwalks are increasingly being rehabilitated or replaced with durable fibre composite materials which are suited to this asset type. The Asset Management branch has replaced several timber pedestrian bridges and one road bridge using fibre composite components. Increased competition in the supply of composite components may make this material a viable alternative.

Although it is a primary aim of maintenance of a structure to achieve its nominal design life, maintenance should be carried out only to the extent that the life cycle cost is optimised.

3.4.2 - Identify related Performance Measures

Structural adequacy

- Load rating as per AS 5100

Serviceability Requirements

- Deflection and vibration under live load – member size, span ratio requirements in the structural design codes
- Crack control especially in concrete structures – Steel percentages and crack widths mentioned in standards

Safety

- Height and type of pedestrian and traffic railings/barriers
- Traffic lane and walkway widths
- Maintenance of walking surfaces

Achievement of design service life

All bridges and culverts - 100 years as per AS 5100
Hydraulic capacity of crossing to cater for higher flood flows – Development Guidelines, QDEM and AS 5100

3.5 - Desired Levels of Service

3.5.1 - Provide details on the Levels of Service desired if different from what is being provided

Structural adequacy

All structures shall be structurally adequate for loadings specified in Australian Standards AS 5100, AUSTROADS and other associated codes and regulations.
The minimum design load for all road traffic bridges shall be SM 1600 load combination, based on requirements of AS 5100 and the particular traffic loadings expected to be received on the road in particular. Maintenance is a key issue affecting the design life of the structure. The design plans shall specify the design life of the structure together with the relevant maintenance programs to be adopted upon which the design life is based. Parameter used in the design shall also be shown on the design plans.

Safety

All assets are to be made safe for users. All structures shall be designed in accordance with AS 5100 and other relevant standards and codes to made safe for users.

3.5.2 - Provide details of differences between current and desired levels of service and how these gaps will be progressively closed

Most of existing bridges have been designed for lower loads compared to SM 1600 loadings given in the current Australian standard AS 5100. There is a need to rate the existing bridges and strength or provide load limits on bridges if necessary. AM has engaged external consultants to evaluate and load rate bridges which are on the heavy load routes. Traffic barriers and pedestrian barriers need upgrading to satisfy current standards.

4.0 - Demand Forecast

4.1 - Demand Forecast

4.1.1 - Factors influencing Demand

With a population of 1.0 million people, metropolitan Brisbane is a rapidly growing city in the centre of the fastest-growing region in Australia. As travel demand continues to grow with the population, Brisbane's roads and river crossings are at risk of becoming more congested. In addition to the growing population the other factors that will influence the demand are:

- New roads, bikeways or access ways that cross roads, creeks, waterways or the river.
- Increased vehicle, pedestrian or cycle traffic on existing crossings requiring enhancement, replacement or duplication of existing assets.
- Major traffic management initiatives such as the Legacy Way tunnel.
- Future demand for allowable vehicle loads is expected to increase. As a result, it will be necessary to re-evaluate structural adequacy of existing road bridges in future.
- Changes in design standards - increased vehicle loading and changes to barrier design.
- Community expectation to maintain major or heritage structures beyond their original design life.

4.1.2 - Details of projected growth or decline of demands on services

Future demand for renewals and new acquisitions will increase beyond the previous levels due to several factors:

- Population growth - future increases in population densities and numbers.
- Age profile - trends of an aging population.
- Leisure trends - increasing leisure travels.
- Real disposable income - increasing real disposable income and more vehicles on road.
- GDP growth.
- Council policies - increasing focus and emphasis on the river as a source of recreation.

4.1.3 - Anticipated changes in Customer Expectations

There has been an increase in customer expectations in service levels of maintenance on bridges, footbridges and boardwalks in recent years. Population growth and other factors mentioned in 4.1.2 will increased the customer expectation for maintenance quality of bridge and culvert assets.

4.1.4 - Impact of changes in Demand on Asset Utilisation

The impact of changes in demand over time on the service level offered should be established to understand cost implications across the whole life cycle of assets. Expressing services in user terms and quantifying different levels of service in user terms helps to examine the range of service levels.

4.2 - Changes in Technology

4.2.1 - Use of New Technology and effects on providing Future Services

Through innovation, council is implementing technology to do things smarter, faster and safer to deliver its *Living in Brisbane 2026* vision. Council will monitor and investigate advances in technology related to bridges and introduce them as appropriate.

Currently Council captures the inspection/condition data for bridge manually which is time consuming and resource intensive. Advances in technology have paved the way for recording data electronically which increases the asset inspection efficiencies by minimising the double handling data. Council is proposing to introduce electronic data capture system for field inspection and it has been included in Action Item Plan (Appendix 1).

To achieve the Living in Brisbane 2026 Vision of a "Clean and Green City" by reducing the carbon footprint generated through road works, FS has introduced "warm asphalt". Using "warm asphalt" up to a 30% reduction in energy and emissions is achieved, which makes it safer for employees and the environment. It also combats visual pollution as the warm mix process does not produce billowing smoke. In addition, the product has a longer lifespan, reduced energy costs and is easier to work with. "Warm asphalt" will be used for future resurfacing/renewal of pavement on the Go Between Bridge. Currently conventional asphalt is used for the pavement wearing surface for other cross-river bridges.

Council has introduced electronic toll collection technology rather than manual toll collection for the Go Between Bridge. This reduces the cost of toll collection as well as increasing traffic performance on the asset. Composite materials are becoming alternative materials for timber in bridge rehabilitations. Led lighting is another new technology used on bridges.

4.2.2 - Obsolescence

The ongoing manual data capturing process which is part of the bridge inspection system may become obsolete with the adoption of new technologies that will automate data gathering.

4.3 - Demand Management Plan

4.3.1 - Describe non-asset solutions available as alternatives to asset-based solutions (i.e. demand management, insurance, managed failures).

Brisbane City Council seeks to provide non-asset solutions (alternatives to the creation of new assets) to increasing demand for new infrastructure through a set of demand management strategies. The strategies focus on ways to modify customer demands in order that the utilisation/performance of existing assets is maximised and the need for new assets deferred or reduced.

The demand management strategies implemented by Brisbane City Council relevant to different demand components are shown in following table.

Demand Component	Strategies Implemented
Regulation	Load and Speed Restrictions
Demand Substitution	Encouraging the community to use public

Demand Component	Strategies Implemented
	transport and other modes of transport. Brisbane City Council's targets for 2026 (under "Accessible, connected city" theme- Living in Brisbane 2026 Vision) are to complete the estimated 1,700 kilometre bikeways network to encourage 41% of morning peak travellers to walk, cycle or use public transport

4.3.2 - Summarise new works programs and costs.

Work program for 2011/12 financial year is follows:

Description	Suburb	Cost
Bundaleer St Bridge Replacement	Brookfield	$400,000
Downey St Bridge over Enoggera Ck	Windsor	$120,000
Edgar St	Northgate	$300,000
Esther St	Deagon	$500,000
Meekes Rd Kholo Creek Crossing	Kholo	$150,000

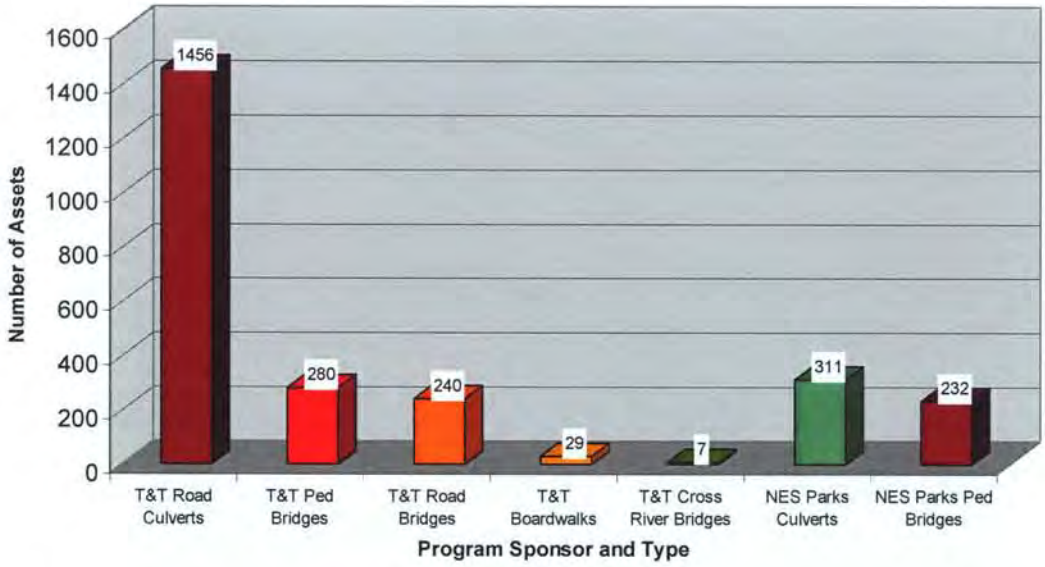
5.0 - Lifecycle

5.1 - Background Data

(i) - Physical Parameters

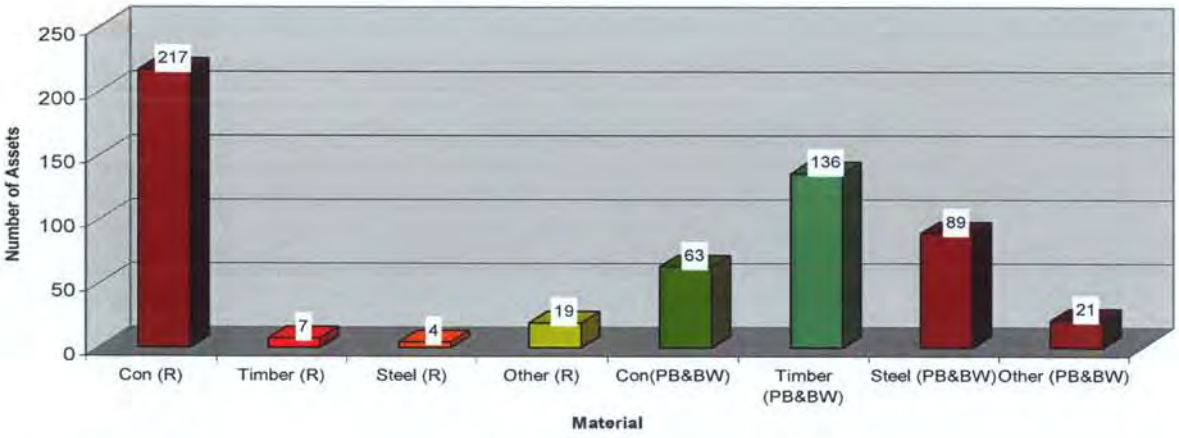
General comments on asset mix, age, size, material, location and current issues

Council's bridge and culvert network consists of the approximately 2,012 T&T structures including 247 road bridges, 280 pedestrian bridges, 1456 road culverts, 29 boardwalks and 543 NES structures including 232 park bridges and 311 culverts. The make up of these is shown in the graph below.



Bridges can be constructed from various materials. These are typically reinforced concrete, steel or timber. Composite fibre components are being increasingly used for durability reasons. Culverts are almost exclusively constructed from reinforced concrete pipes or box sections, while parks boardwalks are almost exclusively constructed from timber. The distribution of material types is shown in the diagrams Figure 4 and Figure 5.

Figure { SEQ Figure * ARABIC } -Transport & Traffic Bridges (excluding culverts) - Material Types
R – Road bridges, PB -Pedestrian



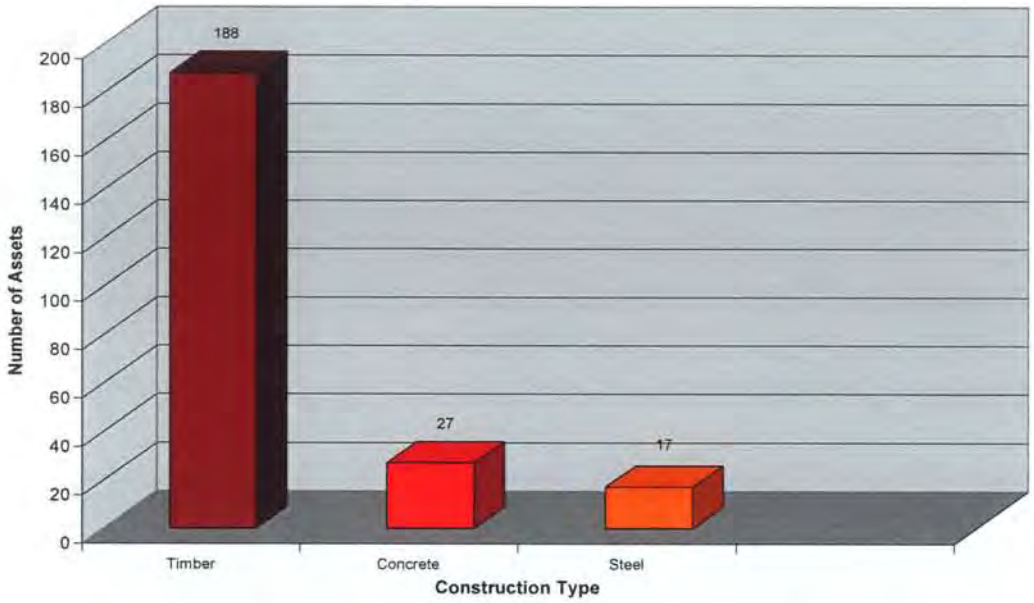


Figure { SEQ Figure * ARABIC } – Park bridges - Material Types

Basic physical parameters are included in the Ellipse and Property Management System databases. Methods and procedures for entering data are given in the documents:

- Managing Structural Asset Data – Bridges, Culverts, Boardwalks
- Asset Classification Manual – Bridge assets
- Asset Classification Manual – Culvert assets

Summary of total parameters in table, or graph formats. ie. Age distribution, size etc.

Construction dates are available only for T&T road bridges. Age or construction dates of NES structures are unknown.

Construction Date	Number of Bridges
Unknown*	70
Before 1920	05
1920/30	06
1930/40	09
1940/50	07
1950/60	17
1960/70	69
1970/80	84
1980/90	114
1990/2000	91
2000/2010	84
Total	{ =SUM(ABOVE) }

Note - * 70 structures have no recorded construction dates so Action Item Plan (Appendix 1) is included to estimate the construction dates.

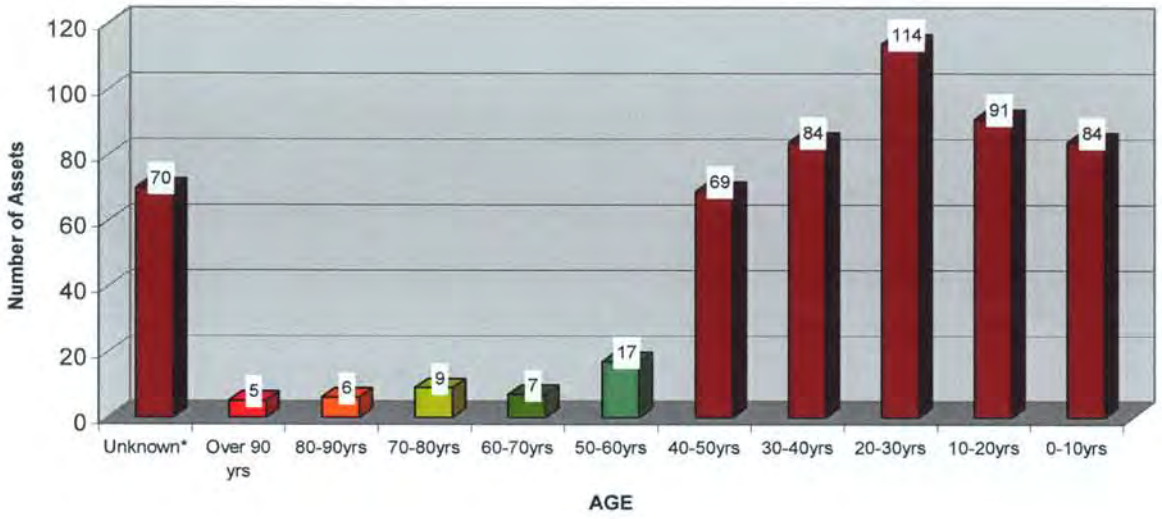


Figure { SEQ Figure * ARABIC } – Age Distribution of T&T Road Bridges

Include an overall plan of the asset system or network

The council owns a stock of 2,555 bridges, culverts, park bridges and boardwalks constructed at various times over the past 100 years. The following drawings (Figure 7 and 8) show the bridge and culvert locations within council.

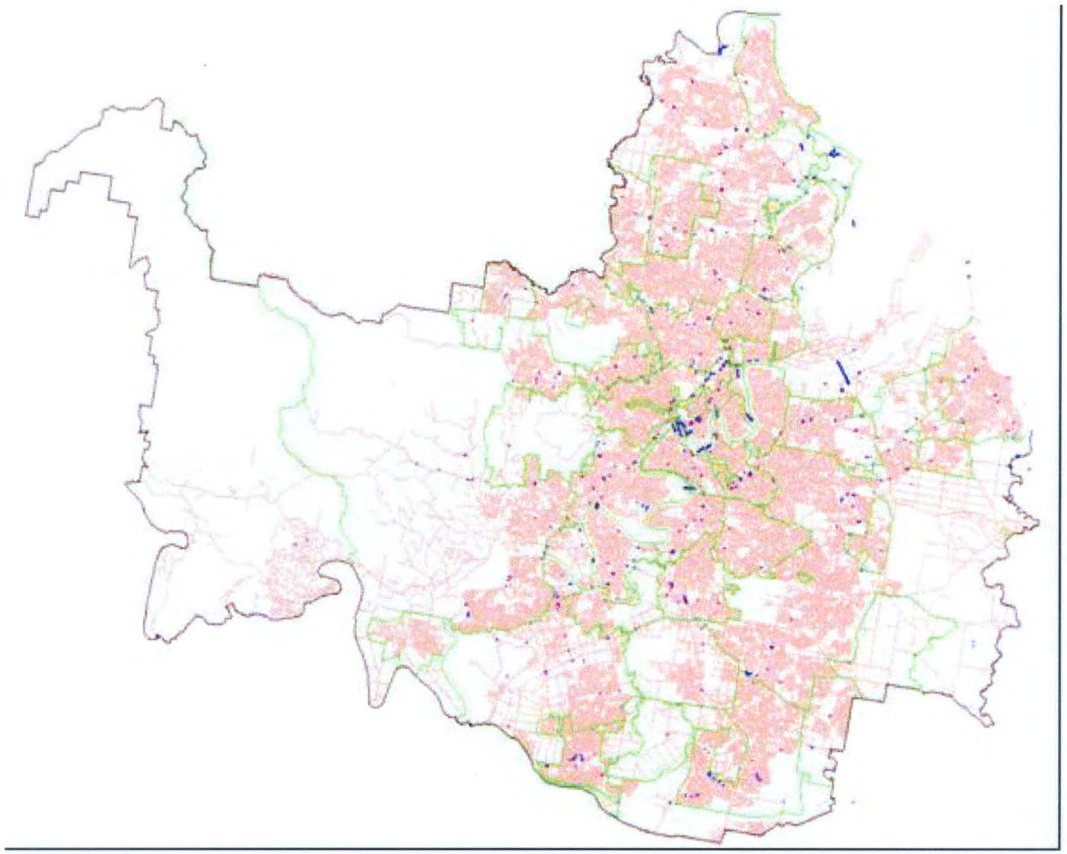


Figure { SEQ Figure * ARABIC } - Bridge Locations

The above image displays the locations, in blue, of the bridges that are maintained and operated by Brisbane City Council, The light pink lines represent the road network and the green lines show the boundaries between suburbs.

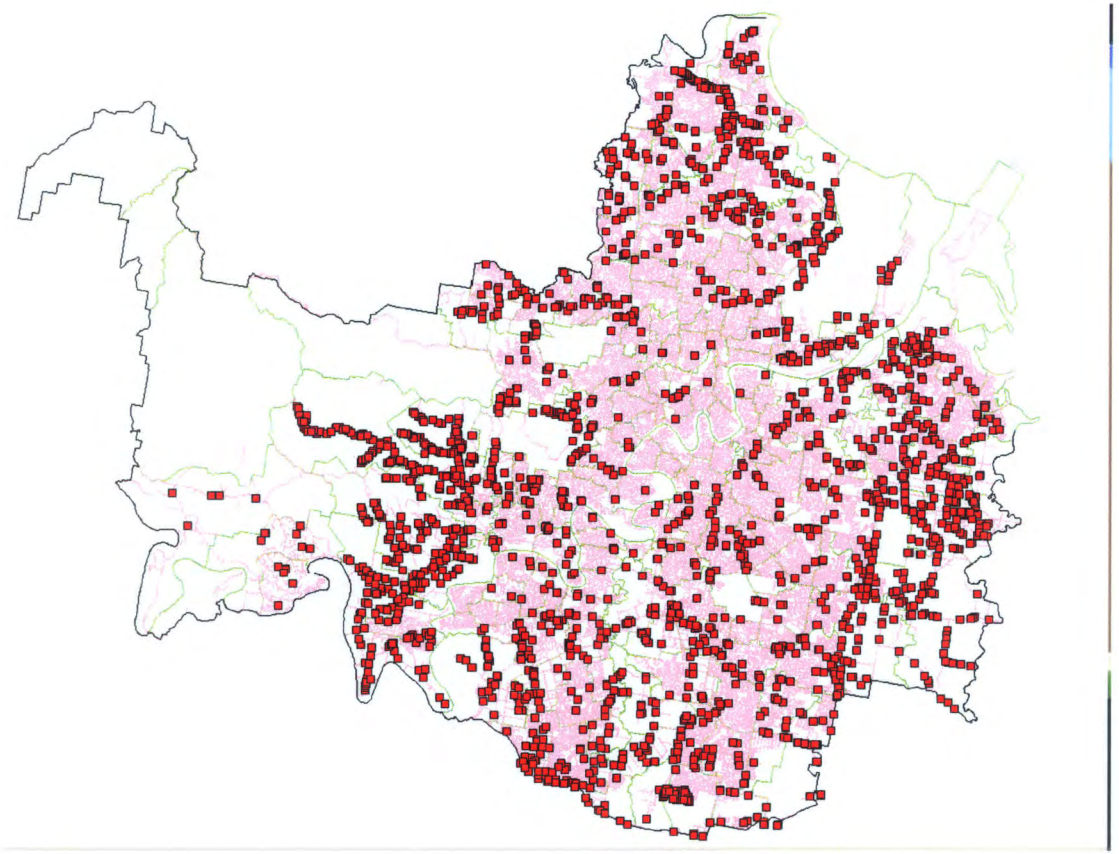


Figure { SEQ Figure * ARABIC } - Culvert Locations

The above image shows the locations of culverts, in red, that are owned and maintained by Brisbane City Council. The green lines represent the boundaries of the suburbs while the light pink lines denote Brisbane's road network.

How to obtain part-by-part asset information (i.e. database)

Council uses Ellipse- an integrated information system to store asset data for bridges and culverts. The Asset Information Management module within Ellipse facilitates the maintenance of a detailed register (Ellipse Equipment Register) of Council's assets including technical data, location and condition. However, there is no system to store part-by-part (component) data of bridges and culverts which is being developed by AIM.

(ii) - Asset capacity / performance

The current Australian bridge design standard - AS 5100 was published in 2004 and the major vehicle design loading specified is SM 1600. Approximately 90 % of road bridges were constructed before 2004 and obviously designed according to design loadings specified in previous bridge design codes which are less than the current requirements of SM 1600. About 90% of road bridges are performing below their required current level of services because their designed loadings are smaller than the current standard loadings. However as industry needs to move heavy mass loads for new infrastructure projects, structures in some specific routes were analysed and checked for higher loads and have been approved for heavy vehicles. The approved routes for heavy loads are shown in the following Figure 10.

Asset capacity deterioration graph and failure modes

Figure 9 illustrates a typical condition decay curve for bridges and culverts. In many instances condition assessment may only identify assets (bridge components) that are well into their useful life and in need of replacement or rehabilitation.

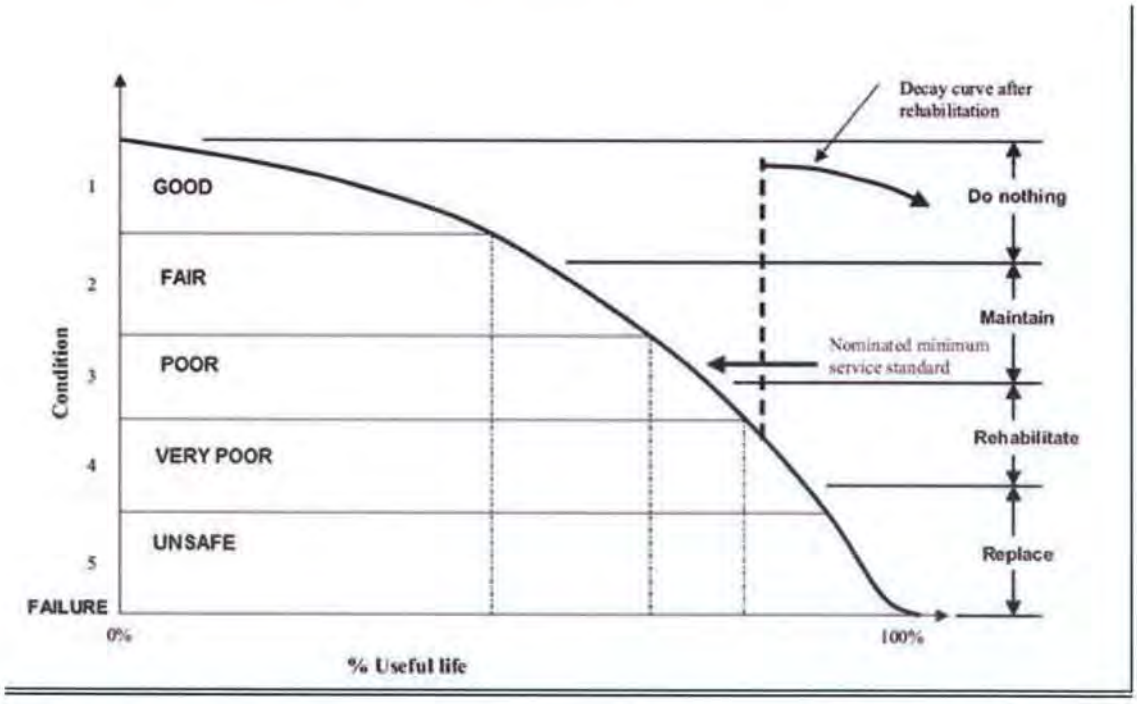


Figure { SEQ Figure * ARABIC } - Typical condition decay curve for bridge and culvert

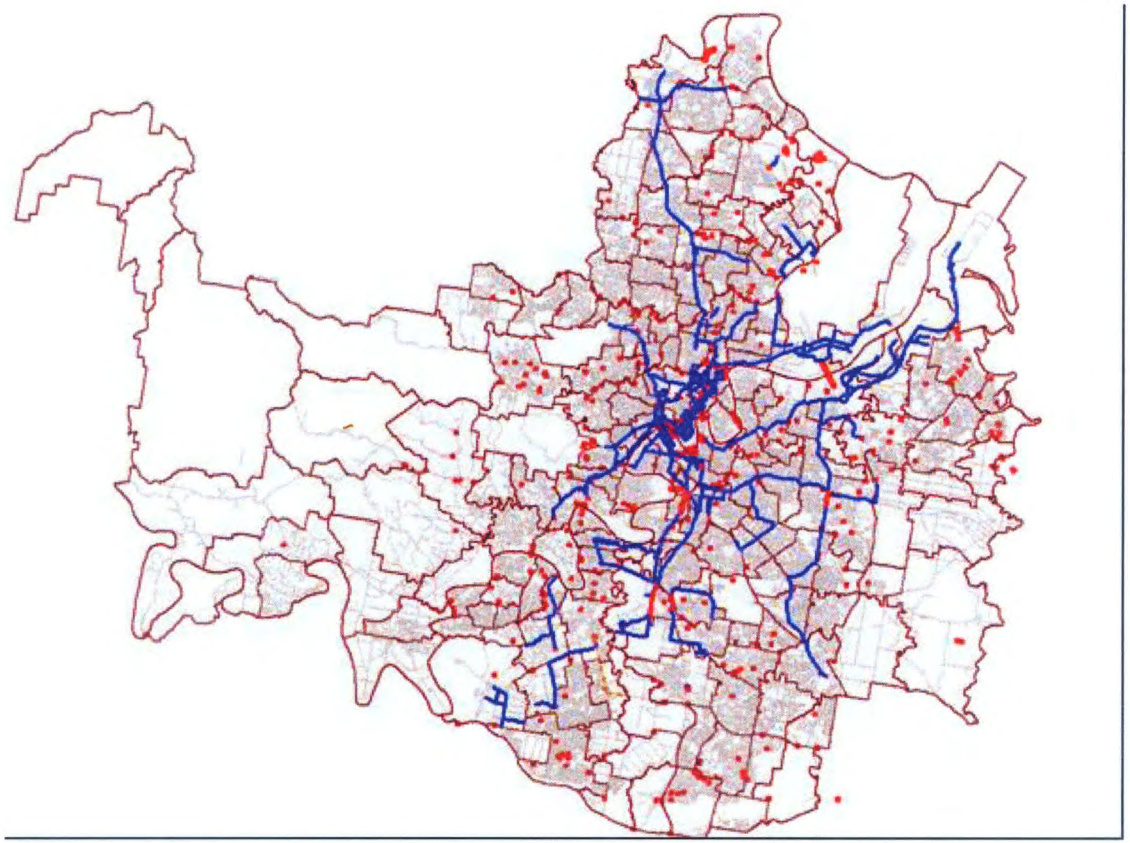


Figure { SEQ Figure * ARABIC } - Approved Heavy Mass Routes

Figure displays the sections of road, in relation to the rest of Brisbane City Council's road network, that are approved for heavy mass loads. The BCC HML routs are shown in blue while the normal road network is shown in gray. This image represents the full land area that is managed by BCC.

Asset Replacement Value Summary

A replacement value of a structure is calculated multiplying structure area by "Bridge Assets Valuation Unit Rate" which is prepared by consultant - Kellogg Brown & Root Pty Ltd. Summary of replacement values as at July 2011 are given below.

Table { SEQ Table * ARABIC } - Assets Replacement values and depreciated values

Roads and Bridges	Replacement Value ($m)	Depreciated Asset Replacement Value ($m)
Story Bridge	222,274,000	153,128,000
Go Between Bridge	196,038,000	1,873,000
William Jolly Bridge	77,999,000	60,666,000
Eleanor Schonell Bridge	57,465,000	2,423,000
Walter Taylor Bridge	43,425,000	35,005,000
Victoria Bridge	36,191,000	12,662,000
Jack Pesch Bridge	-	-
Road Bridges	503,382,000	155,059,000
Culverts - Box & Pipe	378,315,000	120,724,000
Foot Bridges	75,636,000	17,788,000
Boardwalks	26,720,000	3,634,000
Total	{ =SUM(ABOVE) }	{ =SUM(ABOVE) }

Unit rates for the replacement values of road bridges and foot bridges from "Bridge Assets Valuation Rates" report prepared by Kellogg Brown & Root Pty Ltd are given in Appendix 3. In 2000, the BCC commissioned Kellogg Brown & Root (KBR) to undertake representative generic designs, general arrangement drawings, schedules of quantities and cost estimates for each bridge, to the level of detail and documentation necessary to meet accounting audit requirements. In 2004, the BCC commissioned KBR to revalue these designs to current values (published in Jan 2005). In 2009, the BCC again commissioned KBR to value these designs on current data, and to re-validate quantities.
As specified by Brisbane City Council, KBR has used previously determined generic designs and schedule of quantities for the valuation of road bridges and footbridges. Generic designs have been updated to current bridge standards AS 5100. Three sample specifications have been included in the Appendix 4.

Depreciated Asset Replacement Valuation Summary

Depreciated asset replacement value is calculated by deducting depreciation from the replacement value of the asset. Depreciated asset replacement valuation summary is given Table 3.

Description of Valuation Method

Physical revaluations are undertaken on a five- year rolling basis within council. Tenders are reviewed from those organisations from the panel of providers who have tendered for the work.
Drawings, schedules of quantities are examined and unit rates are applied to determine the gross replacement values for the bridge and culvert portfolio.
The acquisition date of the asset is examined in association with the condition of the asset and a remaining life is applied. From gross replacement value and the remaining life, a written down value of the asset is determined. During the intervening four years annual

indexing is applied to evaluate the replacement value. Remaining lives are reviewed annually. The last revaluation was conducted in 2009.

Basis for determining effective lives used for Valuation

The effective life of an asset is significantly influenced by an organisation's maintenance policy and practice. Where detailed condition assessment information is not available to determine the appropriate effective lives for assets, sample listings of effective lives may be used as guide. By considering a current condition point on the bridge decay curve (figure 9), the effective life may be predicted before failure.

All BCC bridges and culverts shall be designed to achieve the following minimum design life without major maintenance or replacement of elements whilst remaining save and functional. For the purpose of valuations, effective lives were calculated by deducting physical age from the design life of structures.

Table { SEQ Table * ARABIC } - Minimum Required Design Life for BCC Assets

Asset	Design Life (years)
Bridge structures and roadway support structures including underpasses	*100*
Reinforced embankments, retaining walls, including reinforced soil structures	*100*
Inaccessible elements of the drainage, fire protection, lighting, mechanical, electrical, traffic management, and control systems	*100*
Drainage elements that are accessible for refurbishment and maintenance	*40*
Roadway noise barriers and architectural or structural noise attenuation devices	*40*
Signage support structures, roadside barriers and other roadside furniture	*40*
Tolling System structures, gantries and other equipment structures	*40*
RCC Pipe and Box culverts	*100*

Key Assumptions made in preparing Valuation

1. All current bridges will be retained.
2. Timber and steel structures will be replaced with concrete structures at end of service life.
3. Current level of service will be maintained without upgrading to satisfy current standards.
4. Council increases maintenance funding to the required amount
5. New and augmentation works as discretionary, and additional to the program.
6. Unit rates were prepared using typical concrete bridges

Details of Historical Valuations

Current and historical valuation details are maintained by AM – Financial group and stored in the corporate directory G:\BI\CA\FIN\FY1011\Non Current Assets\Reconciliations\R&D\P12-2011\Ellipse FAR Reconciliation-12-2011-IM final.xls

Summary of Type of Historical Data Available and Location

All the data are available in G:\BI\AM\FIN\FY1011\Non Current Assets\Reconciliations\R&D\P12-2011\Ellipse FAR Reconciliation - 12-2011-IM draft.xls (file://G:Current Assets&D-2011FAR Reconciliation - 12-2011-IM draft.xls)

Relevant Financial Information (historical expenditure)

In the 2010/11 financial year, council spent $ 6.03 M for inspection and maintenance (recurrent) of bridge and culvert assets and $ 6.98 M for renewal and rehabilitation of assets.

5.2 - Routine Maintenance Plan

Routine maintenance is defined as the regular ongoing day-to-day work that is necessary to keep assets operating, including instances where portions of the asset fail and need immediate repair to make the asset operational again.

Routine asset maintenance is managed by AM. The maintenance work is carried out by FS.

(a) **Planned maintenance** (Planned recurrent)

Planned maintenance works are identified through the bridge, culvert and boardwalk Level 1 Level 2 inspection process. These repair works are commissioned on a yearly basis. Some planned maintenance works are carried out in accordance with a planned cyclic schedule.

(b) **Unplanned maintenance** (Reactive recurrent)

Unplanned maintenance works are reactive to reports/complaints of unsafe or unserviceable bridges and culverts from ratepayers or Councillors or as a result of a regular inspection. A portion of this work also includes the removal of graffiti.

Routine maintenance generally consists of minor structural repairs or component replacement, handrail repairs, repair of scours at abutments, painting etc. The maintenance of the seven major cross river bridges (Story Bridge, Victoria Bridge, William Jolly Bridge and Walter Taylor Bridge) is a significant portion of the routine maintenance budget. The Story Bridge is the largest structure owned by Brisbane City Council. This bridge is constructed primarily from steel and requires continual painting. The required maintenance funding for the Story Bridge accounts for approximately 1/3 of the total recurrent bridge, culvert and boardwalk recurrent maintenance budget.

At present there is no base budget for the recurrent maintenance of NES park bridges and culverts. Limited maintenance works are carried out using general Parks funding. However, funding should be established for scheduled routine maintenance of these structures. The high percentage of timber bridges in parks necessitates regular oiling and handrail/deck repair to ensure safety and longevity of these structures. AM is proposing to increase funding for inspections and general maintenance and it has been included in the Action Item Plan (Appendix 1).

(i) - Maintenance Plan

AM coordinates, oversees, plans and budgets for major maintenance and rehabilitation projects. Most of this work is managed in partnership with FS and includes planned and unplanned minor maintenance.

Complaints to the Customer Services Centre will be handled by FS following the rule of inspect, make safe and report the required short term and/or long term repair work and costs. AM then reviews the scope of work and prioritises the jobs.

All new structures should be handed over to Asset Management Branch with a Level 2 inspection report, As-constructed drawings and other documents mentioned in the BCC land development guidelines. But in practise, no handover process is in place and it has been included in the Action Item Plan (Appendix 1).

The safety and condition of all existing and new structures is monitored by following three levels of bridge inspection regime provided in the Bridge Inspection Manual issued by Queensland Department of Main Roads. These are the Level 1, Level2 and Level 3 bridge inspections.

Maintenance decision-making process (planned and unplanned)

Unplanned Maintenance

Customer Requests

Customer request will be investigated and attended by FS maintenance crews and forwarded to AM if technical assistance is required.

Works arising from Level 1 & 2 Inspections

FS bridge inspectors identify maintenance and repair needs during the Level 1 inspections. The inspectors identify and recommend work and forward to maintenance crew to attend and report costs. Inspectors prepare Level 1 inspection reports using a Microsoft Word document and software application and save it to the council network. If required, inspectors will recommend Level 2 inspections in the Level 1 report. Flow charts are included in the appendix as Appendix 5 and Appendix 6.

Level 1 Inspection - Routine Maintenance Inspections

This consists of visual inspection is to check the general serviceability of the structure, particularly for the safety for road users, and identifying any emerging problems.

The scope will include:

- Inspection of approaches, waterway, deck/footway, substructure, superstructure and attached services to assess and report any significant visible signs of distress or unusual behaviour, including active scours or deck joint movements.
- Recommendation of a Level 2 Bridge Condition Inspection if warranted by observed distress or unusual behaviour of the structure.
- Identify maintenance work requirements, and record on the inspection form.

Minimum frequency is generally one inspection p.a. for all structures. However, frequencies may be increased for defective structures as tabulated in Table 5. In addition, Routine Maintenance Inspections will also be carried out immediately after flooding, fire or accident damage events. Level 1 inspection generally not required in the same year as a Level 2 or 3 inspections.

Table { SEQ Table * ARABIC } - Level 1 Inspection Frequencies

Structure type	Condition rating of structure	Inspection frequency (years)
Timber structures and steel culverts in wet environments	1 – 2	1 *
	3 – 4	1 **
Other structures	1 – 2	1 *
	3	1 *
	4	1 **

* Generally not required in same year as Level 2 or 3 inspection
**Level 1 and Level 2 inspection cycles to be staggered by six months to ensure that the structure is inspected every six months

Level 2 Inspections – Bridge Condition Inspections

This consists of an inspection to assess and rate the condition of a structure as a basis for assessing the effectiveness of past maintenance treatments, identifying current maintenance needs, modelling and forecasting future changes in condition and estimating future budget requirements.

The scope will include:

- Visual inspection of the principal bridge components (including measurement of crack widths, etc) and an assessment of condition using a standard condition rating system as defined in the inspection procedures.
- The inspection of timber bridges will be supplemented by a drilling investigation, and will also include the identification and reporting of undersized timber members.
- 'Soundings' to determine the presence of active scour.
- Reporting the condition of the principal bridge components and determining an aggregated rating of the structure as a whole.
- Identifying and programming preventative maintenance requirements and recording. If access equipment is required to conduct the inspection, then routine / preventative maintenance may also be completed in conjunction with the inspection.
- Requesting a detailed bridge inspection by a bridge engineer if warranted by apparent rapid changes in structural condition and/or apparent deterioration to condition state 4.
- Underwater inspections of those elements in permanent standing water at the specified frequency.
- Recommending requirements for the next inspection and nominating components for closer monitoring as appropriate.
- Recommending supplementary testing as appropriate.
- Completion of the "Design Inventory" data held as part of the initial inspection and as required thereafter

All new structures will be given a Level 2 inspection prior to the end of the Defects Liability period for the construction contract, and thereafter generally in accordance with the frequencies tabulated below. The frequency of inspection defective structures may be increased as stipulated in a specific "Structures Management Plan".

Table { SEQ Table * ARABIC } - Level 2 Inspection Frequencies

Structure type	Condition state of structure	Inspection frequency (years)
Timber or steel culverts in wet environments	1 – 2	2
	3	1 **
Other structures	1 – 2	5
	3	3
Components under water	1 – 2	8
	3	1
All	4	1 ** with "Structures Management Plan"

**Level 1 and Level 2 inspection cycles are to be staggered by six months to ensure that the structure is inspected every six months

These standard frequencies may be modified as a result of recommendations in a Detailed Engineering Inspection Report, and as agreed in the "Structure Management Plan". Additional Level 2 inspections will be required when:

- Recommended in a Level 1 – Routine Maintenance Inspection Report.
- Major maintenance, rehabilitations or other modifications have been carried out and
- Detailed Engineering Inspections are carried out.

Level 3 Inspections - Detailed Structural Engineering Inspection

This consists an extensive inspection which may include physical testing and structural analysis to assess the structural condition and behaviour of a structure, to identify and quantify the current and projected deterioration of the structure, and to assess appropriate management options.
The scope will include:

- Detailed inspection of all relevant bridge components, including testing and analyses as necessary to supplement visual inspection.
- Reporting the condition, structural adequacy, evidence of distress, mode of deterioration.
- Development of "Structure Management Plans".
- Recommendations of management actions and/or maintenance /rehabilitation treatment options.

A detailed Engineering Inspection will also be carried out in one of the following circumstances:

- As the result of recommendations in a Level 2 Inspection report.
- In order to assess the condition of a structure prior to carrying out programmed works such as rehabilitation, strengthening or widening, and
- To provide a Load Rating for the structure.

Data Recording

Level 1 Inspection

The inspector shall record the Level 1 inspection using the "Routine Maintenance Inspection Report" (Appendix 7) and record inspection data in the asset register.

Level 2 Inspection

The Level 2 inspector shall inspect and provide a report of the condition of the components of the structure in accordance with standard components and report format (Appendix 8).

Level 3 Inspection

The inspecting consulting engineer shall provide a written report with:

- Recommendations for further investigation and testing, remedial action and future inspection and monitoring regime as required.
- A "Structure management Plan".

An electronic copy of reports is to be stored in the Bridge Asset Management System which is being developed by AIM.

Maintenance Works

Normal works arising from Level 1 and Level 2 inspections will be directed to FS for immediate attention.

The inspector will inform maintenance works identified in Level 1 inspection to the FS directly by emails to attend as soon as possible.

Defective works identified by a Level 2 inspection and recorded in Defective Component Reports need to be analysed and forwarded to the relevant section to attend.

(ii) - Standards and Specifications

Bridges, culverts and boardwalks repair works should satisfy the Australian Standards and City Assets Design Criteria – Bridge Structures, Culvert structures and boardwalks.

Define materials, methods, service standards to meet the required Levels of Service

Material parameters for bridge design are generally described in AS5100.5 (Concrete Structures) and AS5100.6 (Steel and Composite Construction).

Only materials and products and suppliers approved by BCC and conforming to TMR specifications will be used.

Timber structural components will not be used for BCC road bridges and only used for decking on pedestrian or bikeway bridges with AM specific prior written approval.

All BCC bridges and associated works shall meet the following AM's design criteria.

1. Asset Management Design Criteria – Bridge Structures.
2. Asset Management Design Criteria – Culverts.
3. Asset Management Design Criteria – Elevated Structures.

Following minimum requirements are specified in above mentioned documents.

Exposure Classification

Minimum required exposure classifications for BCC bridge assets

Structure	**Minimum Required Exposure Classification**
Above ground structures (bridge superstructure, pier column and headstocks, barriers)	*B2*
Structures cast against ground	*B2*
Structures in saline water and tidal zones	*C*
Structures in aggressive ground water	*C*

Where reinforced concrete or prestressed concrete elements are exposed to salt water stainless steel reinforcement and fixings shall be used.

Steel girder bridges shall not be used over or immediately adjacent to salt water or where they may be inundated by brackish water in less than a Q100 rain event.

Timber girder bridges shall not be used for BCC owned and maintained structures. Due to increasingly poor performance of timber decks AM prefer that they are not used on bridge structures unless they can be easily replaced and comply with the AM specification.

TMR standard bridge safety barriers or other barrier systems complying with the TMR shall be provided.

Where applicable on all road bridges, the deck wearing surface shall be dense grade asphalt concrete and shall have a design life of 20 years.

Risks associated with alternative standards

If design requirements are not covered by the Australian standards, there is no risk involved when work is performed to comply with following international codes of practice and design guidelines.

- British Standards (BS5400),
- American Standards (AASHTO)
- European Standards (Euro codes)

However, if the work does not comply with Australian Standards or the three standards mentioned above, designers are allowed to use appropriately recognised international standards.

(iii) - Summary of Future Costs

Forecast of planned and unplanned maintenance work and costs

A detailed ten year budget forecast for planned and unplanned maintenance works of bridges and culverts is attached as Appendix 2. A summary of Inspection & general maintenance budget forecast is given below

FYI	11/12 $m	12/13 $m	13/14 $m	14/15 $m	15/16 $m	17/18 $m	18/19 $m	19/20 $m	20/21 $m	21/22 $m
Cross river bridges	4.383	5.619	5.619	5.619	5.619	5.619	5.619	5.619	5.619	5.619
All other T&T assets	5.819	5.,819	5.819	5.819	5.819	5.819	5.819	5.819	5.819	5.819
NES Park Bridges	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46

Note any maintenance deferred and the associated cost

The current level of funding is not sufficient for the Council to maintain the required level of services for the bridges and culvert stock. The 2011/12 council budget allocated $12.581M against the requested funding for the 2011/12 financial year is $17.297m. The reduction in requested level of funding may cause the current backlog of work to grow, which will increase safety hazards to the public and mean an increase in the ultimate rehabilitation costs.

Outline how maintenance will be funded

Maintenance costs of road bridges, culverts, boardwalks and park bridges are currently funded through the operating expense of "Service 3.3.3.1– Maintain and Improve the Network – Moving Brisbane" in the Council Published Budget.

5.3 - Renewal / Replacement Plan

Renewal work is defined as the major work which does not increase the asset's design capacity but restores, rehabilitates, replaces or renews an existing asset to its original capacity. Work over and above restoring an asset to original capacity is new works expenditure

(i) - Renewal Plan

Show how replacements / renewals are identified and to what standards they are replaced (i.e. Modes of failure, options for treatment, risk).

Modes of Failure

Reinforced concrete bridges can fail due to inadequate strength, leading to mechanical failure, or due to a reduction in its durability. Corrosion may damage poorly designed or constructed reinforced concrete. When rebar corrodes due to carbonation and chloride attacks, the oxidation products expand and tend to flake, cracking the concrete and de-bonding the rebar from the concrete.

Ultimate failure leading to collapse can be caused by crushing of the concrete, when compressive stresses exceed its strength by yielding or failure of the rebar, when bending or shear stresses exceed the strength of the reinforcement or by bond failure between the concrete and the rebar.

As part of the annual budgeting process, AM provides the strategic advice for the rehabilitation and replacement of existing bridges and culverts. This includes the determination of the funding levels required.

Assets requiring rehabilitation or replacement are identified by AM through the bridge, culvert and boardwalk inspection process. Typically bridges or culverts recommended by a Level 2 inspection report for renewal or replacement will undergo a Level 3 inspection to determine

the extent of rehabilitation works or the need for replacement. Identified projects are recommended to Council for capital funding.

End of life projections

The design life is normally 100 years for steel or concrete bridges and reinforced concrete culverts. The design life for timber bridges are not properly established and can be assumed around 50 years. When structures are close to the end of their asset life, more frequent condition assessments will assist in monitoring the asset until the intervention level is reached.

Renewal decision-making process

Renewal of timber road bridges

There are only seven timber bridges in the 240 vehicular bridges in council road network. AM has a plan to replace all timber road bridges within next five years. Details are follows:

ID Number	Street Name	Suburb	UBD Ref.	Construction Date	Proposed Replacement Date	Cost
B0380	BUNDALEER St	BROOKFIELD	136Q19	01-July-1984	2011/12 FY	$400,000
B0545	CREEK Rd	CARINA HEIGHTS	181M6	01-April-1982	2014/15 FY	N/A
B0910	GRESHAM St	ASHGROVE	158K1	01-July-1931	2016/17 FY	N/A
B1400	MIRRABOOKA Rd	ASHGROVE	138P18	01-July-1962	2015/16 FY	N/A
B1710	ROSS Rd	UPR KEDRON	136R5	01-July-1974	Not considered	-
B1900	WACOL STATION Rd	SUMNER	197F14	01-July-1985	2013/14 FY	N/A
B8886	MEEKES	KHOLO	173J5	01-July-1974	2011/12 FY	$150,000

Note: The replacement program for other structures will be prepared after the completion of the Level 2 inspection program.

(ii) - Renewal Standards

Define materials, methods, service standards to meet required Levels of Service

All renewals and associated works shall meet the following AM's design criteria.

1. Asset Management Design Criteria – Bridge Structures.
2. Asset Management Design Criteria – Culverts.
3. Asset Management Design Criteria – Elevated Structures.

Forecast program of replacement and costs

Summary of forecasted cost of replacement of T&T and NES – Road Bridges, Park bridges, culvert and Boardwalks are given below and details are given in Appendix 10.

Forecasted Replacement Cost	11/12 $m	12/13 $m	13/14 $m	14/15 $m	15/16 $m	17/18 $m	18/19 $m	19/20 $m	20/21 $m	21/22 $m
	1.330	2.900	3.445	4.400	1.320	1.525	0.580	2.000	N/A	N/A

Risk Analysis (i.e. Risks and long term effects of deferral)

Deferral of renewal work will increase safety hazards to the public and lead to an increase in the ultimate rehabilitation costs. Risk related bridges and culverts on heavy mass routes are being analysed and will be included in risk asset register.

Identify how replacements will be funded

Replacements of road bridges, culverts, boardwalks and park bridges are currently funded through the operating expense of "Service 3.3.3.1 – Maintain and Improve the Network – Moving Brisbane" in the Council Published Budget.

5.4 - Creation / Acquisition / Augmentation Plan

New works are those works that create a new asset that did not previously exist or work which upgrade or improve an existing asset beyond its original capacity. They may result from growth, social or environmental needs. Assets may be acquired at no direct cost to the organisation (i.e. subdivisional development for local authorities)

Formal procedure to rank asset creation / acquisition projects

(i) - Selection criteria

Council may fund new assets under the annual budgeting process from a priority listing of the future projects. TP&S are responsible for the recommendation to Council for provision of funding for new vehicular or cycle bridges and culverts. These are typically related to major road or bikeway projects.

NES is responsible for the listing of projects involving new pedestrian bridges, culverts or boardwalks in parkland. These will typically be required where better access is required in an existing park or as part of a new park project.

New assets may also be constructed as part of private development such as subdivisions, and then donated to Council as "contributed assets".

(ii) - Standards and Specifications
Define materials, methods, and design standards to meet levels of service

All new assets shall be constructed to comply with Brisbane City Council Development Guidelines.
Risks associated with alternatives

If design requirements are not covered by the Australian standards, there is no risk involved when work is performed to comply with following international codes of practice and design guidelines.
- British Standards (BS5400),
- American Standards (AASHTO)
- European Standards (Euro codes)

Since international standards are developed on based on research undertaken in other countries and tested for international conditions, there is no significant risk using international standards.

5.5 - Disposal Plan

Disposal is any of the activities associated with disposal of a decommissioned asset, including sale, demolition or relocation

Financial Management and Accounting Manuals of Brisbane City Council specify accounting methods to transfer and disposal of bridge and culvert assets from asset registers. Assets are disposed of or retired from the Non-Current Assets Register when they are no longer of value to Council. This may occur due to sale, loss, trade-in or scrapping of the asset. Assets are disposed of in such a way as to minimise the economic cost to Council.

Forecast future disposal of assets including the timing and costs

All the assets listed in Appendix 10 for replacement will be disposed.

Cash flow forecast of income / expenditure from asset disposal

There will be no income from asset disposal.

6.0 - Finance

6.1 - Financial Statements and Projections

The summary of approved capital (rehabilitation and reconstruction) and recurrent (inspections and general maintenance) expenditure in the budget delivered in June 2011 for 2011/12 and forecast expenditure up to 2020/21 financial year are given below ($million).

Owner - BI

	11/12	12/13	13/14	14/15	15/16	17/18	18/19	19/20	20/21	21/22
Maintenance	4.482	11.438	11.438	11.438	11.438	11.438	11.438	11.438	11.438	11.438
Capital	8.099	11.862	12.744	12.784	15.448	15.448	15.448	15.448	15.448	15.448

Owner – TP&S

	11/12	12/13	13/14	14/15	15/16	17/18	18/19	19/20	20/21	21/22
Maintenance	0.260	0.460	0.460	0.460	0.460	0.460	0.460	0.460	0.460	0.460
Capital	0.536	0.215	0.300	0.325	0.325	0.325	0.325	0.325	0.325	0.325

6.1.2 - Breakdown of expenditure by service groups

City Projects (CP) will provide design and consultancy services for Level 3 inspection reports and consultancy works associated with the rehabilitation and replacement of structures. FS is envisaged to be the sole internal service group that will be involved in future rehabilitation and maintenance works associated with bridges and culverts. External service providers (expert consultants, subcontractors etc.) will be hired where skills and resources are not available within FS to perform the works. The expenditure shown in the following table is the amount FS and CP estimated to spend over next ten years which includes the cost for hiring consultants and subcontractors.

Activity	11/12 $m	12/13 $m	13/14 $m	14/15 $m	15/16 $m	16/17 $m	17/18 $m	18/19 $m	19/20 $m	20/21 $m
City Projects	0.600	-								
FS	12.377	-	-	-	-	-	-	-	-	-

6.1.3 - Breakdown of expenditure into routine maintenance, renewal and new works expenditure

The expenditure shown in the following table is the total amount T&T and NES estimated to spend over next ten years.

Activity	11/12 $m	12/13 $m	13/14 $m	14/15 $m	15/16 $m	16/17 $m	17/18 $m	18/19 $m	19/20 $m	20/21 $m
Routine Maintenance	4.642	6,279	6,279	6,279	6,279	6,279	6,279	6,279	6,279	6,279
Renewal & New works	8.635	13.551	14.878	13.988	19.772	19.467	20.512	19.092	21.092	21.092

6.1.4 - Trends from the previous two to three years

Data is not available but will be collected and include in the AMP.

6.2 - Funding Strategy

6.2.1 - Provide details of how expenditure will be funded

Routine maintenance, renewal and new works are currently funded through the operating expense of "Service 3.3.3.1 – Maintain and Improve the Network – Moving Brisbane" in the Council published Budget.

6.2.2 - Determine whether any planning is needed to smooth out variations in cash flow

Due to insufficient inspections being carried out in recent years, unplanned asset repair and rehabilitation is often required. Once there is a routine inspection process re-established, the maintenance of the asset base will steadily be brought back under control. Forward planning will facilitate a steady rate of expenditure spread throughout Brisbane (location) and among the different asset categories.

6.3 - Valuation Forecasts

6.3.1 - Forecast of future value asset and valuation methodology

The current asset values prepared by KBR using previously determined generic designs and schedule of quantities for typical bridges as specified by Brisbane City Council, will be revised and updated to suit future materials prices and the construction market in Brisbane. Physical valuations will be carried out every five years and desktop indexing valuations in intervening years.

6.3.2 - Forecasts of Depreciation

Assuming that assets have a 100 year life, assets will be depreciated by 1% per annum.

6.3.3 - List the depreciation expense for all asset categories

All assets will be originally depreciated individually by 1% over their design life. This may alter if a revaluation alters the remaining life of the bridge structures.

6.3.4 - Include the basis for the calculations

The structures will be depreciated using straight line method and over the design useful life.

6.4 - What are the key assumptions made in financial forecasts?

1. The lack of data hinders the strategic asset management process and therefore exposes Council to increase financial, political and safety risk and higher capital investment need. To be in line with the desired guidelines and with the industry, a visual inspection (Level 1) has to be performed annually on every structure to check its general serviceability, particularly for the safety of road users and identify general maintenance work requirements such as cleaning, trip hazards, accident damages etc.

2. Level 2 inspections are performed on structures with frequencies shown in following table to assess and to rate the condition of structures, identify current maintenance needs and estimate future budget requirements.

Structure type	Condition state of structure	Inspection frequency (years)
Timber or steel culverts in wet environments	1 – 2	2
	3	1 **
Other structures	1 – 2	5
	3	3
Components under water	1 – 2	8
	3	1

This table was prepared on the assumption that most of Council bridges and culvert structures are in poor condition and have defects affecting the durability which require monitoring, detailed structural engineering inspection or maintenance. As per the above table from the Manual, a three year average frequency has been used to acquire first set of Level 2 inspection reports for Council Bridge and culvert stock.

3. In addition to Level 1 & 2 inspections, Level 3 inspections are performed in order to assess the condition of structures prior to carrying out programmed maintenance works such as rehabilitation, strengthening or widening and to provide load rating for structures especially for assessment of routes for heavy vehicle permit approvals.

4. In preparation for the budget forecast, a three year (1st year for inspection, 2nd year for design and permits, 3rd year for construction) is assumed for rehabilitation or renewal.

6.5 – Grants and Subsidies

6.5.1 – List potential grants and confirm if forwarded to BCC Grants and Subsidies Officer

No grants and subsidies are applicable.

7.0 - Data Management

7.1 - Accounting / Financial Systems

7.1.1 - Details of accounting system and any changes as a consequence of the asset management plan

The Ellipse register is Council's corporate financial system. It contains software modules which cover financial business functions of Accounts Receivable, Cash Management, Fixed Assets, General Ledger, Internal Trading and Project Accounting. The Ellipse register for bridges and culvert structures is managed by the AM Finance Team.

7.1.2 - Define differences between maintenance, rehabilitation (renewal) and new works expenditure

Maintenance expenditure is the cost at regular ongoing day-to-day work that is necessary to keep assets operating, including instances where portions of the asset fail and need immediate repair to make the asset operational again.

Rehabilitation (renewal) expenditure is the spend on major work which does not increase the asset's design capacity but restores, rehabilitates, replaces or renews an existing asset to its original capacity. Work over and above restoring an asset to original capacity is new works expenditure.

New works are those works that create a new asset that did not previously exist or work which upgrade or improve an existing asset beyond its original capacity. They may result from growth, social or environmental needs. Assets may be acquired at no direct cost to the organisation (i.e. subdivisional development for local authorities).

7.1.3 - Provide details of accounting standards / guidelines that must be complied with

The primary Accounting Standards which have an impact on asset management are:
AAS4 / AASB 1021 Depreciation
AAS5 / AASB 1031 Materiality
AASB 1041 Revaluation of non-current assets
AAS27 – Financial Reporting by Local Governments
AASB 116 – Property, Plant and Equipment

7.2 - Asset Management Systems

7.2.1 - What types of data are available on assets to help Asset Management decision making?

Normally the following data are available for bridges, culverts and boardwalks:

- Plant Number (Asset Identification)
- Equipment Number (Ellipse)
- Name
- Asset Class
- Street Location
- Suburb
- UBD
- Ward

- Size
- Material
- Gross Replacement Value
- Written Down Value
- Depreciation
- Ownership
- Asset condition reports
- BSR (Bridge Service Request) / FEA

7.2.2 - What is the quality / reliability / adequacy of the data?

No comments can be made regarding quality, reliability and adequacy of the data until the data collection process is completed and all data is properly validated. Development of quality system has been included in Action Item Plan (Appendix 1).

7.2.3 - Is any software used to store / analyse asset data?

Council uses Ellipse and iBimap/Gecko system which will be replaced soon by "Gecko program" to store asset data. However, no special software is used to analyse inspection data and prioritise maintenance works.

7.2.4 - Where is the data stored?

Data will be stored in Ellipse and the iBimap/Gecko system. Bridge management system based on the Oracle data base has been designed to store geometric data and inspection data and will be distributed to users for testing.

7.2.5 - How often is the data collected?

Asset data and asset condition is collected during the Level 1 and Level 2 inspection which is on approximately an annual basis and once every tree to five years respectively.

7.3 - Information Flow and Processes

What are the key information flows to and from the asset management plan?

The key information flows to this AMP are:

• The asset register containing information on different components, sizes, age, replacement value and estimated remaining lives
• The customer service levels
• Projections of various factors affecting future demand for services
• Correlations between maintenance and renewal, including degradation models

The key information flows from this infrastructure and AMP are:

• Routine maintenance Level 1, Level 2 requirements
• The assumed Works Program
• The resulting budget, valuation and depreciation projections;

These will impact the council's long term asset management plan, strategic business plan, long term financial forecast, annual operating maintenance and renewal budgets and divisional business plans and budgets.

What processes are used to make decisions on asset management replacement, renewals and acquisitions?

Replacement and Renewal

The result of a Level 1 inspection will determine the timing of Level 2 condition inspection or Level 3 detailed engineering inspections which will give information on how the asset is performing, whether the asset will meet its design life or whether it is cost effective to carry out renewal work. Based on this information, AM will consult with FS to decide the timing of asset replacement or rehabilitation.

Acquisition

Brisbane City Council's decision on acquisition of new assets that relates to reducing the congestion in the road network is driven by the following factors:

- Degree of community benefits (economic, social, environmental)
- Alignment with Brisbane 2026 vision
- Environmental sustainability
- Cultural and heritage significance
- External and internal finance and contribution
- Capability to deliver the project
- Financial sustainability and affordability
- Economic development

Is there a formal project ranking system?

Currently there is no formal project ranking system. AM - Structures is working with AIM to develop electronic project ranking system in associated with new Oracle data base and it has been included in Action Item Plan (Appendix 1). At present, a project ranking system is being considered by the Asset Steering Committee.

How is the best decision made?

The process being used is:

- Identify all potential solutions
- Prioritise the solutions
- Consider financial viability
- Consider social, environmental and cultural factors

Does it take into account risk cost, lifecycle costs, performance prediction and optimised decision making?

During the decision making process, risk cost, lifecycle costs and performance prediction will be taken into account using optimised decision making methodologies.

7.4 - Standards and Guidelines

What are the key standards and guidelines which influence asset management activities?

Brisbane City Council's asset management practices and processes are driven by a number of standards and guidelines. Below are some of them relevant to bridges and culverts:

- City of Brisbane Act 2010
- City of Brisbane (Finance, Plans and Reporting) regulations 2010
- AS 5100 Bridge Design

- AS 2159-1995 Piling Design and Installation
- Department of Local Government and Planning Asset Management Advancement Plan 2009
- A guide to the Hydraulic Design of Bridges, Culverts and Floodways (Austroads Publication)
- International Infrastructure Management Manual, NAMS (Provides guidance and direction on asset management policy and plan development, Asset Management Plan Template)
- AAS (Australian Accounting Standard) 27 Financial Reporting by Local Governments 1996 (sets out the asset accounting requirements)
- Brisbane City Council-Subdivision and Development Guidelines, current edition 2008
- Guide to Traffic Engineering Practice (Austroads Publication).
- Various legislative requirements

8.0 - Continuous Improvement

8.1 - Performance Measures

8.1.1 - Outline of performance measures for the Asset Management System

The performance measures for the Asset Management System will include:

- Operation and maintenance of the AM system achieves cost effective outcomes
- The service provided meets the community expectations
- Reductions in the numbers of structures condition rated 3 and 4
- Reductions in customer requests
- Changing from reactive to a practical maintenance methodology

8.1.2 - Describe how the effectiveness of the AM plan will be measured

Performance measures will usually relate to achieving the defined current levels of service (agreed desired level of service in future) and actions within the improvement program identified within the resources provided. The effectiveness of the asset management plan will be measured in the following ways:

- The degree to which the Key Performance Indicators (KPI) associated with community and technical level of services have been able to meet the performance targets.

- The degree to which the required cash flow (section 6.1.1) identified in this asset management plan are incorporated into council's long term financial plan and Strategic Management Plan

- Compliance with the Appendix 1 action list.

8.2 - Improvement Program

8.2.1 - Details of actions proposed and timetables for improving accuracy and confidence in the AM plan, indicating responsibility for each action

Issues that were identified during the preparation of this plan, but could not be resolved before the due date have been recorded as action items and included in Appendix 1. This system has been implemented to foster continual improvement.

8.2.2 - Details of resources required to implement the improvement program

The resources required to implement the improvement program are defined in Appendix 1.

8.3 - Monitoring and Review Procedures

8.3.3 - Procedures and timetable for performance reporting (three yearly review of Asset Management Plan)

Procedures and timetable for performance reporting will be comprised of:

- Annual review of action items recorded in Appendix 1 including current service levels and resource level during annual budget processes

- Amendment of the AMP to accommodate changes determined in the review process and upgrading the AMP to Advanced level by June 2012

- Revision of the AMP annually thereafter

8.3.4 - Timetable for external audit and review (of process, integrity and Level of Service)

AM will audit and review the asset management practices documented in this AMP annually.

This is added to the list action item in Action Item Plan (Appendix 1).

8.4 - Handover processes and documentation – Constructed Assets

AM group will initiate discussions with Development Assessment, City Projects and FS to develop procedures to accept assets from developers, contractors, Council Major Projects and FS.

This is added to the list of action item in Action Item Plan (Appendix 1).

8.5 - Contract Information

8.5.1 - Current contracts listed in a contracts register with relevant details included

Currently FS undertakes all routine and planned maintenance works of council's assets except Inner City Bypass structures, Northern Bus way and Clem 7 tunnel.

8.6 - Action Items

8.6.1 - Well developed and structured action items arising from the review of the ASP

Refer to Appendix 1.

8.7 - Innovation

8.7.1 - Innovative practices (continuous improvement) for potential implementation

Service Level Agreements will be used to facilitate a quality outcome. These agreements will establish an agreed set of performance outcomes/standards for products and or services to be delivered. These agreements:

- Embrace a commitment to high standards of probity, ethics and professional conduct within an accountable and transparent process.

- Provide and sustain open and effective competition, responding to competitive markets.

Following service level agreements (seven) have been prepared and signed.

1. BCW/CA Service Level Agreement No.01 – Cross River Bridge Structures – Inspection and Minor Maintenance Procedure.

2. BCW/CA Service Level Agreement No.02 – Bridge Structures – Inspection and Minor Maintenance Procedure.
3. BCW/CA Service Level Agreement No.03 – Culvert Structures > 900mm Invert to Crown Inspection and Minor Maintenance Procedure.
4. BCW/CA Service Level Agreement No.04 – Boardwalk Structures - Inspection and Minor Maintenance Procedure.
5. LAS/CA Service Level Agreement No.01 – Park Bridges and Park Culvert Structures Inspection and Minor Maintenance Procedure.
6. LAS/CA Service Level Agreement No.02 – Culvert Structures < 900mm Invert to Crown Inspection and Minor Maintenance Procedure.
7. Service Level Agreement CA/BCW/LAS/CD001 – Major Maintenance, Rehabilitation and Renewal of BCC Structural Assets.

In addition design criteria are being developed for bridges, culvert and elevated structures which include boardwalks.

8.8 - Stock takes

8.8.1 - That stock takes of the asset base have been conducted and are current

There is no specific stock taking activity in current practise. During Level 1 and Level 2 inspections asset verifications are taking place. Any new structures identified during the course of inspections will be included in to asset register.

9.0 - Risk Management

9.1 - Risk Issues

9.1.1 - Inclusion of a risk register that is current and inclusive

Council uses the Risk Management software named IdeaFocus as the corporate standard for all risk assessments. Divisional and Corporate Risk profiles are prepared using the software and the profiles are maintained in the IdeaFocus database. The Risk Register is attached as Appendix 11 at the end of this AMP.

9.1.2 - Existence / adequacy of site based risk management plans

The AM Structures team uses excel spreadsheets to analyse risks associated with structures due to defects identified from Level 2 inspections and to initiate work programs. Sample spreadsheet is attached. Site based risk assessments are undertaken by FS.

9.2 - Business Continuity Plans

9.2.1 - BCPs that are in place if required

BCPs are procedures that are developed, compiled and maintained in readiness for use in the event of an emergency or disaster. Council has a BCP for its road network focussing on roads, Intelligent Transport Systems, Brisbane Metropolitan Transport Management Centre (BMTMC) and Bridges.

9.3 - Workplace Health and Safety

9.3.1 - Evidence Toolbox / Talks Meetings

Workplace health and safety are discussed in every section meetings on Mondays.

9.3.2 - Current updated instructions

Council is committed to being a Zero Harm organisation, where safety is the first priority and where it is not acceptable to cause harm to anyone. The major issues for WH&S surrounding the maintenance of bridges are in areas of high traffic flow. High visibility clothing must be worn. If necessary barriers are to be erected and all precautions taken to restrict access to the site as the site is deemed a construction site while maintenance works are being undertaken. Controls are to be developed to ensure that activities carried out will not cause injury or discomfort to others.

An employee must not commence work at a construction workplace unless they have received a site-specific workplace health and safety induction. All contracts issued by council include clauses that incorporate the Contractors obligations under the WH&S Regulations. There are a number of WH&S checklists that will help an employee to identify WH&S issues in workplace and assist to take appropriate measures.

9.4 - Insurance

9.4.1 - Accurate Asset Registers for insurance purposes and assets covered

Property insurance of assets covered in AMP and personnel injury claims are managed by Corporate Risk Management section. All assets are insured for personnel injuries but only cross river bridges are insured for property damage.

10.0 – Climate Change and Environmental Management

10.1 – Climate Change - Issues

10.1.1 - What are the predictions for climate change in SEQ in relation to the impact climate change may have on the assets covered within the scope of this AMP

Climate change in SEQ is expected to increase the severity and frequency of extreme weather events that cause natural hazards. The Fourth Assessment Report of the Panel on Climate Change (IPCC), released in 2007, identified SEQ as one of six 'hotspots' in Australia due to potentially significant losses to the infrastructure as result of natural hazards such as rising sea level up to 0.8m by 2100, heatwaves and high temperatures, reduced and more variable rainfall, cyclones and severe winds and severe storms and hail. Bridge components are designed for typical weather patterns, reflecting local climate and incorporating assumptions about reasonable range of temperature and precipitation levels. These components will be affected most by climate changes that cause environmental conditions to extend beyond the range for which the bridge system was designed. The following table details the impacts on Bridges and culverts due to potential key climate changes:

Table { SEQ Table * ARABIC } - Potential Climate Changes and Illustrative Impacts on Bridges and Culvert

Potential Climate Change	Example of Impacts on Operations	Examples of Impacts on Bridge
High Temperatures and Heatwaves	Limits on periods of construction and maintenance activities due to health and safety reasons	Thermal expansion on bridge expansion joints pavement surfaces
Rising sea levels, combined with severe storm surges and hail, Variable rainfall	Increases weather related delays and traffic disruptions	Reduced clearance under bridge, erosion of bridge supports
More frequent cyclones and severe winds	More debris on roads/bridge interrupting travel, road closure	Greater probability of bridge failure, increased threat to stability of bridge decks

10.1.2 – List and describe the % of the total asset greenhouse gas (GHG) emissions for assets covered in this AMP to the total GHG emissions for Council

The contribution of different bridge components towards greenhouse gas emissions has not yet been estimated. Considering the size of the structure and materials used for the bridge it is expected that the contribution will be minimal.

10.1.3 – List the critical assets and activities that contribute to the GHG emitted from assets covered in this AMP

The critical assets and activities that contribute to GHG are:

- Pavement wearing surface- Asphalt
- Lighting
- Operational and maintenance activities that consumes energy

10.2 – Climate Change - Mitigating Actions

10.2.1 – What actions are being undertaken to mitigate and to lessen the GHG emissions to meet the 50% target in the "Clean, Green" theme in the 2026 Living in Brisbane vision?

BCC is implementing the following strategies/measures as part of "Clean, Green" theme in 2026 Living in Brisbane vision:

- Reducing greenhouse gas emissions from transport fuel consumption by adopting patterns of urban development that reduce the need to travel and the distance travelled.
- Encouraging residents to use public transport. The Brisbane 2026 Vision goal is for 41% of morning trips to be made by walking, cycling or public transport by 2026.
- Projects are underway to protect Brisbane's rich diversity of plant and animal species, restore 40 per cent of mainland Brisbane to natural habitat, reconnect ecological corridors and plant more trees

10.2.2 – What actions are being implemented to meet the city-wide outcome "Cleaner, sustainable energy use"?

Council has a practical plan to prepare for climate change. It includes strategies such as Council purchasing green power and providing incentives for sustainable development. As per Council's Plan for Action on Climate Change and Energy 2007, Council Officers may investigate the feasibility of the following in construction and maintenance of Bridges and Culverts in Council:

- Move to E10, LPG, B100 and B20 bio diesel for all Council vehicles and machinery.
- Consider contractors' willingness to use available fuels in procurement processes and set minimum bio fuel use requirements as soon as feasible.
- Use reusable and recycled construction materials.
- Use of alternative materials in construction and maintenance.

To ensure successful implementation of the Plan for Action, Council will partner and work with the Commonwealth and State Governments, the community, business and industry to meet Brisbane's greenhouse emission targets.

10.2.3 - What change management initiatives (cultural etc) are being introduced in this AMP to less the impact of GHG emissions?

The following initiatives are being introduced in this AMP to reduce the impact of GHG emissions:

- Identifying asset management practices that reduce energy consumption in infrastructure operations, construction and maintenance.
- Improving the use of alternative materials in construction and maintenance.

10.2.4 - List future actions for follow-up before the next AMP update

Future actions for climate change included in Action items are listed in Appendix 1

10.3 - Climate Change – Responses

How will the activities and assets in this AMP respond in terms of?

10.3.1 - Higher and more extremes of temperature – Comment upon the impacted assets

Please refer to section 10.1.1 for details

10.3.2 - Global sea, river and water table rises – Comment upon the impacted assets

Please refer to section 10.1.1 for details

10.3.3 - Increasing storm surges and wind intensities – Comment upon the impacted assets

Please refer to section 10.1.1 for details

10.3.4 - Erratic rainfall patterns – Comment upon the impacted assets

Please refer to section 10.1.1 for details

10.4 - Environmental Management

10.4.1 - What is the existence / adequacy / currency of site-based environmental management plans?

Section 319 of the *Environmental Protection Act 1994* (EP Act) sets the requirements for a site based Environmental Management Plan.
The Procedures in the *Environmental Management Plan (Construction)* (EMP(C)) outlines measures and design elements that were implemented to prevent and/or minimise potential environmental impacts during the construction phase on the following matters:

• Acid sulphate soils • Air quality • Contaminated land • Environmental incidents • Erosion & sedimentation control • Fauna • Fire ants • Hazardous materials	• Indigenous cultural heritage • Noise • Non-indigenous cultural heritage • Dilapidation survey • Stormwater and river water quality • Vegetation • Vibration • Waste

10.4.2 - What hazardous substances exist and what strategy is in place to eliminate them?

The following precautions are taken when preserving the assets through protective coatings and through repairs, maintenance and cleaning processes:

- No chemicals are used in the cleaning processes
- Check products information sheets and MSDS sheets before applying any substances to the assets

10.4.3 - Air / noise / visual / water management comments

Air quality is generally not an issue with bridges and is not subject to regulations such as vehicles that may pollute. However air inside culverts could become polluted due to sedimentation and silting and may require testing before entering. Some culverts could be considered as confined spaces and confined space requirements are activated. The structures generally do not generate noise, but defective expansion and constructions joints, settlements at relieving slabs could generate varying levels of noise pollutants.

Utmost care is will be taken to ensure that new or rehabilitated components blend with the natural environment and into the original asset design.

Generally, run off from existing long structures is directly discharged to the waterways without any filtering through scuppers and other methods. Proper drainage facilities are required for new assets to collect and discharge to waterways after filtering through swales, sedimentation ponds etc. This is a requirement in AM's design guidelines.

11.0 - Condition Assessment

11.1 - Relevancy

11.1.1 - Describe AM methodology and framework. For different assets in the same category, multiple methodologies are required

In general, and unless noted otherwise, the condition assessment should be carried out for all types of structures with the exception of minor culverts according to the *Bridge Inspection Manual* of Department of Main Roads.

The grade is allocated based on the overall condition of the entire asset and not just the severity of defects in particular. It should therefore be considered in context to what may trigger the replacement of the asset or its effective end of useful life. For example, a component of a bridge may be severely damaged, but this would not necessarily trigger full replacement of the whole structure.

Table { SEQ Table * ARABIC } -Condition Grades for All Types of Structures Except for Minor Culverts

Grade	Subjective Rating	General Description		Age Status	Remaining Life
		Bridges and Major Culverts	Minor Culverts		
1	Good ('as-new')	Free of defects with little or no deterioration evident	Asset appears to be relatively new. No evidence of damage or wear and tear observed. No obvious signs of settlement, movement or displacement.	Asset is in new condition.	100%
2	Fair	Free of defects affecting structural performance, integrity and durability Deterioration of a minor nature in the protective coating and/or parent material is evident	Minor wear and tear, fading, discolouration, or surface defects may be present. No obvious signs of settlement, movement or damage.	The asset is not new, but is in its early life stage and less than halfway through its life.	70%

Grad	Subjective	General Description		Age Status	Remaining Life
3	Poor	Defects affecting the durability/serviceability which may require monitoring and/or remedial action or inspection by a structural engineer. Component or element shows marked and advancing deterioration including loss of protective coating and minor loss of section form the parent material is evident Intervention is normally required	Asset may show signs of wear and tear and discolouration or fading. Some minor defects such as cracking, spalling, and minor damage or displacement may be observed.	The asset is about halfway through its lifecycle.	40%
4	Very Poor	Defects affecting the performance and structural integrity which require immediate intervention including an inspection by a structural engineer, if principal components are affected. Component or element shows advanced deterioration, loss of section from the parent material, signs of overstressing or evidence that it is acting differently to its intended design mode or function	Asset showing signs wear and tear and discolouration or fading. Some defects such as cracking, spalling, and minor damage or displacement may be observed Some larger isolated defects may be observed.	The asset has approximately 20% of its remaining life left.	20%
5	Unsafe	This state is only intended to apply to the "whole structure" rating. Structural integrity is severely compromised and the structure must be taken out of service until a structural engineer has inspected the structure and recommended the required remedial action	Total failure of all or part of the asset has been observed, or Damage, displacement, settlement has been observed to the extent that replacement of the asset is imminent	Asset has reached, or almost reached the end of its serviceable life and replacement is imminent.	2%

Minor Culverts

This approach provides the minimum information required for revaluation of the assets, but it is suggested that a more comprehensive assessment is carried out for some asset types to provide a better predictive tool on the deterioration of assets and to assist with prioritisation of asset replacement and triggers for intervention.
The estimate of 'remaining life' and 'age status' in Table 8 are the preferred indicators for the asset condition grade. The condition grade should also consider the current and expected future service demand and be considered independent of the current age of the asset. For example, if an asset is known to have already reached the age equivalent to its expected useful life, say 50 years, but it is expected that it will not be replaced for another 20 years because of its current condition and low level of use, then it should be assigned a condition grade of 3 (i.e. 40% of 100years useful life = a remaining life of 20 years).

11.1.2 - List the condition ratings for the assets within the ASP

Bridges

Condition Rating of TP&S Bridges inspected to date.

Condition		1	2	3	4	5	Unknown
TP&S Bridges	Number	25	273	127	33	1	
	%	5%	52%	24%	6%	0%	13%

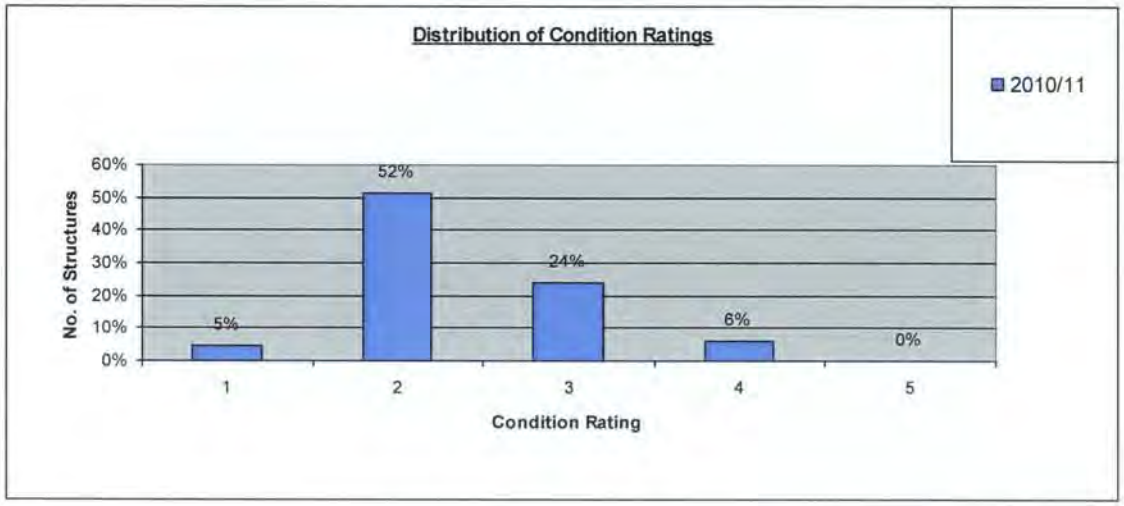


Figure { SEQ Figure * ARABIC } - Distribution of Condition Ratings of TP&S Bridges

This bar chart shows the distribution of condition ratings recorded against bridge assets. All assets have their most up to date information recorded as indicated above and this is an accurate representation of the current condition of Council TP&S bridge structures. Assets are grouped according to their condition rating.

Culverts

Condition Rating of Culverts inspected to date.

Condition		1	2	3	4	5	Unknown
TP&S Culverts	Number	66	152	215	24	1	
	%	4%	8%	12%	1%	0%	75%

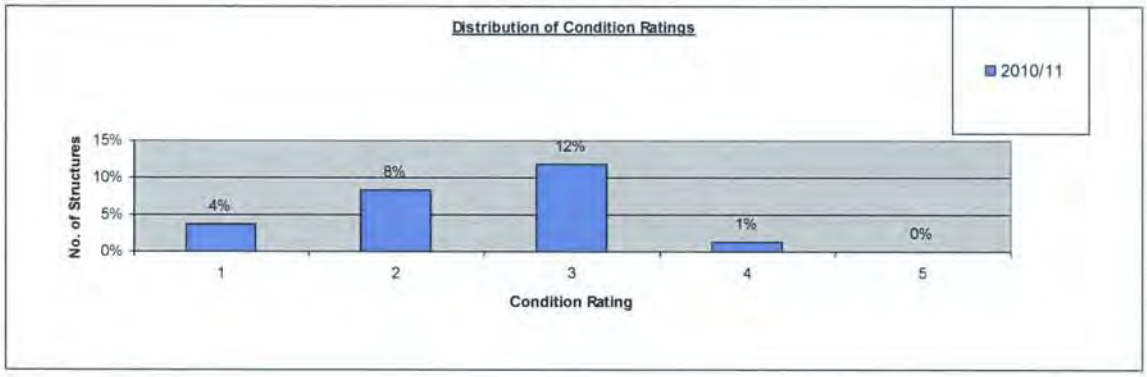


Figure { SEQ Figure * ARABIC } - Distribution of Condition Ratings of Culverts

This bar chart shows the distribution of condition ratings recorded against culvert assets. All assets have their most up to date information recorded as indicated above and this is an accurate representation of the current condition of culvert structures.

NES Park Bridges

Condition Rating of Park Bridges inspected to date.

Condition		1	2	3	4	5	Unknown
Assets	Number	2	117	58	26	3	
	%	1%	49%	24%	11%	1%	14%

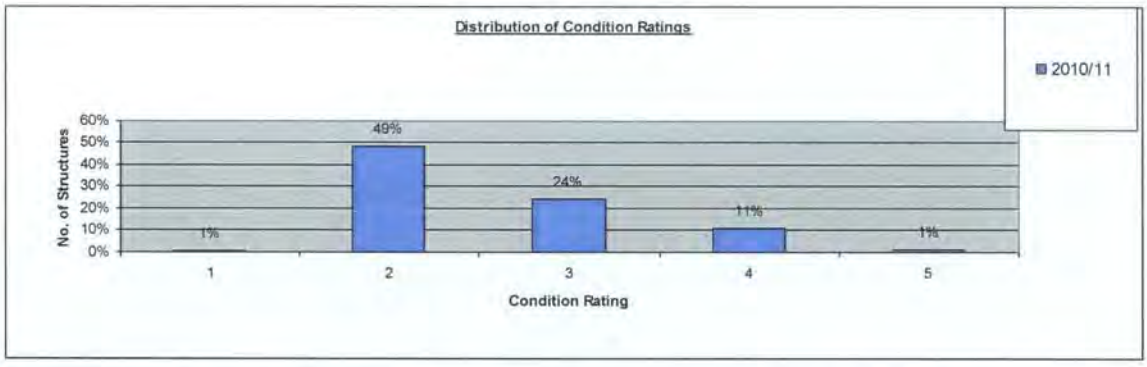


Figure { SEQ Figure * ARABIC } - Distribution of Condition Ratings of NES Parkbridges

This bar chart shows the distribution of condition ratings recorded against NES park bridge assets. All assets have their most up to date information recorded as indicated above and this is an accurate representation of the current condition of Council structures.

11.1.3 - Prepare age and / or condition profile graphs

T&T bridges

Construction dates are available only for T&T road bridges. Condition rating of bridges relative to their age is given in Table 5 and Figure 13. It is difficult relate the condition of a structure since they have gone through several rehabilitation stages. Age or construction dates of NES structures are unknown.

Age Years	Number of Bridges - Condition						
	1	2	3	4	5	Unknown	Total
0 -10	5	27	12	0	0	43	{ =SUM(LEFT) }
10 -20	4	26	45	2	0	14	{ =SUM(Left) }
20 - 30	2	24	60	7	1	20	{ =SUM(Left) }
30 - 40	1	16	42	5	0	20	{ =SUM(Left) }
40 - 50	2	20	31	0	0	14	{ =SUM(LEFT) }
50 - 60	1	2	7	5	0	3	{ =SUM(LEFT) }
60 -70	0	3	1	0	0	4	{ =SUM(LEFT) }
70 - 80	1	1	5	0	0	2	{ =SUM(LEFT) }
80 - 90	0	1	1	0	0	4	{ =SUM(LEFT) }
>90	0	0	0	0	0	5	{ =SU

							M(LEFT) }
Total	{ =SUM(ABOVE) }	{ =SUM(ABOVE) }	{ =SUM(ABOVE) }	{ =SUM(ABOVE) }	{ =SUM(ABOVE) }	{ =SUM(ABOVE) }	{ =SUM(ABOVE) }
	3%	25%	41%	4%	0%	27%	

Table { SEQ Table * ARABIC } – Age and Condition Variation for T&T bridges

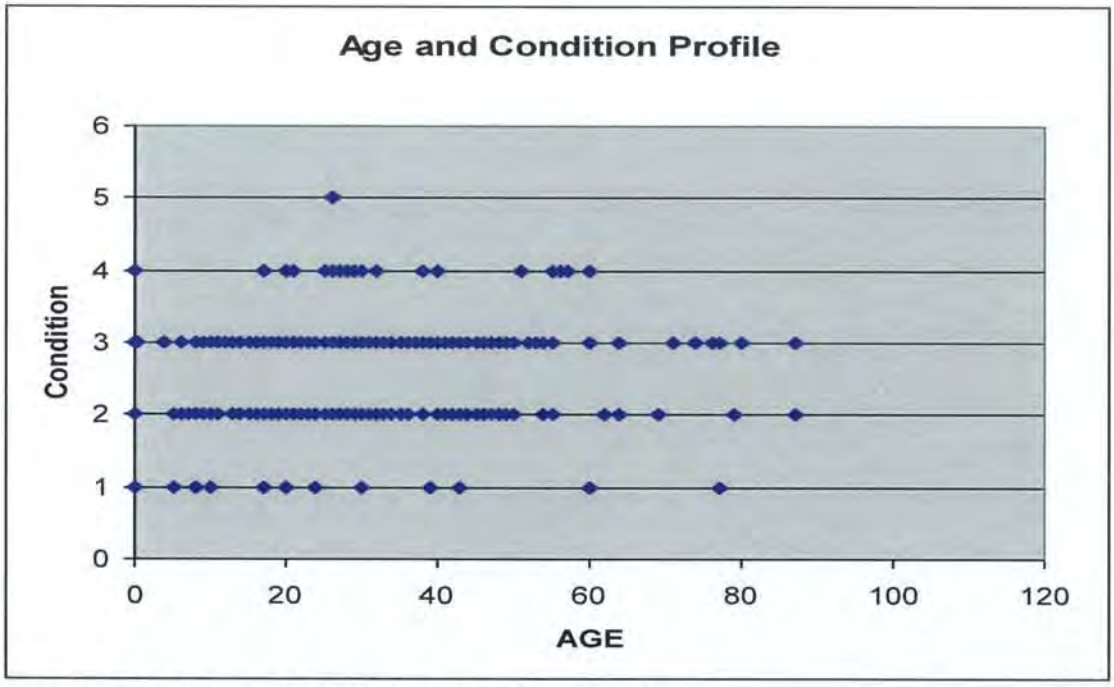


Figure { SEQ Figure * ARABIC } - Age & Condition Profile

11.1.4 - Explain the AM assigned in terms of future maintenance and funding needs

From the condition inspection carried out on bridges, 4% is well past its intervention level and some of them are in the 11/12 published budget. Therefore balance need to be treated as deferred expenditure and allocated for rehabilitation in a future accounting period after 11/12 financial year. Some have been allocated to 12/13 and others are included within the 10 year program.

11.1.5 - That condition assessments are current (i.e. last 12 months)

All inspections have not undertaken to required frequencies suggested in Main Roads Bridge Inspection Manual. But action has been taken to increase number of inspections within next three financial years to achieve required frequencies.

Appendix 1 – Action Items Plan

Action Item List

No.	Ref.	Action Item	Staff	Delivery Date
1.	3.4.1	Develop KPI or performance indicators to monitor level of services	AM	01/07/2012
2.	4.2.1	Introduce electronic data capture system for field inspection	FS	01/07/2012
3.	5.1	Estimate construction dates for the structures with unknown construction dates.	AM	01/07/2012
4.	5.2	Request increase in funding for inspection and maintenance of park bridges	AM	01/07/2012
5.	5.2	Develop procedures to accept assets from developers, contractors, Council Major Projects and FS.	AM	01/07/2012
6.	7.2.2	Develop a system to store part-by-part (component) data of bridges and culverts	AIM	01/07/2012

7.	7.2.2	Develop QA system for collection of data.	FS	01/07/2012
8.	7.3	Develop electronic project ranking system for maintenance	AM	01/07/2012
9.	8.3.4	Audit and review the asset management practices documented in the AMP annually	AM	01/07/2012
10.	10.2.4	Identify reusable and recycled construction materials to reduce GHG.	AM	01/07/2012
11.	10.2.4	Identify alternative materials in construction and maintenance to reduce GHG	AM	01/07/2012

(All Action Items are listed within the Action Plan are hyperlinked to the body of the report)

Appendix 2 – 10 year (2011/12 to 2020/21) bridge Inspection, rehabilitation and maintenance forecast

Various Inspections of Structures required ensuring safety and serviceability of asset portfolio

Asset Number	Schedule	Asset Name/ Description	Suburb	Location - UBD	Description of Work	2011/12	2012/13 to 2020/21
Various Schedules		**Various INSPECTIONS of Structures required to ensure safety and serviceability of asset portfolio**					
		Level 1 Inspection - General Safety and Serviceability Inspection			**Annual inspection as per MR Bridge Manual- $ 250 per inspection (average), $ 2500 for Boardwalk**	**$645,750**	**$645,750**
	OB	526 T&T Road and Pedestrian Bridges	All	All		$131,500	$131,500
		7 Cross River Bridges	All	All			
	OB	1767 T&T & NES Culverts	All	All		$441,750	$441,750
	OB	29 Boardwalks	All	All		$72,500	$72,500
		Level 2 Inspection - Detailed inspection of structure to determine condition rating			**1/3 of assets to be inspected annually to achieve suggested frequencies by the Manual. $ 4000 per bridge, $ 500 per culvert, $ 8000 per boardwalk. (avg)**	**$1,075,833**	**$1,075,833**
	OB	526 T&T Road and Pedestrian Bridges	All	All		$701,333	$701,333
		7 Cross River Bridges	All	All			
	OB	1767 T&T & NES Culverts	All	All		$294,500	$294,500
	OB	29 Boardwalks	All	All		$80,000	$80,000
		Under Water Inspections - Detailed inspection of below water substructure structure to determine condition rating			**1/8 of assets to be inspected annually to achieve suggested frequencies by the Manual. $ 3000 per bridge, $ 5000 per boardwalk. (avg)**	**$215,375**	**$215,375**
			All	All			
	OB	526 T&T Road and Pedestrian Bridges	All	All		$197,250	$197,250
		7 Cross River Bridges	All	All			
	OB	1767 T&T & NES Culverts	All	All			
	OB	29 Boardwalks	All	All		$18,125	$18,125

		Level 3 Inspection & Design Analysis for Excess Mass Vehicle Permits - Assessment of existing structures to provide safe load rating			**20 Structures annually at the rate of $ 20,000**	**$400,000**	**$400,000**
	OB	526 T&T Road and Pedestrian Bridges	All	All		$400,000	$400,000
		7 Cross River Bridges	All	All			
	OB	1767 T&T & NES Culverts	All	All			
	OB	29 Boardwalks	All	All			
		General Maintenance Works arising from Level 1 & 2 inspections			**Annual general maintenance cost for bridges, culverts and Boardwalk - $ 1500**	**$3,483,000**	**$3,483,000**
	OB	526 T&T Road and Pedestrian Bridges	All	All		$789,000	$789,000
		7 Cross River Bridges	All	All			
	OB	1767 T&T & NES Culverts	All	All		$2,650,500	$2,650,500
	OB	29 Boardwalks	All	All		$43,500	$43,500
		Inspection & Maintenance (Recurrent)- T&T				**$5,819,958**	**$5,819,958**
		Cross River Bridges				**$4,383,000**	**$5,619,000**
		Budget Forecast				**$10,202,958**	**$11,438,958**

Programmed Maintenance Works arising from Level 2 & 3 reports

FY 2011/12							
Asset Number	**Schedule**	**Asset Name/ Description**	**Road**	**Suburb**	**Location - UBD**	**Description of Work**	**Estimate**
		Level 3 Inspection & Design					
	56	526 T&T Road and Pedestrian Bridges		All		**20 Structures annually at the rate of $ 30,000**	$600,000
		7 Cross River Bridges		All			
	56	1767 T&T & NES Culverts		All			
	56	29 Boardwalks		All			
B0380	56	1 SPAN TIMBER BEAM ROAD BRIDGE	BUNDALEER STREET	Brookfield	136 Q 19	Bridge Replacement	$400,000
B0530	56	1 SPAN CONCRETE BEAM ROAD BRIDGE	COX ROAD	Windsor	139 Q 16	DWS Rehabilitation/QR	$100,000
B0620	56	1 SPAN TIMBER BEAM FOOTBRIDGE	DOWNEY PARK #2	Windsor	139 P 18	Timber Bridge Replacement	$90,000
B0680	56	3 SPAN COMPOSITE BEAM FOOTBRIDGE	EDGAR STREET	Northgate	121 A 19	Dry rot damage in piles, headstocks, abutments and hand rail posts; poor timber decking.	$300,000
B0740	56	1 SPAN TIMBER BEAM FOOTBRIDGE	FINSBURY PARK #2	Wilson	139 J 19	Single span footbridge in poor condition and could be replaced with fibre composite.	$20,000
B0830	56	2 SPAN CONCRETE BEAM ROAD BRIDGE	GIPPS STREET	Fortitude Valley	160 A 16	Rehabilitation of bridge/QR	$180,000
B0910	56	4 SPAN COMPOSITE ROAD BRIDGE	GRESHAM STREET	Ashgrove	158 K 1	Replacement Pier/Girders	$200,000
B 1370	56	3 SPAN CONCRETE BEAM ROAD BRIDGE	TRAMWAY STREET	Ferny Grove	137 L 3	Bridge Rehabilitation	$80,000

Asset Number	Schedule	Asset Name/ Description	Road	Suburb	Location - UBD	Description of Work	Estimate
B1585	56	1 SPAN CONCRETE ARCH ROAD BRIDGE	PARK AVENUE	Clayfield	140 H 6	Poor condition of the AMst-in-situ arch and wing walls; suspected heavier dead; L3 Inspection & City Design assessment required.	$300,000
B1611	56	1 SPAN STEEL BEAM FOOTBRIDGE	PRESTON ROAD	Carina	162 B 19	Repairs to structure and replace decking Possible maintenance works	$50,000
B1850	56	3 SPAN CONCRETE BEAM ROAD BRIDGE	SHERWOOD ROAD #2	Sherwood	179 A 20	Bridge Rehabilitation	$160,000
B1910	56	4 SPAN TIMBER BEAM FOOTBRIDGE	STEEGE STREET	Ashgrove	139 A 17	Timber Bridge Rehabilitation - Replace Pile, Headstock, Timber & decking repairs.	$120,000
B2150	56	Webster Road 4 SPAN CONCRETE BEAM ROAD BRIDGE	Webster Rd #1, Grange	Grange	139 K 9	Bridge Rehabilitation - water proofing	$160,000
B2250	56	4 SPAN CONCRETE BEAM ROAD BRIDGE	WYNNUM ROAD #4 D/S	Tingalpa	162 J 10	Triple wrap Joints, water blast, moisture seal, concrete repairs, AC Ops to profile $ resheet & line mark	$100,000
B9803	56	1 SPAN STEEL BEAM FOOTBRIDGE/BIKEWAY	Downey Park, Windsor	Herston		Structural steel repairs & protection	$120,000
B9858	56	2 SPAN STEEL TRUSS FOOTBRIDGE	LEEDS ROAD, ROCKLEA	Rocklea		Bridge Rehabilitation (Strengthening)	$70,000
B9857	56	1 SPAN STEEL TRUSS FOOTBRIDGE	COLVIN STREET, ROCKLEA	Rocklea		Bridge Rehabilitation (Strengthening)	$30,000
C0023B	56	2 CELL 2.7 * 1.2 BOX CULVERT	Esther St DEAGON	Deagon	110 M 9	Culvert Rehabilitation/Replacement	$500,000
	56	Gold Creek Rd Culverts	Gold Creek Rd			Culvert Rehabilitation/Replacement	$50,000
B0460	56	2 SPAN CONCRETE BEAM ROAD BRIDGE	COOPERS AMMP ROAD	Bardon	158 M 3	Repair significant cracks in pier headstocks and repair joints	$30,000
B0450	56	1 SPAN TIMBER BEAM FOOTBRIDGE	COOLIBAH STREET	Bardon	157 M 5	Replace deck planks, kerbs, piking planks and concrete approaches and some girders	$20,000

Asset Number	Schedule	Asset Name/ Description	Road	Suburb	Location - UBD	Description of Work	Estimate
B9971	56	2 SPAN CONCRETE ROAD BRIDGE	Wallum Street	Parkinson		Deck water proofing	$90,000
B9972	56	3 SPAN STEEL BEAM ROAD BRIDGE	Near House #11.	Parkinson		Rehab Crack sealing	$50,000
B2840	56	1 SPAN STEEL TRUSS FOOTBRIDGE	QUEENSLAND ROAD	DARRA	198 A13	Replace failing ply decking with fibre composite/recycled plastic	$25,000
B0770	56	1 SPAN CONCRETE BEAM ROAD BRIDGE	FLINDERS PARADE	FLINDERS	100 P 15	Repairs	$70,000
	56	Radio Street Bridge	Eagle Farm Road	Pinkenba		Replacement of crossing with suitable structure (possibly culvert)	$325,000
B0545	56	2 SPAN TIMBER BEAM ROAD BRIDGE	CREEK ROAD #4	AMRINA HEIGHTS		Rehabilitate existing timber structure by replacing components (headstocks and closing footpath) Replacement to be scheduled for 5yrs	$50,000
B8886	56	1 SPAN TIMBER & STEEL ROAD BRIDGE	MEEKES ROAD	KHOLO		Replacement of crossing with suitable structure (possibly culvert)	$10,000
		Rehab & Renewal - T&T	**Total**				**$4,300,000**
		Cross river bridges					**$2,795,000**
		Budget Forecast					**$7,095,000**

FY 2012/13							
Asset Number	**Schedule**	**Asset Name/ Description**	**Road**	**Suburb**	**Location - UBD**	**Description of Work**	**2012/13**
		Level 3 Inspection & Design					
	56	526 T&T Road and Pedestrian Bridges		All		**20 Structures annually at the rate of $ 30,000**	$600,000
		7 Cross River Bridges		All			
	56	1767 T&T & NES Culverts		All			
	56	29 Boardwalks		All			
B0060	56	12 SPAN CONCRETE BEAM ROAD BRIDGE	ALBION OVERPASS	Albion	140 D 14	Crack sealing, patch repairs and anti carbonation coating etc	$300,000
B0380	56	1 SPAN TIMBER BEAM ROAD BRIDGE	BUNDALEER STREET	Brookfield	136 Q 19	Bridge Replacement	$400,000
B0511	56	1 SPAN CONCRETE BEAM ROAD BRIDGE	HALE STREET #2	Redhill	159 K 6	DWS/Rehab/Anti carbonation/concrete Repairs	$250,000
B0514	56	2 SPAN CONCRETE BEAM ROAD BRIDGE	MILTON ROAD #2	Brisbane	159 H 8	DWS/Rehab/Anti carbonation/concrete Repairs	$520,000
B0520	56	2 SPAN CONCRETE BEAM ROAD BRIDGE	CORONATION DRIVE #2	Milton	159 E 13	Pile Rehabilitation (ASR)	$200,000
B0550	56	1 SPAN TIMBER BEAM FOOTBRIDGE	CRESSEY STREET	Wavell Heights	120 E 20	Timber Bridge Rehab/Replacement	$50,000
B0630	56	1 SPAN TIMBER BEAM FOOTBRIDGE	DOWNEY PARK #3	Windsor	139 P 18	Timber Bridge Replacement	$60,000
B0680	56	3 SPAN COMPOSITE BEAM FOOTBRIDGE	EDGAR STREET	Northgate	121 A 19	Dry rot damage in piles, headstocks, abutments and hand rail posts; poor timber decking.	$400,000
B0740	56	1 SPAN TIMBER BEAM FOOTBRIDGE	FINSBURY PARK #2	Wilson	139 J 19	Single span footbridge in poor condition and could be replaced with fibre composite.	$100,000
B0800	56	2 SPAN CONCRETE BEAM ROAD BRIDGE	FULCHER ROAD	Redhill	159 C 1	Bridge Rehabilitation	$80,000

Asset Number	Schedule	Asset Name/ Description	Road	Suburb	Location - UBD	Description of Work	Estimate
B0980	56	2 SPAN TIMBER BEAM FOOTBRIDGE	HIGH STREET	Highgate Hill	179 M 1	Footbridge replacement, will require significant design and constructability due to location of structure,	$400,000
B1660	56	3 SPAN CONCRETE BEAM ROAD BRIDGE	RICKERTT ROAD #1	Ransome	163 H 18	Bridge deck wearing surface and joint repairs	$440,000
B1860	56	1 SPAN CONCRETE BEAM ROAD BRIDGE	SIMPSONS ROAD	Bardon	158 K 6	DWS/Rehab/Anti carbonation/concrete Repairs	$40,000
B2685	56	3 SPAN STEEL BEAM FOOTBRIDGE	TURBO DRIVE #2	Coorparoo	160 H 20	One span of structure has severe corrosion of the bottom chord and will need to consider replacement of this span. Temporary works carried out in 10/11	$20,000
B2020	56	4 SPAN CONCRETE BEAM FOOTBRIDGE	BENSON STREET	Toowong	159 A 18	Bearings, Concrete repairs Anti carbonation etc	$60,000
B2095	56	Bicentennial Bikeway	North Quay Rd	Brisbane	159 L 11	Bearing to be replaced; FS to re-inspect and update report; City Design to propose methodology to replace bearing within one low tide.	$40,000
B2570	56	3 SPAN COMPOSITE BEAM ROAD BRIDGE	BROOKES STREET	Bowen Hills	160 C 3	Bridge Rehabilitation/QR	$200,000
B2630	56	2 SPAN COMPOSITE BEAM ROAD BRIDGE	GILSTON STREET	Keperra		Bridge Rehabilitation/QR	$100,000
B2720	56	2 SPAN CONCRETE BEAM ROAD BRIDGE	O'CONNELL TERRACE	Bowen Hills		Bridge Rehabilitation/QR	$80,000
B3050	56	1 SPAN CONCRETE BEAM ROAD BRIDGE	GLOUCESTER STREET #2	Highgate Hill		Bridge Rehabilitation/QR	$150,000
B4020	56	2 SPAN CONCRETE BEAM ROAD BRIDGE	MILTON ROAD	Milton		Pile Rehabilitation (ASR)	$150,000
B9790	56	2 SPAN PRESTRESSED CONCRETE ROAD BRIDGE	Nudgee Road	Nudgee		Bridge Rehab & Barriers	$200,000

Asset Number	Schedule	Asset Name/ Description	Road	Suburb	Location - UBD	Description of Work	Estimate
B1830	56	2 SPAN TIMBER BEAM FOOTBRIDGE	SHELGATE STREET	Chermside West	119 H 14	Bridge Replacement	$400,000
C0023B	56	2 CELL 2.7 * 1.2 BOX CULVERT	Esther St DEAGON	Deagon	110 M 9	Culvert Rehabilitation/Replacement	$700,000
C0026B	56	1 CELL 2.4 * 1.5 BOX CULVERT	Smith St DEAGON	Deagon	110 M 9	Culvert Rehabilitation/Replacement	$650,000
B0026	56	1 SPAN TIMBER BEAM FOOTBRIDGE	Taronne St Footbridge	Carindale	181 P9	Replace structure with concrete pipe bridge structure	$20,000
B8886	56	1 SPAN TIMBER & STEEL ROAD BRIDGE	MEEKES ROAD	KHOLO		Replacement of crossing with suitable structure (possibly culvert)	$120,000
		Rehab & Renewal - T&T	**Total**				**$6,730,000**
		Cross river bridges					**$4,227,000**
		Budget Forecast					**$10,957,000**

FY 2013/14							
Asset Number	**Schedule**	**Asset Name/ Description**	**Road**	**Suburb**	**Location - UBD**	**Description of Work**	
		Level 3 Inspection & Design					
	56	526 T&T Road and Pedestrian Bridges		All		**20 Structures annually at the rate of $ 30,000**	$600,000
		7 Cross River Bridges		All			
	56	1767 T&T & NES Culverts		All			
	56	29 Boardwalks		All			
B0065	56	3 SPAN TIMBER BEAM ROAD BRIDGE	ALDERLEY AVENUE	Alderly	139 E 11	Replacement - Concrete bridge	$200,000
B0210	56	2 SPAN TIMBER BEAM FOOTBRIDGE	BISHOP STREET	Kelvin Grove	139 J 18	New Bridge to replace existing timber pedestrian bridge	$700,000
B0274	56	9 SPAN TIMBER BEAM FOOTBRIDGE	BRACKEN RIDGE ROAD (HAROLD KIELLY PARK)	Bracken Ridge	109 N 1	Bridge Rehabilitation	$500,000
B0502	56	12 SPAN CONCRETE BEAM ROAD BRIDGE	KELVIN GROVE ROAD	Kelvin Grove	139 G 19	Bridge Rehabilitation	$240,000
B0503	56	5 SPAN CONCRETE BEAM ROAD BRIDGE	KELVIN GROVE ROAD	Kelvin Grove	139 G 19	Bridge Rehabilitation	$180,000
B0506	56	1 SPAN CONCRETE BEAM ROAD BRIDGE	MUSGRAVE ROAD #1	Redhill	159 J 6	DWS/Rehab/Anti carbonation/concrete Repairs	$120,000
B0630	56	1 SPAN TIMBER BEAM FOOTBRIDGE	DOWNEY PARK #3	Windsor	139 P 18	Timber Bridge Replacement	$20,000
B0650	56	3 SPAN TIMBER BEAM FOOTBRIDGE	RAVEN RESERVE #1	Chermside West	119 F 15	Timber Bridge Rehabilitation	$100,000
B0820	56	5 SPAN CONCRETE BEAM ROAD BRIDGE	GILBERT ROAD	Lutwyche	139 P 10	Bridge Rehabilitation	$150,000
B0980	56	2 SPAN TIMBER BEAM FOOTBRIDGE	HIGH STREET	Highgate Hill	179 M 1	Footbridge replacement, will require significant design and constructability due to location of structure,	$400,000

Asset Number	Schedule	Asset Name/ Description	Road	Suburb	Location - UBD	Description of Work	
B1020	56	1 SPAN STEEL TRUSS FOOTBRIDGE	HYACINTH STREET	Inala	218 L 5	New Bridge	$450,000
B1150	56	3 SPAN CONCRETE BEAM ROAD BRIDGE	KENMORE ROAD	Kenmore	177 Q 15	Bridge Rehabilitation/QR	$120,000
B1710	56	2 SPAN TIMBER BEAM ROAD BRIDGE	ROSS ROAD	Upper Kedron	137 A 10	Timber Bridge Rehabilitation	$50,000
B2000	56	4 SPAN CONCRETE BEAM ROAD BRIDGE	THISTLE STREET	Gordon Park	140 A 9	Concrete crack and spall, moisture penetration, crack in deck wearing surface.	$150,000
B2685	56	3 SPAN STEEL BEAM FOOTBRIDGE	TURBO DRIVE #2	Coorparoo	160 H 20	One span of structure has severe corrosion of the bottom chord and will need to consider replacement of this span. Temporary works carried out in 10/11	$100,000
B2540	56	3 SPAN CONCRETE BEAM ROAD BRIDGE	CREEK STREET	Brisbane	159 Q 9	Bridge Rehabilitation/QR	$200,000
B2680	56	2 SPAN CONCRETE BEAM ROAD BRIDGE	TURBO DRIVE #1	WOOLLOONGA BBA		Bridge Rehabilitation	$200,000
B2830	56	3 SPAN CONCRETE BEAM ROAD BRIDGE	FIG TREE POCKET ROAD	Chapel Hill		Bridge Rehabilitation	$80,000
C0024B	56	2 CELL 3 * 1.8 BOX CULVERT	Blackwood Rd DEAGON	Deagon	110 N 9	Culvert Rehabilitation/Replacement	$300,000
C0025B	56	2 CELL 3 * 1.8 BOX CULVERT	Finnie Rd DEAGON	Deagon	110 N 9	Culvert Rehabilitation/Replacement	$600,000
	56	Savages Road Culverts, Brookfield	Savages Road	Brookfield		Culvert Rehabilitation/Replacement	$50,000
	56	Upper Brookfield Road Culverts, Brookfield	Upper Brookfield Road	Brookfield		Culvert Rehabilitation/Replacement	$80,000
CXXXXB	56	Blunder Road	Blunder Road			Culvert Rehabilitation/Replacement	$245,000
B0026	56	1 SPAN TIMBER BEAM FOOTBRIDGE	Taronne St Footbridge	Carindale	181 P9	Replace structure with concrete pipe bridge structure	$250,000

Asset Number	Schedule	Asset Name/ Description	Road	Suburb	Location - UBD	Description of Work	
B0804	56	8 SPAN CONCRETE BEAM ROAD BRIDGE	Logan Road	Greenslopes	180 E4	Waterproof membrane, deck wearing surface and joint works. Work to occur after bus way is completed	$300,000
B0545	56	2 SPAN TIMBER BEAM ROAD BRIDGE	CREEK ROAD #4	AMRINA HEIGHTS		Rehabilitate existing timber structure by replacing components (headstocks and closing footpath) Replacement to be scheduled for 5yrs	$50,000
		Rehab & Renewal - T&T	**Total**				**$6,435,000**
		Cross river bridges					**$6,309,000**
		Budget Forecast					**$12,744,000**

FY 2014/15							
Asset Number	**Schedule**	**Asset Name/ Description**	**Road**	**Suburb**	**Location - UBD**	**Description of Work**	
		Level 3 Inspection & Design					
	56	526 T&T Road and Pedestrian Bridges		All		**20 Structures annually at the rate of $ 30,000**	$600,000
		7 Cross River Bridges		All			
	56	1767 T&T & NES Culverts		All			
	56	29 Boardwalks		All			
B0220	56	2 SPAN CONCRETE BEAM ROAD BRIDGE	BLUNDER ROAD #1	DURACK	218 P 4	Crack sealing, patch repairs and anti carbonation coating etc	$80,000
B0280	56	3 SPAN TIMBER BEAM FOOTBRIDGE	BOWERING STREET	Lota	163 Q 12	New Bridge to replace timber bridge	$500,000
B1900	56	2 SPAN TIMBER BEAM ROAD BRIDGE	WACOL STATION ROAD		197 F 14	Timber bridge to be replaced with new structure after rehabilitation works.	$2,000,000
B0507	56	1 SPAN CONCRETE BEAM ROAD BRIDGE	MUSGRAVE ROAD #2	Redhill	159 J 6	DWS/Rehab/Anti carbonation/concrete Repairs	$80,000
B0508	56	Musgrave road 1 SPAN CONCRETE BEAM ROAD BRIDGE 03	Musgrove Rd #3	Redhill	159 J 6	DWS/Rehab/Anti carbonation/concrete Repairs	$80,000
B0509	56	1 SPAN CONCRETE BEAM ROAD BRIDGE	MUSGRAVE ROAD #3	Redhill	159 J 6	DWS/Rehab/Anti carbonation/concrete Repairs	$150,000
B0610	56	1 SPAN TIMBER BEAM FOOTBRIDGE	DOWNEY PARK #1	Windsor	139 P 18	Timber Bridge Replacement	$150,000
B0780	56	1 SPAN TIMBER BEAM FOOTBRIDGE	FLINDERS PARADE	Brighton		Repair/replace Bolts general repairs	$80,000
B1611	56	1 SPAN STEEL BEAM FOOTBRIDGE	PRESTON ROAD	Carina	162 B 19	Repairs to structure and replace decking Possible maintenance works	$50,000
B1640	56	2 SPAN CONCRETE BEAM ROAD BRIDGE	QUIRK STREET	The Gap	137 R 19	Bridge Rehabilitation	$80,000

Asset Number	Schedule	Asset Name/ Description	Road	Suburb	Location - UBD	Description of Work	
B1990	56	4 SPAN TIMBER BEAM FOOTBRIDGE	TENNIS AVENUE	Ashgrove	139 E 19	Timber Bridge Rehab/Replacement	$400,000
B2210	56	4 SPAN CONCRETE BEAM ROAD BRIDGE	WEBSTER ROAD #1 D/S	Tingalpa	162 P 8	Bridge Rehabilitation	$125,000
B2400	56	2 SPAN CONCRETE BEAM ROAD BRIDGE	WEBSTER ROAD #2	Stafford	139 K 9	Bridge Rehabilitation	$200,000
B2560	56	2 SPAN CONCRETE BEAM ROAD BRIDGE	CONSTANCE STREET	Fortitude Valley	160 B 5	Bridge Rehabilitation/QR	$200,000
B2610	56	3 SPAN TIMBER BEAM ROAD BRIDGE	FREDERICK STREET	Alderley	139 C 12	Bridge Rehabilitation/QR	$200,000
B8886	56	1 SPAN TIMBER & STEEL ROAD BRIDGE	MEEKES ROAD	Kholo		Steel Girder Timber Bridge Rehab	$150,000
C0194B	56	2 cell 2.3 * 1.5 Box Culvert	Washington St DEAGON	Deagon	110 P 6	Culvert Rehabilitation/Replacement	$300,000
B0545	56	2 SPAN TIMBER BEAM ROAD BRIDGE	CREEK ROAD #4	AMRINA HEIGHTS		Rehabilitate existing timber structure by replacing components (headstocks and closing footpath) Replacement to be scheduled for 5yrs	$1,000,000
B1900	56	2 SPAN TIMBER BEAM ROAD BRIDGE	WACOL STATION ROAD	SUMNER		Replacement of timber structure. T&T have replacement scheduled for next 2-5 years	$50,000

		Rehab & Renewal - T&T	**Total**				**$6,475,000**
		Cross river bridges					**$6,309,000**
		Budget Forecast					**$12,784,000**

FY 2015/16							
Asset Number	**Schedule**	**Asset Name/ Description**	**Road**	**Suburb**	**Location - UBD**	**Description of Work**	
		Level 3 Inspection & Design					
	56	526 T&T Road and Pedestrian Bridges		All		**20 Structures annually at the rate of $ 30,000**	$600,000
		7 Cross River Bridges		All			
	56	1767 T&T & NES Culverts		All			
	56	29 Boardwalks		All			
B0100	56	3 SPAN CONCRETE BEAM ROAD BRIDGE	ARNWOOD PLACE	Annerley	180 D 10	Patch repairs, Crack sealing and barrier painting	$50,000
B0320	56	1 SPAN COMPOSITE FOOTBRIDGE	BRICKYARD ROAD	Geebung	120 L 12	Bridge Replacement	$170,100
B8137	56	1 SPAN TIMBER FOOTBRIDGE	MISKIN STREET (OAKMAN PARK)	Toowong	158 Q 20	Maintenance	$15,000
B0931	56	1 SPAN CONCRETE BEAM FOOTBRIDGE	GYMPIE ROAD	ASPLEY		Rebuilding	$78,000
B9550	56	1 SPAN STEEL TRUSS FOOTBRIDGE	In park off Jasmine Crt, Fitzgibbon	FITZGIBBON		Maintenance	$20,000
B1830	56	2 SPAN TIMBER BEAM FOOTBRIDGE	SHELGATE STREET	CHERMSIDE WEST	119 G 13	Replace deck planks and some girders	$20,000
B770	56	1 SPAN CONCRETE BEAM ROAD BRIDGE	FLINDERS PARADE	Brighton	100 P 15		$64,500
B0140	56	3 SPAN STEEL TRUSS FOOTBRIDGE	BEATA STREET	Greenslopes		Timber deck replacement of and girders, repairs to steel truss	$200,000
B0375	56	1 SPAN STEEL TRUSS FOOTBRIDGE	EMERSON ST, TOOWONG @ GOWER ST	Toowong		Rebuilding or replacement	$75,400
B1400	56	3 SPAN TIMBER BEAM ROAD BRIDGE	MIRRABOOKA ROAD	ASHGROVE		Replacement of remaining timber superstructure and abutments	$75,000

Asset Number	Schedule	Asset Name/ Description	Road	Suburb	Location - UBD	Description of Work	
B1900	56	2 SPAN TIMBER BEAM ROAD BRIDGE	WACOL STATION ROAD	SUMNER		Replacement of timber structure. T&T have replacement scheduled for next 2-5 years	$1,000,000
		Various bridges from future L 2 inspections					$6,771,844
		Rehab & Renewal - T&T	**Total**				**$9,139,844**
		Cross river bridges					**$6,309,000**
		Budget Forecast					**$15,448,844**

FY 2016/17							
Asset Number	**Schedule**	**Asset Name/ Description**	**Road**	**Suburb**	**Location - UBD**	**Description of Work**	
		Level 3 Inspection & Design					
	56	526 T&T Road and Pedestrian Bridges		All		**20 Structures annually at the rate of $ 30,000**	$600,000
		7 Cross River Bridges		All			
	56	1767 T&T & NES Culverts		All			
	56	29 Boardwalks		All			

B1400	56	3 SPAN TIMBER BEAM ROAD BRIDGE	MIRRABOOKA ROAD	ASHGROVE		Replacement of remaining timber superstructure and abutments	$1,500,000
B1710	56	2 SPAN TIMBER BEAM ROAD BRIDGE	ROSS ROAD	UPR KEDRON		Replacement of timber structure with concrete	$25,000
		Various bridges from future L 2 inspections					$7,014,844
		Rehab & Renewal - T&T	**Total**				**$9,139,844**
		Cross river bridges					**$6,309,000**
		Budget Forecast					**$15,448,844**

FY 2017/18							
Asset Number	**Schedule**	**Asset Name/ Description**	**Road**	**Suburb**	**Location - UBD**	**Description of Work**	
		Level 3 Inspection & Design					
	56	526 T&T Road and Pedestrian Bridges		All		**20 Structures annually at the rate of $ 30,000**	$600,000
		7 Cross River Bridges		All			
	56	1767 T&T & NES Culverts		All			
	56	29 Boardwalks		All			
B0910	56	4 SPAN COMPOSITE ROAD BRIDGE	GRESHAM STREET	ASHGROVE		Replacement of timber superstructure and one pier. Difficult structure to work on as it is only access to Ashgrove area	$100,000
B1710	56	2 SPAN TIMBER BEAM ROAD BRIDGE	ROSS ROAD	UPR KEDRON		Replacement of timber structure with concrete	$480,000
		Various bridges from future L 2 inspections					$7,959,844
		Rehab & Renewal - T&T	**Total**				**$9,139,844**
		Cross river bridges					**$6,309,000**
		Budget Forecast					**$15,448,844**

FY 2018/19							
Asset Number	**Schedule**	**Asset Name/ Description**	**Road**	**Suburb**	**Location - UBD**	**Description of Work**	
		Level 3 Inspection & Design					
	56	526 T&T Road and Pedestrian Bridges		All		**20 Structures annually at the rate of $ 30,000**	$600,000
		7 Cross River Bridges		All			
	56	1767 T&T & NES Culverts		All			
	56	29 Boardwalks		All			
B0910	56	4 SPAN COMPOSITE ROAD BRIDGE	GRESHAM STREET	ASHGROVE		Replacement of timber superstructure and one pier. Difficult structure to work on as it is only access to Ashgrove area	$2,000,000
		Various bridges from future L 2 inspections					$6,539,844
		Rehab & Renewal - T&T	**Total**				**$9,139,844**
		Cross river bridges					**$6,309,000**
		Budget Forecast					**$15,448,844**

FY 2019/20							
Asset Number	**Schedule**	**Asset Name/ Description**	**Road**	**Suburb**	**Location - UBD**	**Description of Work**	
		Level 3 Inspection & Design					
	56	526 T&T Road and Pedestrian Bridges		All		**20 Structures annually at the rate of $ 30,000**	$600,000
		7 Cross River Bridges		All			
	56	1767 T&T & NES Culverts		All			
	56	29 Boardwalks		All			
		Various bridges from future L 2 inspections					$8,539,844
		Rehab & Renewal - T&T	**Total**				**$9,139,844**
		Cross river bridges					**$6,309,000**
		Budget Forecast					**$15,448,844**

FY 2020/21							
Asset Number	**Schedule**	**Asset Name/ Description**	**Road**	**Suburb**	**Location - UBD**	**Description of Work**	
		Level 3 Inspection & Design					
	56	526 T&T Road and Pedestrian Bridges		All		**20 Structures annually at the rate of $ 30,000**	$600,000
		7 Cross River Bridges		All			
	56	1767 T&T & NES Culverts		All			
	56	29 Boardwalks		All			
		Various bridges from future L 2 inspections					$8,539,844
		Rehab & Renewal - T&T	**Total**				**$9,139,844**
		Cross river bridges					**$6,309,000**
		Budget Forecast					**$15,448,844**

Appendix 3 – Bridge Assets Valuation Rates

The following tables from "Bridge Assets Valuation Rates" report prepared by Kellogg Brown & Root Pty Ltd, summarises the unit rates

Group No	Type	Length	Description	Unit Cost ($/m2)
1	Footbridge	< 8m over water	Single span timber	3,430
2	Footbridge	8m-12m over water	Single span PSC	3,850
2 A	Footbridge	8m-12m over rail	Single span PSC Slab	12,210
3 A	Footbridge	12m – 21.6m over water	Single span Steel	3,650
3 B	Footbridge	12m – 21.6m over road	Single span Steel	7,010
3 C	Footbridge	12m – 21.6m over rail	Single span Steel	8,900
4	Footbridge	21.6m – 150m over water	Multi-span Steel	2,880
5	Footbridge	21.6m – 150m over road	Multi-span Steel	2,770
5 A	Footbridge	21.6m – 150m over rail	Multi-span Steel	3,710
6	Boardwalk	<30m over water	Multi-span Timber	1,900
7	Boardwalk	30-120m over water	Multi-span Timber	2,840
8A	Road Bridge	<12m over water	Single span PSC deck unit	6,340
8B	Road Bridge	<12m over road	Single span PSC deck unit	6,520
8C	Road Bridge	<12m over rail	Single span PSC deck unit	6,720
9	Road Bridge	12m – 21m over water	Single span PSC deck unit	4,890
10	Road Bridge	21m over road	Single span PSC deck unit 12m	5,330
11	Road Bridge	12m – 21m over rail	Single span PSC deck unit	5,440
12	Road Bridge	21m – 63m over water	Multi-span PSC deck unit	3,990
13	Road Bridge	21m – 63m over road	Multi-span PSC deck unit	5,730
14	Road Bridge	21m— 63m over rail	Single span PSC deck unit	6,290
15	Road Bridge	>63m over water	Multi-span insitu PSC	5,130
16	Road Bridge	PSC >63m over road	Multi-span insitu	4,250
17	Road Bridge	>63m over rail	Multi-span insitu PSC	4380

Appendix 4 – Bridge Estimates

Bridge Group 5
Footbridge 21.6 - 150m over road
Multi-span Steel (Drg. No. BCA004-S-SK-005)

Estimate

Plan Area	437	m2	
Cost			$ 1210448
Unit rate	2,770	$/m2	

Item No.	Description of Work	Unit	Quantity	Unit Rate	($) Amount
	Contractor's Site Facilities and Camp				
1101	Contractor's Site Facilities	lump sum	1		16242
	Provision for Traffic				
1201	Provision for Traffic	lump sum	1		43460
	Environmental Management				
1332	Implement Environmental Management Plan (Construction)	lump sum	1		4346
	Demolition of Existing Bridge				
9100	Demolition of Existing Bridge	lump sum	1		213468
	Earthworks, Preparation				
3102	Bridge site preparation	m2	336	5	1680
3103	Stripping of topsoil	m3	40	7	280
	Earthworks, Excavation				
3204	Excavation at ramp landing, all materials	m3	7	26	182
	Bridge Substructure				
7321	Steelwork in piers	tonne	5.3	3998	21189
7311	Concrete in ramp landing	m3	17.6	866	15242
	Cast-In-Place Piles				
9899	Establishment for piling	lump sum	1	25000	25000
7415	Excavation for bored piles at piers	m3	38.9	1027	39950
7423	Concrete Class 40MPa/20 in bored piles	m3	38.9	645	25091
7425	Steel reinforcing bar in bored piles	tonne	7.8	3897	30397
	Bridge Deck				
$252.1	Supply Steel Trusses and floor steelwork	tonne	39.8	6757	268929
$255.1	Install Steel Trusses and floor steelwork	tonne	39.8	2123	84495
7019	Hardwood joists	m	689	52	35828
7003	Hardwood deck planks	m2	437	204	89148
	Bridge Barrier, Steel				
8402	Supply and fabrication of bridge balustrade, steel	m	16	106	1689
8405	Transport and erection of bridge balustrade, steel	m	16	24	390
	Consultant Fees				
9000	Fees for design & contract administration, Project Management	lump sum	1		91701
	Contingency				
9998	Contingency	lump sum	1		201741
			Total		**1210448**

Bridge Group 6
Boardwalk < 30m over water
Multi-span Timber (Drg. No. BCA004-S-SK-006)

Plan Area 54 m2
Cost $ 102822
Unit rate **1,900** $/m2

Estimate

Item No.	Description of Work	Unit	Quantity	Unit Rate	($) Amount
	Contractor's Site Facilities and Camp				
1101	Contractor's Site Facilities	lump sum	1		6497
	Environmental Management				
1332	Implement Environmental Management Plan (Construction)	lump sum	1		388
	Demolition of Existing Bridge				
9100	Demolition of Existing Bridge	lump sum	1		26378
	Earthworks, Preparation				
3102	Site preparation	m2	145	5	725
	Earthworks, Excavation				
3204	Excavation at abutments and piers all materials	m3	13	26	338
3508	Crushed rock bedding layer	m3	2	120	240
	Substructure				
7314	Concrete Class 40MPa/20 in abutment headstock	m3	1.27	2337	2968
7321	Steel reinforcing bar in abutment	tonne	0.18	3998	720
7012	Timber in pier headstock 150 x 100	m	69	52	3588
7013	Timber in pier columns 200 dia	m	57	86	4902
7014	Timber in pier braces 200 x 75	m	20	86	1720
7016	Timber in pier bedlog 250 dia	m	33	120	3960
	Deck				
7019	Hardwood joists	m	108	52	5616
7003	Hardwood deck planks	m2	54	204	11016
7101	Hardwood kerb	m	52	68	3536
	Timber handrail				
7022.1	Timber handrail	m	52	102	5304
	Consultant Fees				
9000	Fees for design & contract administration, Project management	lump sum	1		7790
	Contingency				
9998	Contingency	lump sum	1		17137
			Total		**102822**

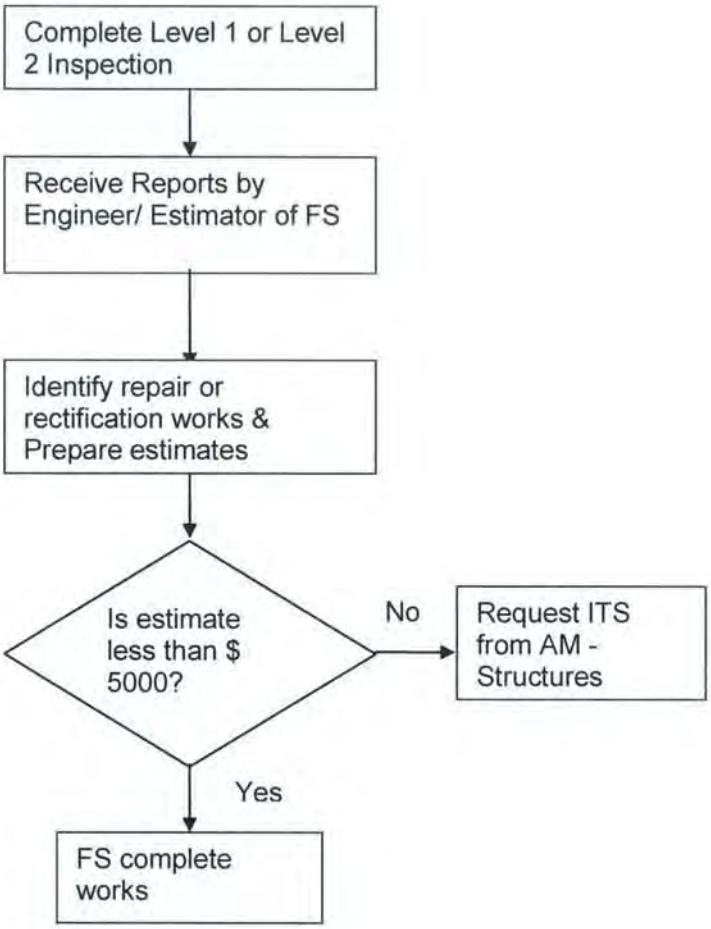
Bridge Group 11
Road Bridge 12 - 21m over rail
Single span PSC (Drg. No. BCA004-S-SK-011)

Estimate

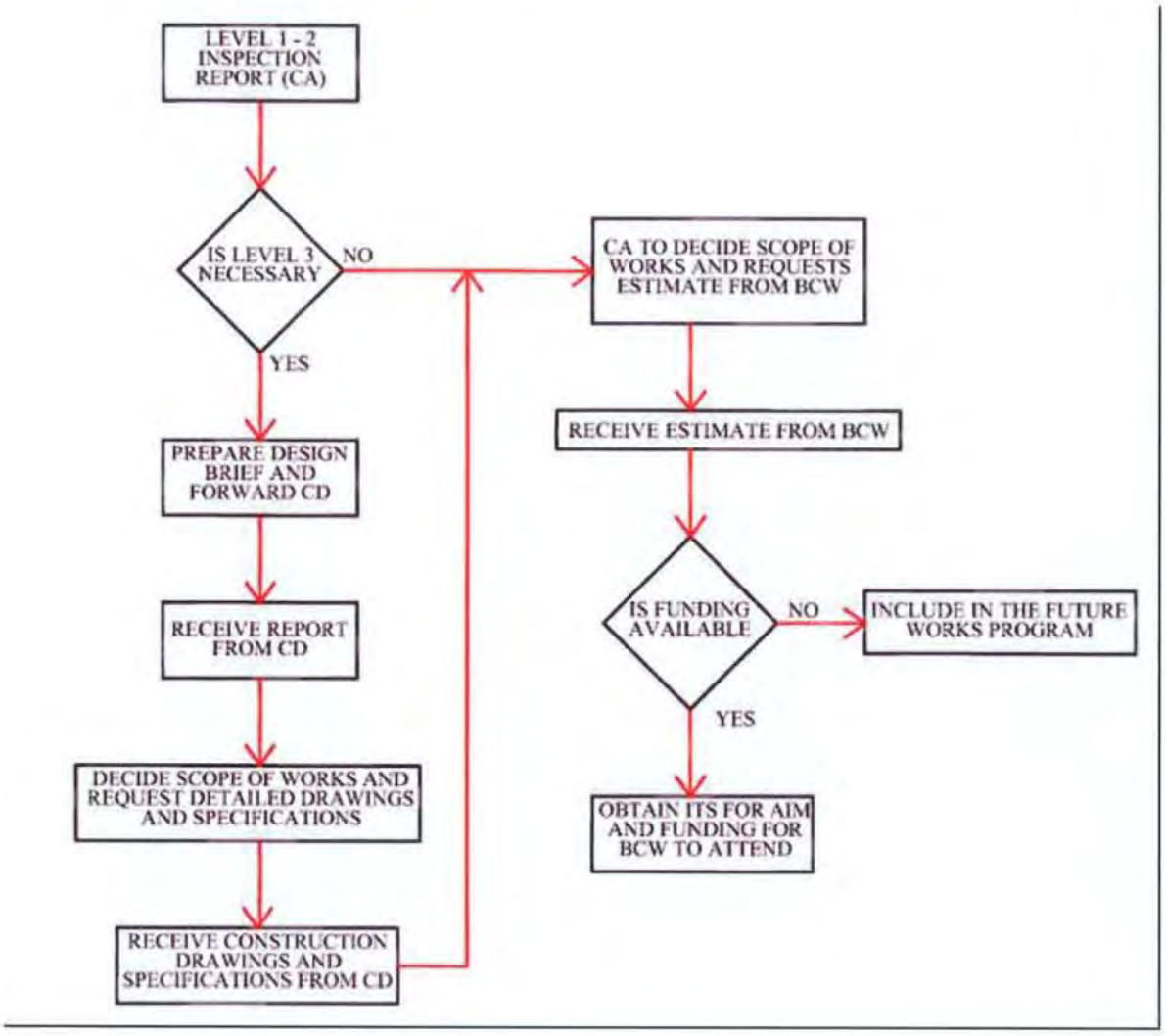
Plan Area 195 m2
Cost $ 1061462
Unit rate **5,440** $/m2

Item No.	Description of Work	Unit	Quantity	Unit Rate	($) Amount
	Contractor's Site Facilities and Camp				
1101	Contractor's Site Facilities	lump sum	1		9745
	Railway Control				
9010	Railway Control Liason Officer and Flagmen	lump sum	1		50757
	Environmental Management				
1332	Implement Environmental Management Plan (Construction)	lump sum	1		4132
	Demolition of Existing Bridge				
9100	Demolition of Existing Bridge	lump sum	1		95255
	Earthworks, Preparation				
3102	Bridge site preparation	m2	575	5	2875
3103	Stripping of topsoil	m3	46	7	322
3104	Ground surface treatment under embankment, standard	m2	170	1	170
	Earthworks, Excavation				
3204	Excavation at abutments, all materials	m3	208	26	5408
	Earthworks, Embankment				
3301	Embankment using general fill material from all sources	m3	728	26	18928
	Bridge Substructure				
7311	Concrete Class 40MPa/20 in Abutment footing	m3	36.4	866	31522
7313	Concrete Class 40MPa/20 in abutments above footing	m3	73	2337	170601
7321	Steel reinforcing bar in abutments	tonne	16.4	3998	65567
	Prestressed Concrete Deck Units				
8101.15	Prestressed concrete deck units, supply on Site, 620mm deep, 15m long	each	20	5818	116360
8102	Transverse stressing bars,supply on site	lump sum	1	7820	7820
8121.15	Erection of prestressed concrete deck units, 620mm deep, 15m long	each	20	3100	62000
8122	Erection of transverse stressing bars	lump sum	1		4670
8131.9	Holding down bolts for deck units, 920mm long	each	40	120	4800
8141	Transverse prestressing of deck	lump sum	1		3,248
	Bridge Deck				
8303	Concrete Class 40MPa/20 in in situ kerb	m3	8.7	2431	21150
8304	Concrete Class 40MPa/20 in parapet	m3	18	2431	43758
8306	Concrete Class 40MPa/20 in relieving slabs	m3	12	2683	32196
8312	Reinforcing steel in insitu kerbs and parapets	tonne	4	4002	16008
8313	Reinforcing steel in relieving slabs	tonne	2.6	3993	10382
8331	Anchors for bridge rail	lump sum	1		4574
8371	Stabilised sand in footway	m3	19	178	3382
	Bridge Barrier, Steel				
8401	Supply and fabrication of bridge traffic rail, steel	m	38	826	31388
8404	Transport and erection of traffic rail, steel	m	38	120	4560
	Deck Wearing Surface				
8601	Bituminous waterproof membrane	m2	168	42	7056
8603	Dense graded asphalt pavement layer, DG14 mm mix	tonne	10	193	1930
	Consultant Fees				
9000	Fees for design & contract administration, Project Management	lump sum	1		53987
	Contingency				
9998	Contingency	lump sum	1		176910
			Total		**1061462**

Appendix 5 – Flow Chart – Minor maintenance works arising from Level 1 and Level 2 Inspections



Appendix 6 – Flow Chart – Major maintenance works arising from Level 1 and Level 2 Inspections



Appendix 7 – Level 1 Bridge, Culvert and Pedestrian Bridge Inspection Reports

Level 1 Bridge Inspection Report

Condition state (Any rating exceeding 3 must be referred for a level 2)		
1 Good	2 Fair	3 Poor

Asset ID:	**Bridge Name:**		
Facet/Pid ID:	**Crossing:**		
Structure Type:	**Road:**		
Construction Material:	**Suburb:**		
Construction Type:	**UBD Map:**	**Ref #**	
Inspector:	**Perm. In water** YES / NO		
Date of Inspection:	**Date of Next Inspection:**		

Inspection Elements	Problem: Yes	Problem: No	Location & Comments	Rectified Yes	Rectified No	Maintenance Required Yes	Maintenance Required No	Level 2 Required Yes	Level 2 Required No
Approaches **1 Signs & Delineation** • Missing, Damaged • Obscured • Required									
2 Guardrail • Accident damage • Incorrect Alignment • Connection to Bridge • Delineators/Reflectors • To MRD Standard									
3 Road Drainage • Blocked inlets/outlets • Scour of embankments									
4 Road Surface • Material Defect: Surfacing • Material Defect: Concrete • Settlement, depressions • Rough joint transition									
Bridge Surface **5 Bridge Surface** • Material Defect: Timber • Material Defect: Surfacing • Material Defect: Concrete • Scuppers									
6 Footpaths • Clean • Even									
7 Barriers • Impact damage • Loose/damaged fixings • Loose post base • Material defects • Delineators • Clean & paint • Standard height									
8 Expansion joints • Loose/Damaged fixing • Damaged/missing seals • Deck/nosing/ballast wall damage • Obstructions in the gap									

Inspection Elements	Problem: Yes	Problem: No	Location & Comments	Rectified Yes	Rectified No	Maintenance Required Yes	Maintenance Required No	Level 2 Required Yes	Level 2 Required No
Substructure (Including wing walls) **10 Material Defects** • Piles • Footings • Walls/Stems • Headstocks									
11 General • Forward movement of abutments/wings • Blocked drains/weepholes • Debris on shelf/bearing • Scour/erosion of spill through • Dampness/Leakage from deck • Substructure protection									
12 Bearings • Gap closed/decks in contact/damaged • Bearing displaced/damaged • Poorly seated • Corroded/Seized/ No lubricant									
Superstructure **13 Material defects in:** • Girders (Incl. fasteners) • Cross girders • Deck • Coatings									
14 General • Debris/dirt build-up • Impact damage • Excessive movement/vibration • Dampness • Vent holes									
Miscellaneous **15 Damage to Services** • Fasteners / Brackets • Pipe / Conduit • Openings									
16 Path or Roadway under bridge • Delineation • Barriers • Road drainage • Standard height									

Material	Defect Descriptions
Concrete	Cracking, spalling, corrosion of reinforcement, drummy areas
Steel	Bending, buckling, cracking, distortion, loose bolts, rivets, corrosion, coating damage
Timber	Splitting, crushing, decay, infestation, loose bolts or pins
Masonry	Cracking, opening joints, mortar loss, bulging
Bituminous Surfacing	Cracking, crazing, breaking up, lifting off, rutting, pushing
Protective coatings	Cracked, peeling, weathered

Comments/ Recommendations

LEVEL 1 CULVERT INSPECTION REPORT

Culvert id. No	Description:
Street:	UBD map reference:
Suburb:	Creek/ tributary:

INSPECTION INFORMATION.

Inspection date:	Photos taken:	Inspected by:

Type of Culvert: (Highlight)

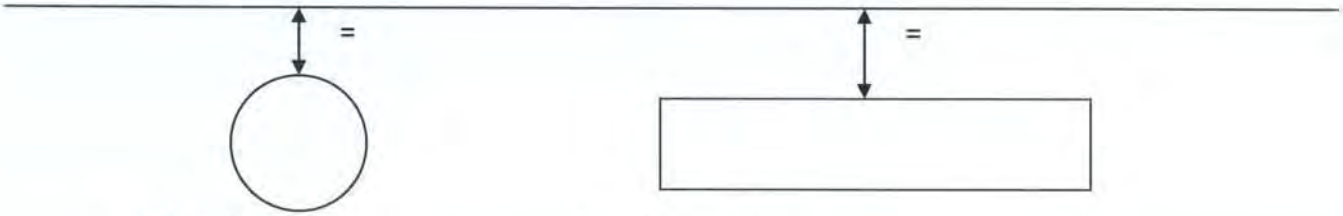
ARCH BOX MODULAR PIPE

Condition State: Any rating >3 must be referred for a level 2.		
1 Good	**2** Fair	**3** Poor

Element	Description and Location	Checked	Needs repair	level 2 required	Notes
Wearing surface					
Barriers (Including Armco)					
Waterway (Silt, Debris & Scouring)					
Pedestrian access (Footpaths etc.)					
Wingwalls					
Headwalls					
Culvert Units (Pipes & Box)					
Base/Apron Slabs					
Services:					
General Cleaning / Maintenance					

Comments/Recommendations

Cover:



Dedicated to a better Brisbane

Level 1 Footbridge Inspection Report

Condition State: Any rating >3 must be referred for a level 2.		
1 Good	2 Fair	3 Poor

Structure ID:				**Park Name:**							
Structure Type:				**Crossing:**							
Construction Material:				**Road Name:**							
Inspector(s):				**Suburb:**							
Date of Inspection:				**UBD Map#:**							
Inspection Elements	**Present**		**Location & Comments**	**Problem**		**Maintenance Required**		**Level 2 Inspection Required**			
	Y	**N**		**Y**	**N**	**Y**	**N**	**Y**	**N**		
Abutments											
Approaches / Footpath											
Bearings/Mortar Pad											
Barriers											
Batter Protection / Retaining Walls											
Piles / Piers											
Crossbeam/Joist											
Deck/Wearing Surface											
Girders											
Headstocks											
Headwall/Wingwalls											
Kerb											
Expansion Joint											
Waterway											

Comments:

Appendix 8 – Level 2 Bridge, Culvert and Pedestrian Bridge Inspection Reports

Statistics sheet			
Inspected by:			
Asset ID:		**Date of Inspection:**	
Address:		**UBD Map & Reference:**	
Description: *(Include No. lanes if applicable)*			

Superstructure / Girder Details					
Span / Cell	**Length**	**No. Girders / Units**	**Material**	**Size** *(Diameter etc)*	**Type** *(E.g. I beam)*
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Totals:					

Barrier details				
	Component:	**Size** *(eg 50 x 50mm)*	**Length / Height**	
	Posts			
	Top rail			
	Middle rail			
	Bottom rail			
	Barrier Height			

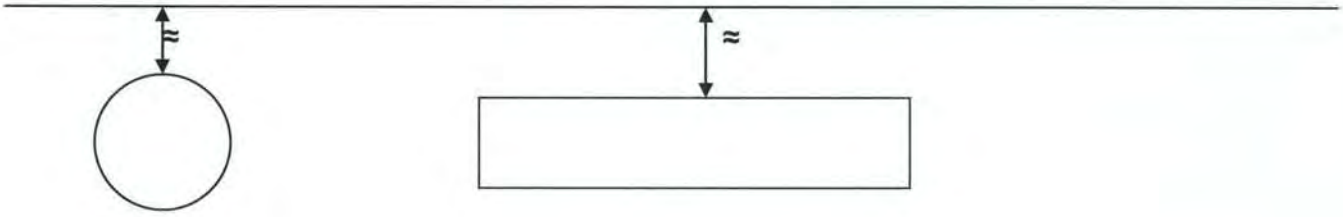
Substructure details		
Component:	**Material**	**Size** *(eg 50 x 50mm)*
Headstocks		
Piles		
Abutments		
Braces		
Corbels		

Truss details *(If applicable)*				
	Component:	**Size** *(eg 50 x 50mm)*	**Length / Height**	
	Top Chord			
	Bottom Chord			
	Verticals (Posts)			
	Diagonals			

Road / Deck details						
Component:	**Material**	**Size** *(E.g. 140 x 40 x 3000mm)*				
Decking						
Deck / Road Dimensions		Width		Length		

Asphalt thickness (mm)											
	Joint No.	1	2	3	4	5	6	7	8	9	10
Lane	Side of Joint										
1	N / S / E / W										
	N / S / E / W										
2	N / S / E / W										
	N / S / E / W										
3	N / S / E / W										
	N / S / E / W										
4	N / S / E / W										
	N / S / E / W										
5	N / S / E / W										
	N / S / E / W										
6	N / S / E / W										
	N / S / E / W										
7	N / S / E / W										
	N / S / E / W										
8	N / S / E / W										
	N / S / E / W										

Culvert Cover (mm)



Structure Condition Inspection Report				B2/1
Structure ID:		Bridge Name:		
Crossing:		UBD Number:		
Structure Type:		Road Name:		
Construction Material:		District:		
Inspector:		Local Authority: BRISBANE CITY		
Inspection Level 2		Programmed	Exceptional	Underwater
Date of Inspection:		Date of next inspection:		

Chainage (km) on the to Road

Component Location							Quantity Per Condition State					Comments
Modification	Group	Component	Standard Number	Exposure Class	Quantity	Unit	1	2	3	4	Maintenance Req'd	▪ Location of item/condition ▪ Description of defects by location type, magnitude, extent ▪ References of sketches and photos (Roll/Exposure Nos)

Overall Ratings	1	2	3	4	5	Comments
Original Structure						
Modification ( )						
Modification ( )						
Modification ( )						

Widening (WL*n*, WR*n*), Lengthening (L1, L2), Raised (Ra), Rechecked (Re), Shortening (S1, S2)
Strengthening (St)

Defective Components Report									B2/3
Structure ID:						Bridge Name:			
Crossing:						UBD Number:			
Inspector:						Local Authority: BRISBANE CITY			
Date of Inspection:						Date of next inspection:			
Chainage		(km)		on the		to			Road
Component Location				Exposure Class	Condition State	Descriptions of defect ▪ Detailed Description ▪ Estimated Quantity ▪ "Other action required ▪ Urgency of action (what, who, when, how) ▪ Recommended testing ▪ Reference of sketches and photos (Roll/Exposure Nos)	Required Action (√)		
Modification	Group	Component	Standard Number				Monitor	Level 3 Inspection	Other

Standard Procedure Exceptions Report									B2/4
Structure ID:								Bridge Name:	
Crossing:								UBD Number:	
Inspector:								Local Authority: BRISBANE CITY	
Date of Inspection:								Date of next inspection:	
Chainage			(km)		on the			to	Road
Component Location					Exception (√)				
Modification	Group	Component	Standard Number	Exposure Class	Undefined Component	Component Not Inspected	Less than 25% Comp. Inspected	Other	Comments ▪ Description of undefined component ▪ Photograph/sketch reference ▪ Reason component not inspected ▪ Any other exceptions

Timber Drilling Survey Report — B2/5

Structure ID:	Bridge Name:
Crossing:	UBD Number:
Inspector:	Local Authority: BRISBANE CITY
Date of Inspection:	Date of next inspection:

Chainage (km) on the to Road

Component Location					Test Details			Test Results (mm)			%	C	U	Sn in	Comments
Modification	Group	Component	Standard Number	Diameter (mm)	Location	Diameter	Orientation (H,V, Other)	Solid	Rot	Pipe					

Test Locations

Component	Defect	Location (Abbreviation) (Describe Other (O) in comments)	% Consumed CS 2 E	CS 2 MS	CS 3 E	CS 3 MS	CS 4 E	CS 4 MS
Pile	*Pipe*	Top (T), Ground Level (GL), Other (O)	1-20	1-20	21-35	21-35	36-50	36-50
Girder	*Pipe*	End1 (E1), Midspan (MS), End 2 (E2), Other (O)	1-20	1-30	21-35	31-50	36-50	51-70
Corbel	*Pipe*	End1 (E1), End 2 (E2), Other (O)	1-20	1-20	21-35	21-35	36-50	36-50
Headstock[1]	*Edge Area*	End1 (E1), End 2 (E2), Other (O)	1-5	1-5	6-10	6-10	11-20	11-20
Headstock[2]	*Pipe*	End1 (E1), End 2 (E2), Other (O)	1-45mm		45-65mm		66-90mm	
Other Component		Enter relevant component code and describe location in comments field.						

1. Area of headstock (%) for external loss of section (top, bottom or sides).
2. Maximum pipe diameter (mm) in headstock for internal piping defects.
*3. **Members in excess of CS4 deterioration are critical and should be replaced immediately**.*

Photographic and Sketches Record					B2/6
Structure ID:				Bridge Name:	
Crossing:				UBD Number:	
Inspector:				Local Authority: BRISBANE CITY	
Date of Inspection:				Date of next inspection:	
Chainage	(km)	on the	to	Road	

Film/Exposure Number	Sketch No.	Location			Description
		Modification	Group	Component	▪ Deck Surface Full Width and alignment ▪ Side View (waterways, spans, piers, etc) ▪ Underside (deck and pier construction) ▪ Deficient Component and Major Defects ▪ Undefined Elements
	1	O			
	2	O			
	3	O			
	4	O			
	5	O			
	6	O			
	7	O			
	8	O			
	9	O			
	10	O			
	11	O			
	12	O			
	13	O			
	14	O			
	15	O			
	16	O			
	17	O			
	18	O			
	19	O			

Level 2 Inspection Report – Photos & Sketches Record

B2/6

Photographic and Sketches Record

B2/6

Structure ID:	Bridge Name:
Crossing:	UBD Number:
Inspector:	Local Authority: BRISBANE CITY
Date of Inspection:	Date of next inspection:

Chainage (km) on the to Road

Film/Exposure Number	Sketch No.	Location			Description
		Modification	Group	Component	▪ Deck Surface Full Width and alignment ▪ Side View (waterways, spans, piers, etc) ▪ Underside (deck and pier construction) ▪ Deficient Component and Major Defects ▪ Undefined Elements
	20	O			
	21	O			
	22	O			
	23	O			
	24	O			
	25	O			
	26	O			
	27	O			
	28	O			
	29	O			
	30	O			
	31	O			
	32	O			
	33	O			
	34	O			
	35	O			
	36	O			
	37	O			

Structure Id:	Name:
Inspection Date:	Inspection Level: 2

ID #:
Exposure No:
Sketch No:
Mod:
Comp:
Standard No:



ID #:
Exposure No:
Sketch No:
Mod:
Comp:
Standard No:



Bridge Scour Soundings Report

B2/7

Structure ID:	Bridge Name:
Crossing:	UBD Number:
Inspector:	Local Authority: BRISBANE CITY
Date of Inspection:	Date of next inspection:

Chainage (km) on the to Road

Sounding Location			Permanent Reference Feature	Sounding Depth (m)				Condition State	Comments
					Stream Bed				
Modification	Group	Location	Top of kerb, deck, or concrete parapet	Water Surface	Previous	Current	Difference		

Sounding Locations

Group	Location Abbreviation	Depth (metres) CS 1		CS 2		CS 3		CS 4	
		Change in depth	Local Scour depth	Change in depth	Local Scour depth	Change in depth	Local Scour depth	Change in depth	Local Scour depth
Span	End 1 (E1), Midspan (MS), End 2 (E2), Other (O)	<0.2	<0.5	0.2 to 0.49	0.5 to 1.99	0.5 to 1.0	2 to 4	>1.0	>4.0

Appendix 10 – 10 Year Replacement Program

11/12 Financial Year

B0380	1 SPAN TIMBER BEAM ROAD BRIDGE	BUNDALEER STREET	Brookfield	$400,000
B0620	1 SPAN TIMBER BEAM FOOTBRIDGE	DOWNEY PARK #2	Windsor	$90,000
B0740	1 SPAN TIMBER BEAM FOOTBRIDGE	FINSBURY PARK #2	Wilson	$20,000
B0740	1 SPAN TIMBER BEAM FOOTBRIDGE	FINSBURY PARK #2	Wilson	$20,000
	Gold Creek Rd Culverts	Gold Creek Rd		$50,000
	Radio Street Bridge	Eagle Farm Road	Pinkenba	$325,000
B0545	2 SPAN TIMBER BEAM ROAD BRIDGE	CREEK ROAD #4	AMRINA HEIGHTS	$50,000
	Radio Street Bridge	Eagle Farm Road	Pinkenba	$325,000
B0545	2 SPAN TIMBER BEAM ROAD BRIDGE	CREEK ROAD #4	AMRINA HEIGHTS	$50,000

12/13 Financial Year

B0380	1 SPAN TIMBER BEAM ROAD BRIDGE	BUNDALEER STREET	Brookfield	$400,000
B0630	1 SPAN TIMBER BEAM FOOTBRIDGE	DOWNEY PARK #3	Windsor	$60,000
B0550	1 SPAN TIMBER BEAM FOOTBRIDGE	CRESSEY STREET	Wavell Heights	$50,000
B0740	1 SPAN TIMBER BEAM FOOTBRIDGE	FINSBURY PARK #2	Wilson	$100,000
B0980	2 SPAN TIMBER BEAM FOOTBRIDGE	HIGH STREET	Highgate Hill	$400,000
B1830	2 SPAN TIMBER BEAM FOOTBRIDGE	SHELGATE STREET	Chermside West	$400,000
B0740	1 SPAN TIMBER BEAM FOOTBRIDGE	FINSBURY PARK #2	Wilson	$700,000
C0026B	1 CELL 2.4 * 1.5 BOX CULVERT	Smith St DEAGON	Deagon	$650,000
B0026	1 SPAN TIMBER BEAM FOOTBRIDGE	Taronne St Footbridge	Carindale	$20,000
	Radio Street Bridge	Eagle Farm Road	Pinkenba	$120,000

13/14 Financial

B0065	3 SPAN TIMBER BEAM ROAD BRIDGE	ALDERLEY AVENUE	Alderly	$200,000
B0210	2 SPAN TIMBER BEAM FOOTBRIDGE	BISHOP STREET	Kelvin Grove	$700,000
B0630	1 SPAN TIMBER BEAM FOOTBRIDGE	DOWNEY PARK #3	Windsor	$20,000
B0650	3 SPAN TIMBER BEAM FOOTBRIDGE	RAVEN RESERVE #1	Chermside West	$100,000
B0980	2 SPAN TIMBER BEAM FOOTBRIDGE	HIGH STREET	Highgate Hill	$400,000

B1020	1 SPAN STEEL TRUSS FOOTBRIDGE	HYACINTH STREET	Inala	$450,000
C0024B	2 CELL 3 * 1.8 BOX CULVERT	Blackwood Rd DEAGON	Deagon	$300,000
C0025B	2 CELL 3 * 1.8 BOX CULVERT	Finnie Rd DEAGON	Deagon	$600,000
	Savages Road Culverts, Brookfield	Savages Road	Brookfield	$50,000
	Upper Brookfield Road Culverts, Brookfield	Upper Brookfield Road	Brookfield	$80,000
CXXXXB	Blunder Road	Blunder Road		$245,000
B0026	1 SPAN TIMBER BEAM FOOTBRIDGE	Taronne St Footbridge	Carindale	$250,000
B0545	2 SPAN TIMBER BEAM ROAD BRIDGE	CREEK ROAD #4	AMRINA HEIGHTS	$50,000

14/15 Financial

B0280	3 SPAN TIMBER BEAM FOOTBRIDGE	BOWERING STREET	Lota	$500,000
B1900	2 SPAN TIMBER BEAM ROAD BRIDGE	WACOL STATION ROAD		$2,000,000
B0610	1 SPAN TIMBER BEAM FOOTBRIDGE	DOWNEY PARK #1	Windsor	$150,000
B1990	4 SPAN TIMBER BEAM FOOTBRIDGE	TENNIS AVENUE	Ashgrove	$400,000
C0194B	2 cell 2.3 * 1.5 Box Culvert	Washington St DEAGON	Deagon	$300,000
B0545	2 SPAN TIMBER BEAM ROAD BRIDGE	CREEK ROAD #4	AMRINA HEIGHTS	$1,000,000
B1900	2 SPAN TIMBER BEAM ROAD BRIDGE	WACOL STATION ROAD	SUMNER	$50,000

15/16 Financial

B0320	1 SPAN COMPOSITE FOOTBRIDGE	BRICKYARD ROAD	Geebung	$170,100
B0375	1 SPAN STEEL TRUSS FOOTBRIDGE	EMERSON ST, TOOWONG @ GOWER ST	Toowong	$75,400
B1400	3 SPAN TIMBER BEAM ROAD BRIDGE	MIRRABOOKA ROAD	ASHGROVE	$75,000
B1900	2 SPAN TIMBER BEAM ROAD BRIDGE	WACOL STATION ROAD	SUMNER	$1,000,000

16/17 Financial

B1400	3 SPAN TIMBER BEAM ROAD BRIDGE	MIRRABOOKA ROAD	ASHGROVE	$1,500,000
B1710	2 SPAN TIMBER BEAM ROAD BRIDGE	ROSS ROAD	UPR KEDRON	$25,000

17/18 Financial

B0910	4 SPAN COMPOSITE ROAD BRIDGE	GRESHAM STREET	ASHGROVE	$100,000
B1710	2 SPAN TIMBER BEAM ROAD BRIDGE	ROSS ROAD	UPR KEDRON	$480,000

18/19 Financial

B0910	4 SPAN COMPOSITE ROAD BRIDGE	GRESHAM STREET	ASHGROVE	$2,000,000

19/20 Financial

In development

20/21 Financial

N/A

Appendix 11 – Risk Assement

Risk Profile

Asset Risk Plan: Other Bridges and Culverts

Risk Areas	Risk ID	Inherent Risk	Current Risk	Residual Risk	Budget $
Environmental		Medium +	Medium +	Medium +	$0

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Spillage during transport of HAZMAT across bridge	Possible	Major	Medium +	Medium +	Medium +	Active

Control Task	Like -%	Cons -%	Risk ID	Status	Due	Assigned to	Budget $
Specific routes for vehicle carrying hazardous materials enables better planning	-30	-30		In Progress			

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Fire / smoke / noxious gases on bridge following vehicle accident	Unlikely	Major	Medium -	Medium -	Medium -	Active
Noxious gases from electrical failure	Rare	Minor	Negligible	Negligible	Negligible	Active
Heavy vehicle accident causes diesel spillage diesel enters river	Possible	Major	Medium +	Medium -	Medium -	Active

Control Task	Like -%	Cons -%	Risk ID	Status	Due	Assigned to	Budget $
Restriction on vehicles	-20			In Progress			
Low speed and separated lanes for buses	-50			Completed			

Natural disasters		Medium +	Medium +	Medium +	

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Bridge damaged by floodwaters	Likely	Moderate	Medium +	Medium +	Medium +	Active
Severe storm damages bridge	Likely	Moderate	Medium +	Medium +	Medium +	Active
Extended heat wave damages structure buckling of handrails, pavement damage	Unlikely	Moderate	Low +	Low +	Low +	Active

Public and Worker safety		Medium +	Medium -	Medium -	$0

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status

Risk Profile

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Objects thrown from bridge onto river craft	Rare	Moderate	Negligible	Negligible	Negligible	Active
Objects thrown from bridges onto cyclists or walkers	Rare	Moderate	Negligible	Negligible	Negligible	Active
Object thrown from bridge onto vehicles beneath	Unlikely	Major	Medium -	Medium -	Medium -	Active

Control Task	Like -%	Cons -%	Risk ID	Status	Due	Assigned to	Budget $
Investigate options to minimise	0			In Progress			

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Inappropriate behaviour (including harassment)	Likely	Minor	Medium -	Medium -	Medium -	Active
Wind or rain impacts pedestrians	Likely	Insignificant	Low -	Low -	Low -	Active
Worker injured in Confined space restricted access but large space	Possible	Major	Medium +	Medium -	Medium -	Active

Control Task	Like -%	Cons -%	Risk ID	Status	Due	Assigned to	Budget $
Confined space training and procedures	-50	-30		Completed			
Signage on entry warning of confined space	-20			Not Started			

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Worker injured working from heights	Possible	Major	Medium +	Low -	Low -	Active

Control Task	Like -%	Cons -%	Risk ID	Status	Due	Assigned to	Budget $
Safe work practices training and procedures	-80	-30		Completed			

River traffic		Low +	Low +	Low +	$0

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Bridge damaged by Vessel Collision with bridge	Unlikely	Moderate	Low +	Low +	Low +	Active

Control Task	Like -%	Cons -%	Risk ID	Status	Due	Assigned to	Budget $
Waterway depth limits vessel size		-30		Completed			

Road and PedestrianTraffic		Medium +	Medium +	Medium +	$0

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Vehicle Collision with Structure	Likely	Moderate	Medium +	Medium +	Medium +	Active
Cyclist hit by vehicle on shared roadway cycle lane is narrower than industry standard	Possible	Major	Medium +	Medium +	Medium +	Active
Vehicle hits pedestrian	Possible	Major	Medium +	Medium +	Medium +	Active
Vehicle breaks down and blocks traffic	Unlikely	Moderate	Low +	Low -	Low -	Active

Control Task	Like -%	Cons -%	Risk ID	Status	Due	Assigned to	Budget $
Traffic Response Unit BMTMC intervention		-50		Completed			

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Traffic accident blocks bridge	Possible	Moderate	Medium -	Low +	Low +	Active

Control Task	Like -%	Cons -%	Risk ID	Status	Due	Assigned to	Budget $
TRU, BMTMC, Emergency Services intervention		-50		Completed			

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Pedestrian injured by cyclist on pathway	Likely	Moderate	Medium +	Medium +	Medium +	Active

Security

Medium + Medium + Medium +

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Arson	Rare	Minor	Negligible	Negligible	Negligible	Active
Assault - Verbal	Possible	Minor	Low +	Low +	Low +	Active
Assault – Physical	Possible	Moderate	Medium -	Medium -	Medium -	Active
Bomb Threat - Hoax	Rare	Moderate	Negligible	Negligible	Negligible	Active
Bomb threat - Genuine	Rare	Catastrophic	Low +	Low +	Low +	Active
Civil disturbance	Rare	Moderate	Negligible	Negligible	Negligible	Active
Jumping from bridge structure - thrill seeker	Likely	Minor	Medium -	Medium -	Medium -	Active
Robbery	Unlikely	Moderate	Low +	Low +	Low +	Active
Substance abuse (on-site)	Likely	Minor	Medium -	Medium -	Medium -	Active
Suicide by anyone at site	Possible	Major	Medium +	Medium +	Medium +	Active
Unauthorised access to bridge structure	Unlikely	Moderate	Low +	Low +	Low +	Active

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Vagrants accost bridge users	Possible	Minor	Low +	Low +	Low +	Active
Vandalism (Includes Graffiti)	Possible	Minor	Low +	Low +	Low +	Active

Services

Low + Low + Low -

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Failure of lighting	Possible	Minor	Low +	Low +	Low -	Active

Structural

Medium + Medium + Low +

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Structural Failure - Collapse	Rare	Catastrophic	Low +	Low +	Low +	Active

Control Task	Like -%	Cons -%	Risk ID	Status	Due	Assigned to	Budget $
Annual inspection and maintenance	-50			In Progress			

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Structural Failure - Significant damage	Unlikely	Catastrophic	Medium +	Medium +	Low +	Active

Control Task	Like -%	Cons -%	Risk ID	Status	Due	Assigned to	Budget $
Annual inspection and maintenance	-50			In Progress			

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Structural failure - moderate damage Bearing failure	Possible	Moderate	Medium -	Medium -	Low +	Active

Control Task	Like -%	Cons -%	Risk ID	Status	Due	Assigned to	Budget $
Annual inspection and maintenance	-50			In Progress			

Risk	Likelihood	Consequence	Inherent Risk	Current Risk	Residual Risk	Risk Status
Premature failure of barriers and/or traffic surfaces	Likely	Moderate	Medium +	Medium +	Negligible	Active

Control Task	Like -%	Cons -%	Risk ID	Status	Due	Assigned to	Budget $
Annual inspection and repair program	-30			In Progress			
Operational maintenance	-10			In Progress			
Planned rehabilitation program	-50			In Progress			

Asset Maintenance Management Plan

Beryl Roberts Park Detention Basin

June 2009

Prepared for
Strategic Asset Management
City Assets
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Document Control

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Document Approval		
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1.0 INTRODUCTION

1.1 Purpose of Asset Maintenance Management Plan

The purpose of this Asset Maintenance Management Plan is to;

- Provide a comprehensive reference for the Flood Mitigation Asset, including the original design objectives, drawings and survey.
- Define the required level of service or performance of the Flood Mitigation Asset.
- Outline possible risks which may prevent the Asset performing to the required level of service.
- Specify a maintenance regime to manage these risks so that the Asset may function at the required level of service.
- Ensure that a long term record of condition assessments reports and a log of maintenance work are recorded.

1.2 Plan Framework

The Beryl Roberts Park Asset Maintenance Management Plan forms part of a suite of Management Plans for flood mitigation assets within Brisbane. These documents form an integral part of Brisbane City Council's *"City Plan"*, which promotes the Council's vision and desired environmental outcomes for the city's assets for the future.

The Waterways Asset Strategic Plan (ASP) provides a summary of flood mitigation assets in Brisbane. The ASP is a reference point for citywide policy and incorporating the AMMP, the document includes the following relevant information:

- An asset's purpose and function; and
- A 'Management Plan' for the mitigation asset.



Figure 1. Brisbane City Council Policy Framework - Showing AMMP

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2.0 DESCRIPTION OF ASSET

2.1 General Description of Flood Mitigation Asset

The Beryl Roberts Park Detention Basin is a local flood mitigation device located at Barham Street, Coopers Plains on the north branch tributary of Stable Swamp Creek.

The basin is located in Beryl Roberts Park (UBD 200 E14) and consists of an earthen embankment which runs along the north-west boundary of the site, a weir, a spillway and a grated outlet structure. Two tributaries flow from the south east and north east into the basin discharging via the grated outlet. The basin is heavily vegetated and two concrete footpaths navigate through the basin area. For further details of the location, ground cover and topography of the basin, refer to **Figure 2**, **Figure 3** and **Figure 4 respectively.**

Design drawings of the Basin are provided in **Appendix A**.



Figure 2: Location of the Beryl Roberts Park Detention Basin at Coopers Plains (Brisway 2007)



Figure 3: Beryl Roberts Park Detention Basin site at Coopers Plains (IBIMAP 2008)

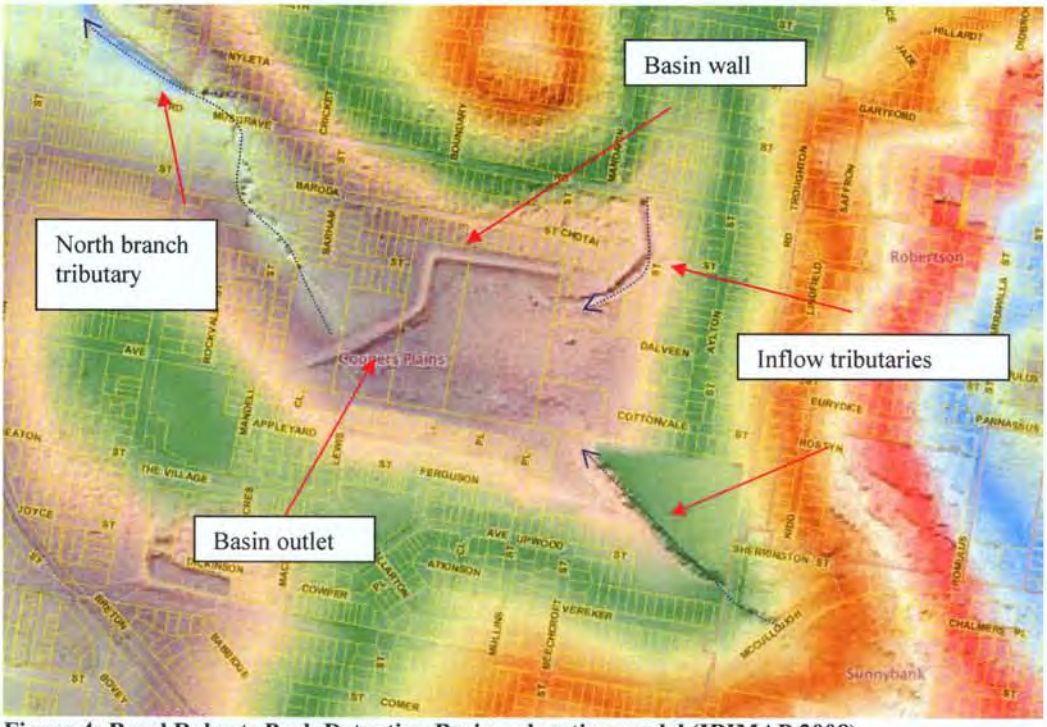


Figure 4: Beryl Roberts Park Detention Basin - elevation model (IBIMAP 2008)

2.2 Background

The Beryl Roberts Park Detention Basin is a component of the Flood Mitigation Scheme for Stable Swamp Creek proposed in the Stable Swamp Creek Flood Mitigation Report (BCC Department of Works, 1981).

The Mitigation Scheme consisted of

- Channel works on North Branch downstream of Orange Grove Rd through to the confluence with Stable Swamp Creek, and on Stable Swamp Creek from Boundary Rd through to Beaudesert Rd consisting of 3.6 km of grassed lined channel; 160m of concrete lined channel and associated culverts and drop structures.
- A detention basin earth filled wall with appropriate spillway and outlet structures; and
- Other minor works including the removal of approximately 4,000 cubic metres of fill in the floodplain.

Table 1A of the BCC report stated that the various components of the Stable Swamp Creek Flood Mitigation Scheme together were expected to reduce flood levels on Stable Swamp in the vicinity of Granard Rd by up to 0.65m in a 100yr Annual Recurrence Interval (ARI) event, 0.85m in a 50yr ARI event and 0.9m in a 20yr ARI event. The report did not analyse the performance of the basin in isolation.

Design drawings for the basin are provided in **Appendix A**. Construction of the basin was completed in 1984 and since then it has operated during numerous storms, notably the March 2001 and November 2004 events.

2.3 Function

The BCC report states the various components of the Stable Swamp Creek Flood Mitigation Scheme together were expected to significantly reduce flood frequency and flood damage both on North Branch downstream of the Basin and on Stable Swamp Creek between Boundary and Musgrave Roads.

The detention basin was designed to mitigate flood flows in the north branch of the creek system and downstream of the confluence with the main branch of Stable Swamp Creek.

The BCC report states '*the basin will have a piped outlet designed to give the maximum flood mitigation in a once in 10 year flood. The spillway will have a capacity equal to the maximised flood flow*' (page 58).

It is therefore understood the basin provides maximum flood mitigation for a 10 yr ARI event, and the spillway is designed to contain a Probable Maximum Flood (PMF) within the basin embankment.

2.4 Various Components of Flood Mitigation Asset

2.4.1 Embankment

The BCC report states the basin was to be constructed with a spillway level of 21.5m AHD for a 50m length and a further 130m length at a level of 21.9mAHD. The embankment was designed to be 3.7m wide at the crest, with upstream and downstream side slopes of 4H: 1V.

The embankment was specified as homogeneous earth fill embankment and drawings indicate Pine Mountain overburden fill compacted to 90% of Modified Maximum Dry Density.

The downstream face in the overtopping or spillway section is faced with rock filled Reno mattresses, overlain with 50mm thick topsoil and then grassed. Elsewhere the embankment is grassed earth fill embankment. See Appendix A for details of the Reno mattresses, topsoil and grass. **Figure 5** and **Figure 6** show the basin wall.
Survey of the Basin was completed by BCC in August 2006. The contour plan of the basin, as well as the long section along the top of the embankment is provided in Appendix B.



Figure 5: Beryl Roberts Park Detention Basin Embankment - from outlet looking north east (June 2006)



Figure 6: Beryl Roberts Basin Embankment - downstream of basin looking upstream towards outlet (June 2006)

2.4.2 Storage

The basin was surveyed in August 2006 to estimate its current storage capacity. Both spot levels and cross sections were surveyed to aid in the development of a stage-storage relationship for the basin (**Appendix B**) and an elevation model of the basin using the software package 12D (**Figure 7**). The surveyed levels are stored in the Registered File No.152/8202552-10283/2. At its spillway level of 21.5m, the storage volume of the basin is approximately 47 700 m^3.

The basin is heavily vegetated with trees and shrubs covering much of its area. A low flow channel, draining the area to the north-east, runs along the northern perimeter of the basin. Another low flow channel, draining the area to the south-east, runs along through the southern part of the basin to the outlet.

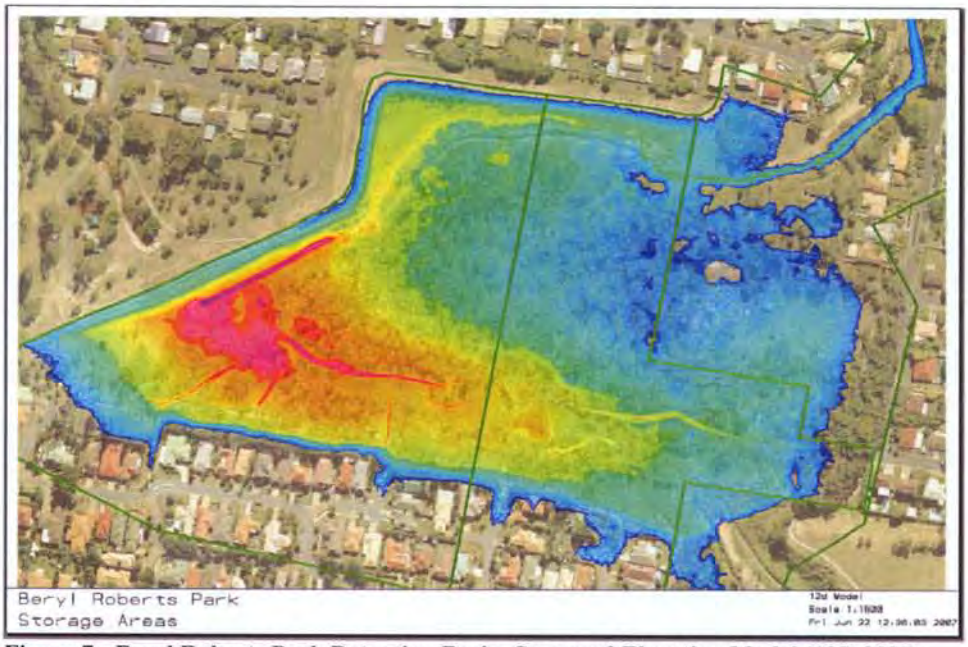


Figure 7: Beryl Roberts Park Detention Basin, Surveyed Elevation Model (12D 2007)

2.4.3 Bikeway Structure and Low Flow Channel

A bikeway crossing is located approximately halfway along the embankment at the north-western edge of the detention basin. The structure comprises box culverts over the low flow channel.

2.4.4 Inlet Structure

The inflow structure located immediately upstream of the basin embankment consists of a grated chamber leading to 43m long, 1950mm diameter Reinforced Concrete Pipe (RCP). The inlet is a large, galvanised iron grated chamber with approximate plan dimensions 6.2 m x 4.3 m and surrounded by galvanised post and rail fence. **Figure 8** shows the details of the grate. Details of the inlet structure components including dimensions and pipe class are included in the drawings in **Appendix A**.



Figure 8: Basin inlet structure (June 2006)

2.4.5 Outlet Structure

The downstream outlet structure comprises a 1950mm diameter pipe outlet and reinforced concrete wing walls leading to a rock lined natural channel. Details of the pipe outlet, wing walls and rock lining are included in **Appendix A**. The outlet structure is shown in **Figure 9** below.



Figure 9: Basin outlet structure (June 2006)

3.0 REQUIRED LEVEL OF SERVICE

3.1 Legislative, Strategic and Corporate Requirements

The legislative and corporate requirements for flood mitigation schemes are outlined in the Waterways ASP (Asset Strategic Plan).

3.2 Required level of service

The 1981 study calculated the total reduction in design flood levels resulting from the various components of the Stable Swamp Creek Flood Mitigation Scheme. However, since the study did not analyse the performance of the basin in isolation, it is not possible to ascertain the anticipated reductions in flood levels and discharges the basin afforded by the original design.

Hydraulic simulation of the basin in its original condition was also difficult, since there is considerable uncertainty regarding the storage characteristics of the basin at that time. The design storage curve differs notably from the curve calculated using the 2006 levels and contemporary modelling techniques. Some of this discrepancy may have arisen from changes to the basin bathymetry (e.g. vegetation and siltation) but a considerable part due to more sophisticated modelling and increased accuracy of recent surveys.

Therefore the level of service provided by the basin will be the flood storage / detention it provides based on its characteristics when surveyed in 2006.

The flood immunity of residents upstream and downstream of the flood detention basin may be adversely affected by climate change if rainfall events become more erratic and intense, or if there is a considerable increase in impermeable surfaces due to development upstream of the detention basin. Maintenance of the basin cannot reduce the impact from either intensification of rainfall events, or development upstream. Maintenance can however ensure that the basin provides the flood storage / detention level of service as required based on the 2006 survey.

3.3 Risks to level of service

Risks to each component providing the required level of service are listed below.

3.3.1 Storage

The storage component of the basin may no longer support the required level of service if there is;

- An accumulation of sediment which reduces the storage volume; or
- A significant increase in vegetation

3.3.2 Embankment

The embankment component may no longer support the required level of service as a consequence of:

- Failure of the spillway and / or embankment during a flood event; or
- Reduction in the level of the embankment through erosion or slump / compaction of the embankment.

3.3.3 Bikeway structure and low flow channel

The bikeway structure may no longer support the required level of service as a consequence of:

- Debris build up on the structure blocking the passage of water
- Siltation or vegetation overgrowth of the low flow channel

3.3.4 Inlet structure

The low flow inlet structure located immediately upstream of the embankment may no longer support the required level of service as a consequence of;

- Blockage due to debris build-up; or
- Degradation of the structural components, e.g. grate and concrete chamber

3.3.5 Outlet structure

The low flow outlet structure located immediately downstream of the embankment may no longer support the required level of service as a consequence of;

- Blockage of the pipe outlet; or
- Erosion of the pipe outlet and / or the outlet channel (this could potentially affect the integrity of the embankment).

The risks to the required levels of service listed above are mitigated by ensuring the detention basin and its components are properly maintained. Section 4 below outlines the maintenance requirements for the detention basin.

4.0 MAINTENANCE REQUIREMENTS

The maintenance schedule outlined in ***Table C2*** (***Appendix C***) aims to ensure the mitigation asset achieves the level of service defined in ***Section 3.2***.

The level of service should be preserved with regular inspections and an appropriate maintenance plan that protects the asset from the risks to service identified in ***Section 3.3*** of this Asset Maintenance Management Plan.

This chapter of the Beryl Roberts Park AMMP discusses the maintenance requirements for each of the components of the mitigation asset.

4.1 Storage

The key requirement for the storage component of the asset is to provide adequate flood storage to reduce flood levels downstream.

To ensure that the basin provides the required level of service the following maintenance regime is required:

- Monitoring vegetation and sediment levels
- Review impact of sediment and vegetation levels on expected level of service
- Survey basin and calculate storage
- Review hydrological estimates to ensure storage provided in the basin can support the desired level of service of the Basin.

4.2 Bikeway Structure and Low Flow Channel

The bikeway structure upstream of the inlet structure enables users of the bikeway to cross the embankment. Water flows under the bikeway structure, along the low flow channel, and into the inlet structure.

To ensure that the bikeway structure provides the required level of service, the following maintenance regime is required:

- Check for debris and erosion in the low flow channel
- Inspect bikeway structure to ensure its structural integrity and safety for pedestrians and cyclists.

4.3 Basin embankment and Spillway

In order to support the desired level of service, the basin embankment provides a physical barrier to detain flood waters during a flood event and the spillway protects the embankment so excess floodwaters do not cause erosion and failure of the embankment.

To ensure that the embankment provides the required level of service the following maintenance regime is required:

- Investigation into consequences associated with failure of the embankment
- Geotechnical inspection of the earthen embankment to confirm structural integrity
- Visual inspection of rock gabions to ensure structural integrity
- Visual inspection to confirm soil and grass cover is protecting gabions
- Monitoring of embankment level to confirm level is appropriate to support required service level of the basin
- Maintenance of gabions

- Maintenance of grass.

4.4 Inlet Structure

Water enters the pipe under the embankment via the inlet structure and is discharged downstream of the embankment. Water flows into the inlet structure from the low flow channel and when the basin is full of flood water.

To ensure that the inlet provides the required level of service the following maintenance regime is required:

- Investigation into impact of blockage of outlet grate on required levels of service
- Visual inspection of inlet pipe to ensure structural integrity
- Visual inspection of inlet grate to ensure structural integrity
- Removal of material causing blockage following storm events.

4.5 Outlet Structure

Water from the pipe under the embankment discharges via the outlet structure into the rock lined trapezoidal channel.

To ensure that the outlet structure provides the required level of service the following maintenance regime is required:

- Inspect pipe outlet to ensure structural integrity
- Inspect rock lining of outlet channel to determine if maintenance is required.

5.0 ASSET MAINTENANCE PLAN

The working forms of the Maintenance Plan are outlined in ***Appendix C*** and comprise an Inspection Form (***Table. C1***) and Asset Maintenance Plan (***Table C.2***).

The Inspection and Maintenance Form should be filled out by LAS during the scheduled site inspection. The Inspection Form is a fundamental element of the Asset Maintenance Plan. ***Table C1*** and ***Table C2*** provide a framework for site inspections and are intended to establish consistent guidelines for commenting on the Assets' current level of service. The Maintenance Plan should be used to determine the requirement for maintenance, remediation and specialist work.

Inspection of the Beryl Roberts Park mitigation asset is scheduled to be carried out annually, with an inspection date recommended in September or October; prior to the onset of the summer storm season. The Maintenance Plan also prescribes an inspection of the asset after a significant flood event (>200mm rainfall).

5.1 Inspection and Maintenance Forms

The necessary forms to conduct the scheduled condition assessment reports and maintenance are located in ***Appendix C***.

Table C1 is the record of inspection completed during the scheduled assessment of the asset. Specialist technical advice will be based on the details and trends described by the inspection and maintenance form.

Table C2 provides a detailed Maintenance Plan for the asset. The plan documents the objectives and instructions for the inspection and evaluation of the asset. The Maintenance Plan contains information relating to:

- Health and Safety,
- Quality Assurance,
- Inspection requirements and
- Maintenance requirements.

It is imperative that all forms and site photos are completed and filed according to ***6.0 Record Keeping*** requirements of the AMMP.

5.2 Hierarchy of Maintenance Inspections

The three levels of inspection for the asset and its associated components are outlined below:

5.2.1 Level 1 inspection (LAS)

- Undertaken by LAS Technical Officer
- Inspect components, take photos, checklist for each component
- Frequency at least annually and after a major flood / storm event
- Funded from *Budget Service 2.4.2.5 Manage and Maintain Assets*

This level of inspection requires survey to be undertaken regularly at agreed locations identified in the AMMP. LAS will commission City Design Survey Services to carry out the survey.

Actions (post inspection):

1. Record inspection and survey information and;
2. Minor maintenance (job brief to BCW or others) and/or;
3. Commission Level 2 inspection (specialist advice).

Minor maintenance is funded by Budget Service 2.4.2.4 Mitigate Flooding (Service Budget Operating).

5.2.2 Level 2 inspection (specialist advice)

- LAS to engage City Design Water & Environment, Geotechnical Services, etc for specialist advice and recommendations
- Triggered by a Level 1 inspection. Triggers include for example significant scouring around inlet / outlet / spillway.
- Inspections undertaken by City Design are funded from *Budget Service 2.4.1.3 Flooding Investigations*

Actions:

1. City Design Water & Environment prepares report to LAS with maintenance / rehabilitation recommendations and costings.
2. LAS organises capital works or maintenance.

5.2.3 Level 3 inspection (long term)

- Survey, hydraulic analysis, function check, structural checks, specialist report (City Design (W & E), Brisbane City Works, Geotechnical advice etc)
- Frequency 5 to 10 years
- Initiated by City Assets and/or Water Resources
- Funded by *Budget Service 2.4.2.4 Mitigate Flooding (Schedule 160)*

Actions:

1. City Design (W&E) prepares report to LAS with maintenance / rehabilitation recommendations and costings.
2. LAS organise capital works / maintenance.

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6.0 RECORD KEEPING

The procedure for logging condition reports, maintenance requests, and site photos has been established to ensure a long term record of the Asset's performance is documented.

Upon completion of each inspection and condition assessment, LAS Regional will scan the completed form and all associated documentation and place the PDF file at the following location:

G:\BI\CD\CD_Business

The PDF file will have the following naming convention:

BerylRoberts_InspectionForm&ConditionAsessment_yymmdd.pdf

Where "yymmdd" denotes the year, month and day the inspection was carried out.

7.0 ACTIONS

7.1 Listing of Works

After the inspection and condition assessment, maintenance work as required will be carried out. If rehabilitation works are identified, these works will be listed by LAS in Ellipse for consideration in the future capital or recurrent program.

7.2 Undertaking Maintenance Works

The undertaking of maintenance works is described in detail in Appendix C.

7.3 Review of Asset Maintenance Management Plan

LAS Southern Region in consultation with the Strategic Asset Management team in City Assets Branch shall review this Beryl Roberts Park Asset Maintenance Management Plan every 5 years.

8.0 REFERENCES

Brisbane City Council, Department of Works, *Oxley Creek System: Stable Swamp Creek Flood Mitigation Report*, November 1981

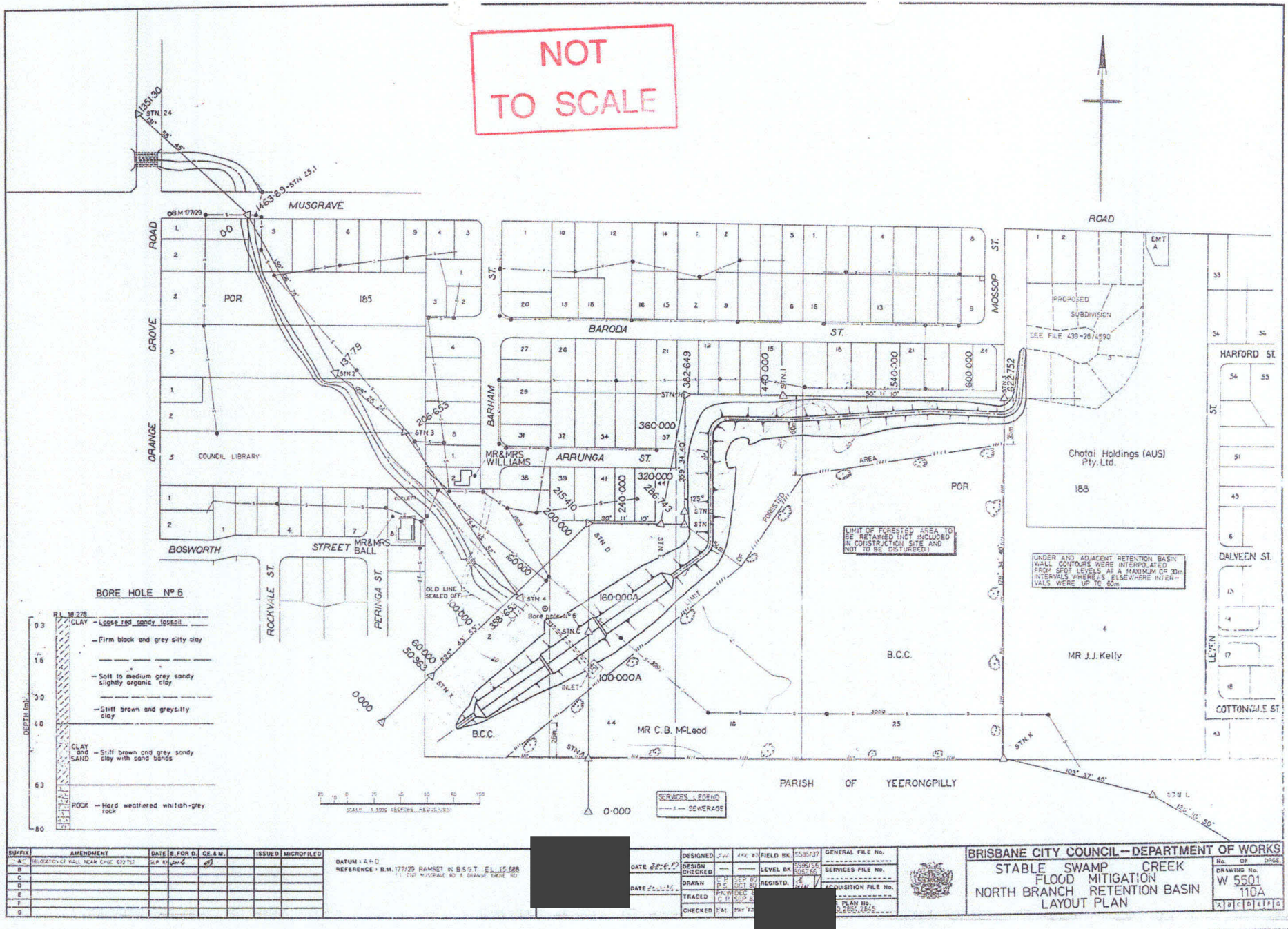
Budget document (2008/09)
Corporate Plan (2008)
Flood Mitigation Schemes in Brisbane – An Overview (late 1980s)
International Infrastructure Management Manual (2006)
Living in Brisbane 2026 (2007)
Mitigate Flooding Business Case 2.6.2.4 (2008)
Water for Today and Tomorrow (2008)
Waterways Asset Strategic Plan (currently being prepared by City Assets)

9.0 APPENDICES

Appendix A: Design Drawings

W5501-110A	Layout Plan
W5501-112A	Longitudinal & Typical Sections
W5501-114	Outlet Pipe Details
W5501-116	Inlet Grate Details

BCC.123.0023



SUFFIX	AMENDMENT	DATE	B.FOR D.	CE & M.		ISSUED	MICROFILED
A	RELOCATION OF WALL NEAR CHGE 622.752	SEP 87					
B							
C							
D							
E							
F							
G							

DATUM : A.H.D.
REFERENCE : B.M. 177/29 RAMSET IN B.S.S.T. EL. 15.688
(TO END MUSGRAVE RD & ORANGE GROVE RD)

[redacted]

DESIGNED	SW	FIELD BK.	5586/37
DESIGN CHECKED	—	LEVEL BK	5586/56, 5587/66
DRAWN	CP SEP 87, PS OCT 87	REGISTD.	
TRACED	PW DEC 87, CP SEP 87		
CHECKED	TM MAY 88		

DATE 22.6.87
DATE 21.11.88

GENERAL FILE No.
SERVICES FILE No.
ACQUISITION FILE No.
PLAN No. D.2852, 2845

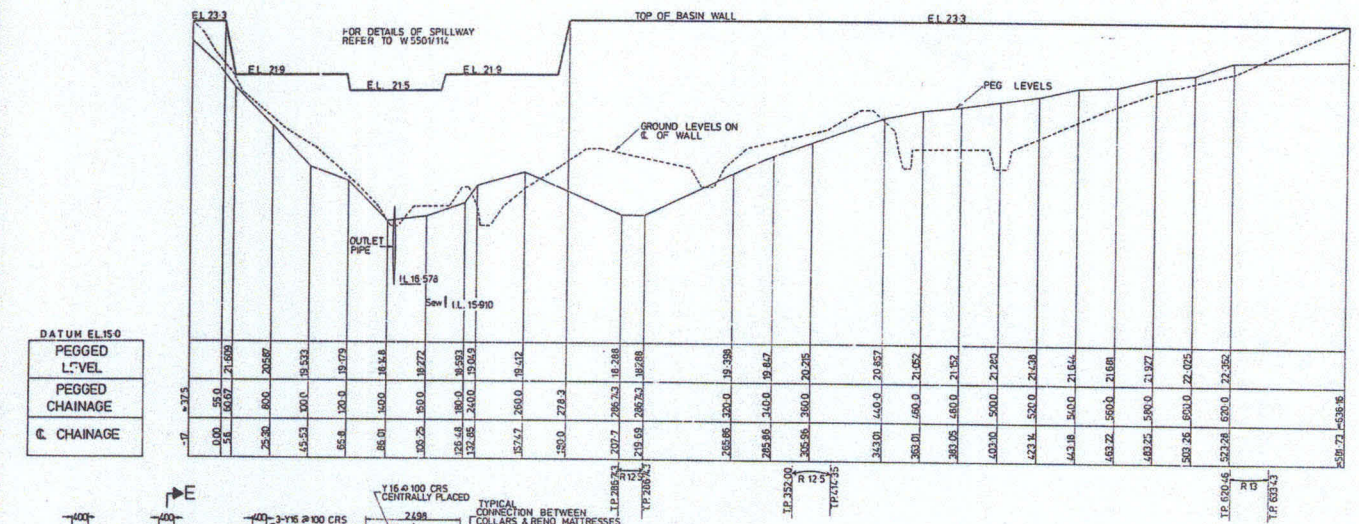
BRISBANE CITY COUNCIL – DEPARTMENT OF WORKS

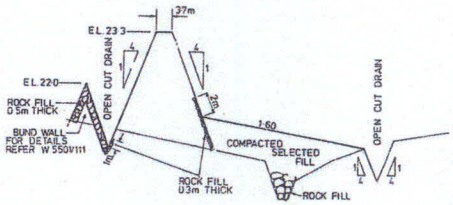
STABLE SWAMP CREEK FLOOD MITIGATION NORTH BRANCH RETENTION BASIN LAYOUT PLAN

No. OF DRGS
DRAWING No. W 5501 110A
A B C D E F G

BCC.123.0024

NOT TO SCALE



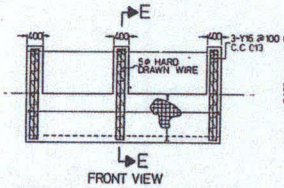


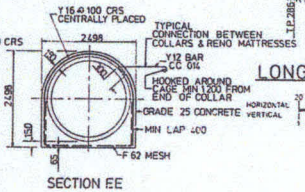
SECTION D-D

HORIZONTAL 1:500 (BEFORE REDUCTION)
VERTICAL 1:50 (BEFORE REDUCTION)

BASIN WALL MATERIAL

PINE MOUNTAIN OVERBURDEN IS TO BE FILL MATERIAL. IT SHALL BE COMPACTED TO AT LEAST 90% OF ITS MAXIMUM DRY DENSITY AS DETERMINED BY THE MODIFIED A.A.S.H.O. COMPACTED TEST IN 300mm LAYERS WITH A MOISTURE CONTENT OF BETWEEN 9 AND 11%.

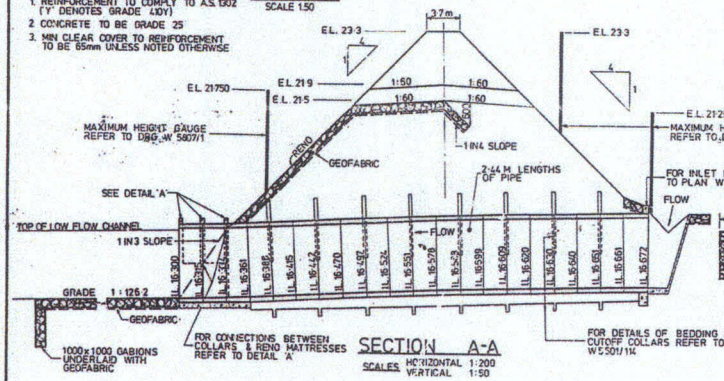


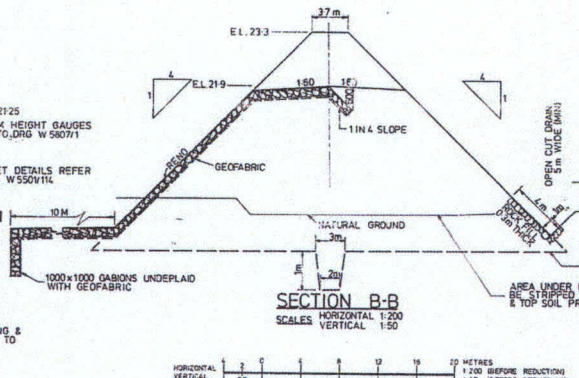


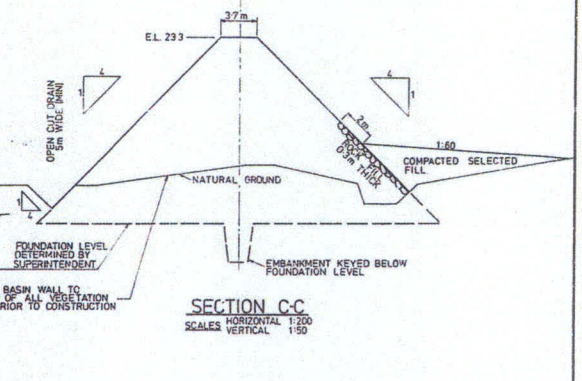
NOTES ON DETAIL A

1. REINFURCEMENT TO COMPLY TO A.S. 1302 ('Y' DENOTES GRADE 410Y)
2. CONCRETE TO BE GRADE 25
3. MIN CLEAR COVER TO REINFORCEMENT TO BE 65mm UNLESS NOTED OTHERWISE

DETAIL A
SCALE 1:50







HORIZONTAL 1:200 (BEFORE REDUCTION)
VERTICAL 1:50 (BEFORE REDUCTION)

NOTES

1. ROCK FILL TO BE QUARRY FACE SPALLS
2. ALL SIDE SLOPES TO BE GRASSED AS PER JOB SPECIFICATION
3. ALL AREAS ON WHICH RENO MATTRESSES & ROCK FILL PLACED, TO BE TOPSOILED (50 THICK) & GRASSED WITH KIKUYA. MAINTENANCE OF GRASSING TO STANDARD SPECIFICATION FOR GRASSING

SUFFIX	AMENDMENT	DATE	E. FOR D.	CE. & M.		ISSUED	MICROFILED
A	RELOCATION OF WALL AND PIT UNDER WALL	SEP 83					
B							
C							
D							
E							
F							
G							

CONTACT STAFF SURVEYOR CONCERNING ENDANGERED P.S.M's OR B.M's
DATUM : A.H.D.
REFERENCE : B.M. 177/29 RAMSET IN BSGT EL. 15.656
SE. CORNER MUSGRAVE RD & ORANGE GROVE RD.

[redacted]

DESIGNED	J.W.	APR '83	FIELD BK.
DESIGN CHECKED	[illegible]	[illegible] '83	LEVEL BK. 5585/56, 57/66
DRAWN	C.P.	AUG '82	REGISTD.
TRACED	C.P.	SEP '82	
CHECKED	P.M.	MAY '83	

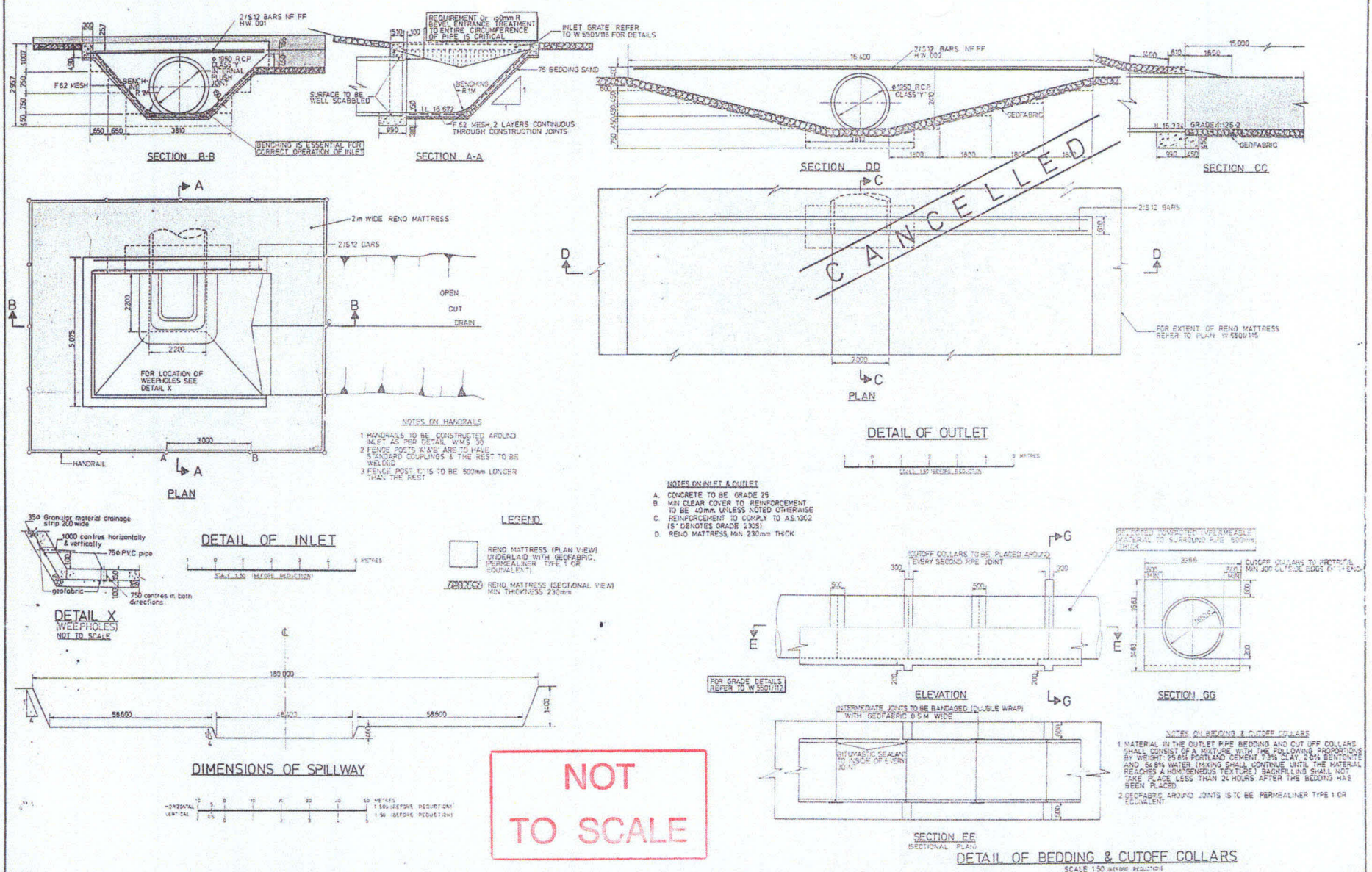
GENERAL FILE No.
SERVICES FILE No.
ACQUISITION FILE No.
SUR PLAN No.

BRISBANE CITY COUNCIL — DEPARTMENT OF WORKS

STABLE SWAMP CREEK
FLOOD MITIGATION
NORTH BRANCH RETENTION BASIN
LONGITUDINAL & TYPICAL SECTIONS

No. OF DWGS.
DRAWING No. W 5501 112A
A B C D E F G

BCC.123.0025



SUFFIX	AMENDMENT	DATE	E. FOR D.	CE & M.		ISSUED	MICROFILED
A							
B							
C							
D							
E							
F							
G							

CONTACT STAFF SURVEYOR CONCERNING ENDANGERED P.S.M's OR B.M's
DATUM : A.H.D.
REFERENCE : B.M. 177129 RAMSET IN B.S.G.T. EL 15.688 S.E. CNR MUSGRAVE RD & ORANGE GROVE RD.

CHIEF ENGINEER & MANAGER [redacted] DATE 2.4.82
DATE 2.4.82

DESIGNED	J.W.	FIELD BK.	—
DESIGN CHECKED		LEVEL BK.	—
DRAWN	C.P.	REGISTD.	
TRACED	C.P.		
CHECKED	F.M.		

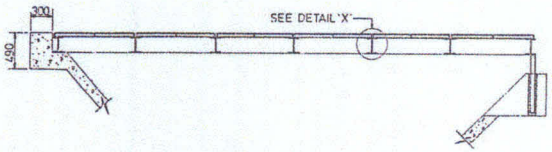
GENERAL FILE No.
SERVICES FILE No.
ACQUISITION FILE No.
SUN PLAN No.

BRISBANE CITY COUNCIL — DEPARTMENT OF WORKS

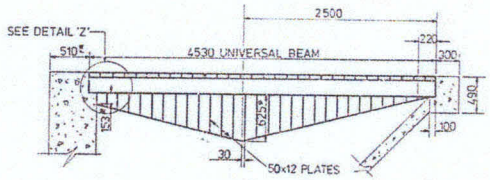
STABLE SWAMP CREEK
FLOOD MITIGATION
NORTH BRANCH RETENTION BASIN
OUTLET PIPE DETAILS

No. OF DRGS.
DRAWING No. W 5501 114
A B E F G C S G

BCC.123.0026

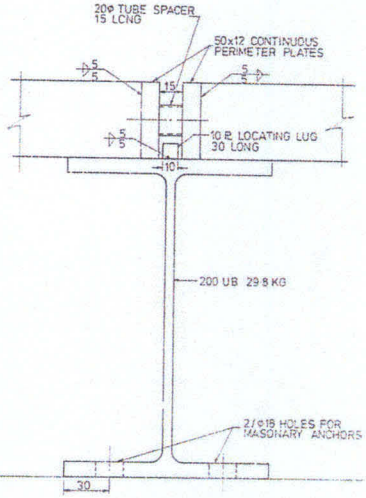


SECTION BB
SCALE 1:30

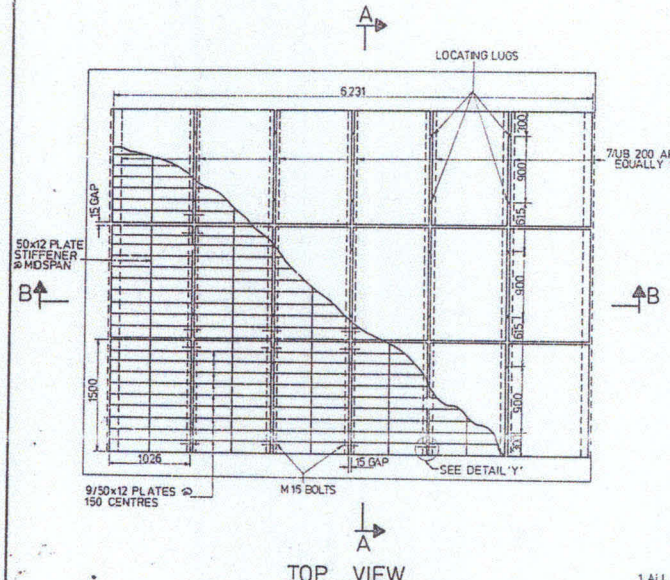


SECTION AA
SCALE 1:30

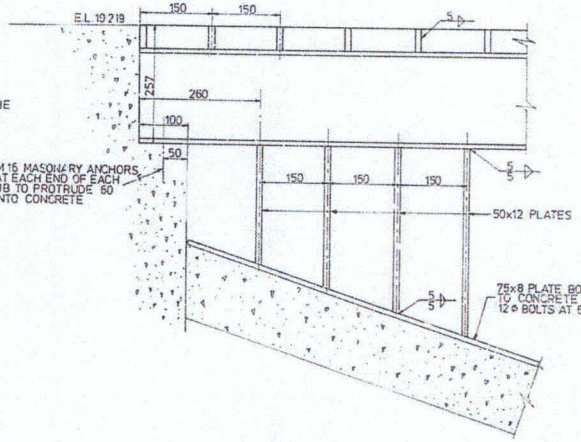
* THESE DIMENSIONS ARE IDEAL. THE ACTUAL DIMENSIONS MAY BE VARIED SLIGHTLY ON SITE TO SUIT THE EXACT PROFILE OF THE OPEN CUT DRAIN



DETAIL X
SCALE 1:15



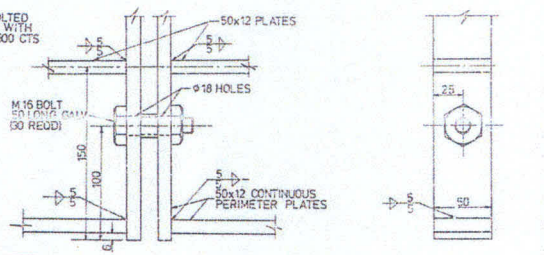
TOP VIEW
SCALE 1:30



DETAIL Z
SCALE 1:5

NOTES

1. ALL PARTS TO BE HOT DIP GALVANISED
2. ALL WELDS TO BE 5mm CONTINUOUS FILLET WELDS UNLESS NOTED OTHERWISE
3. ALL WELDS TO BE MADE WITH E 41XX ELECTRODES UNLESS NOTED OTHERWISE
4. BOLTS TO BE METRIC HEXAGON COMMERCIAL GRADE 4·6 TO AS 1111
5. FOR REINFORCED CONCRETE DETAILS REFER TO DRG NO W 5501/114



TOP VIEW

RIGHT SIDE VIEW

DETAIL Y
SCALE 1:2

NOT TO SCALE

ADDITIONAL DIMENSIONS TO SECTION A-A

SUFFIX	AMENDMENT	DATE	E. FOR D.	C.E. & M.	ISSUED	MICROFILED
A						
B						
C						
D						
E						
F						
G						

DATUM = A.H.D.
REFERENCE : B.M. 177/29 RAMSET IN B.S.G.T. E.L. 15.688 S.E. CNR MUSGRAVE RD & ORANGE GROVE RD

CHIEF ENGINEER & MANAGER [redacted]

DESIGNED	J.W.	MAY 83	FIELD BK.	——	GENERAL FILE No.
DESIGN CHECKED	M.C.S.	JUN 83	LEVEL BK.	——	SERVICES
DRAWN	C.P.	MAY 83	REGISTD.		ACQUISITION PLAN No.
TRACED	C.P.	MAY 83			SUR PLAN No.
CHECKED	[redacted]				

BRISBANE CITY COUNCIL — DEPARTMENT OF WORKS

STABLE SWAMP CREEK
FLOOD MITIGATION
NORTH BRANCH RETENTION BASIN
INLET GRATE DETAILS

No. OF DRGS.
DRAWING No. W 5501 116
A B C D E F G

BCC.123.0027

Appendix B: Survey

Figure B1: Contour Plan of the Basin
Figure B2: Long Section Along Top of Levee Bank
Figure B3: Basin Stage-Storage Curve

BCC.123.0028