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<p>Corporate Plan Output: Various</p>	

The purpose of this report is to follow up on the City Services Seminar of 20 May, and in particular the financial aspects of the implementation programme and emergency management planning.

This report is divided into parts covering City Streets, Waste Management, Water Services and Response Plans.

CITY STREETS

The programme of mitigation measures is primarily focussed on the bridge infrastructure as this is the most vulnerable, particularly to earthquake. Some attention is also being given to better understanding the liquefaction risk to roads adjoining rivers and joint research of wave patterns by NIWA. The latter contributing to understanding tsunami events.

The budget approach has been as follows:

- On an annual basis we allow approximately \$100,000 in the capital programme. This funds an ongoing investigation programme by the Council’s structural engineering team, including site testing. In recent years, the team has taken on an additional engineer to assist with this work. This budget allocation also covers moderate cost improvements, such as those shown at the seminar for Fitzgerald Avenue bridge.
- In the forward programme, we include major Lifelines related projects and works separately and prioritised against other projects. Ferrymead and Blenheim Road overbridge are two examples where significant funding has been included in current or forward programmes.
- Low cost mitigation measures can be incorporated in the operational budget under bridge maintenance.
- Transfund financial assistance is paid for maintenance and on a case by case basis may be available for capital improvements.

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This budget approach has been appropriate in maintaining a programme of investigating bridges, reporting and undertaking low to moderate cost remedial work. When works have been scoped and agreed, additional funding is sought in the Annual Plan if needed. We can expect this to become more demanding in future years as the easy work is completed and as we get a better understanding of how the bridges will behave and whether they can be cost effectively protected.

We have also found that the "bigger cost items", such as Ferrymead, Blenheim Road, Marshland Road and Pages Road, need also to be associated with traffic capacity and/or safety improvements. Therefore, the timing of these projects needs to be integrated with other planning.

What will be important then is that the Committee support the priorities of projects when submitted in future programmes.

WASTEWATER

The Lifelines study highlighted issues in the Wastewater system that needed to be addressed to better prepare the City for a major natural disaster to minimise the immediate impacts of a natural disaster and to enable a speedy recovery of services should a disaster occur.

Initiatives Completed

Waterproofing of Pumping Stations

A total of 12 out of 13 at risk stations have been waterproofed to reduce the likelihood or impact of inundation in the event of a Tsunami or local river flooding. This has involved the strengthening and sealing of pumping station doors in Eastern areas and in the lower reaches of the Avon and Heathcote Rivers.

Installation of Sewer Overflows

A further 22 overflows have been installed on the reticulation system and in pumping catchments that do not have a formal overflow system. There are now 102 overflows on the network that in the event of a major disaster will allow sewage to overflow directly to a river or drain rather than on to private property or public areas such as roads. There remains 2 pumping station catchments that do not have a formal overflow and these will be equipped with either mobile standby generation equipment, mobile pumping facilities, or permanently installed standby generation.

Pressure Mains on Susceptible Bridges

Sewer pressure mains on at risk bridges will be made flexible enough to withstand differential movement of the bridge without failure or removed entirely from these bridges. One pressure main has been replaced by an "under river" pipe and removed from the Ferrymead Bridge. One further pressure main will need to be removed from this bridge and one pressure main is also to be removed from the Pages Road Bridge.

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Lifelines Work To Do

Brick Barrels

The central city has 7 kilometres of brick barrel sewers that could be susceptible to damage in a major earthquake. Renewal or strengthening of these sewers has been programmed to start in 2003/4.

Building Strengthening

A full assessment of pumping station seismic strength has shown that two pumping stations require internal strengthening of walls and some internal bracing.

Flexible Couplings at Structures

The lifelines study highlighted the possibility of differential settlement occurring at all types of below ground structures due to liquefaction of sandy and the consequent shearing off of connected pipelines. It is not considered practical to retrospectively establish sufficient flexibility at all pipeline to structure connections (22,000 manholes and 78 sewer pumping stations) with any degree of certainty of success. All new and future design work can and will provide appropriate flexibility at these interfaces.

Current Lifelines Work

In the current year further overflows have been installed on the reticulation system and in pumping station catchments without overflows. The flotation proofing of No 57 pumping station in McCormacks Bay has been deferred as there is currently no suitable contractor available to complete the required bolting of the station caisson to bedrock 10 meters below the ground surface. The installation of electrical plug connections to pumping stations that do not have standby power generators installed has commenced. This work will allow the stations to be run using mobile standby generators in the event of a disaster involving the loss of electricity supply and covers the situation of potential loss of power in the unlikely event of transmission failure associated with Y2K. As many stations as possible will have these connections installed before the end of the year. Hired suction tankers in the event of widespread and prolonged power failure will be used to service very small stations.

Budgeted Expenditure On Lifelines – Wastewater \$1000:

	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07
Overflows	10								
Waterproofing (P/S 15)		10							
Electrical Connections	90	190	70						
Standby Generator (No 20 P/S)		90							
Building Strengthening (P/S 2, 5)		20	80						
Mobile and/or fixed Standby Generators			150						
Pipes on Bridges (Ferryhead & Pages)				170					
Flotation Proofing (No 57 P/S)				130					
Brick Barrel Investigations and Strengthening					50	1050	1050	1050	1050
TOTAL	100	310	300	300	110	1050	1050	1050	1050

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Additional expenditure was sought in the 1999/2000 budget round over the next three years to ensure better disaster preparedness for the wastewater system. This is included in the above table.

WATER SERVICES

The Christchurch Engineering Lifelines Project was commenced in 1994 with the following objectives:

- (i) To identify the vulnerability of Engineering Lifelines Services to damage from earthquakes, flooding, tsunami and meteorological hazards.
- (ii) To identify practical engineering strategies for reducing the risk or impact of such damage and providing for reinstatement following such events.
- (ii) To communicate the issues to people involved in the management of these services and to raise the awareness of the public to their importance.

Council Units, particularly City Streets, Waste Management and Water Services are progressing with Lifelines investigations and risk reduction.

HAZARDS AFFECTING THE STORMWATER SYSTEM

Stormwater infrastructure and the rivers and waterways of Christchurch are believed to be at the greatest risk from earthquakes and tsunami.

Earthquakes will affect the stormwater drainage system through both shaking and liquefaction. Liquefaction occurs where unconsolidated sand lying below the water table is shaken around so vigorously that the sand particles (which are surrounded by water) become partly suspended. The sand loses its strength and behaves like a heavy liquid.

During liquefaction a buried structure like an underground pumping station or a pipe can float, and river banks and stopbanks on liquefiable foundations can slump into the adjacent river.

Shaking will damage stormwater facilities, both above and below ground with effects predominating in older reticulation featuring brick barrels, ceramic pipes and rigid mortared joints. The point of connection between pipelines and structures is another location of vulnerability during seismic events.

The risk from a tsunami to the coastline is well known, however there is also a risk in the major rivers. A sufficiently large tsunami would fill the estuary and flow up the Avon and Heathcote Rivers, spilling over the stopbanks as it progresses upstream.

The attached table lists the significant vulnerabilities and investigative work in place to assess options for mitigation. Funding has been requested in the Unit's 10 year capital works programme and shown in its utility asset management plan. However noting the uncertainty surrounding possible work and costs the Parks and Recreation Committee has decided to wait for further information before budgeting the funds. Investigations are continuing.

Progress With Stormwater System Lifelines

System Component	Issues	Progress
SEISMIC HAZARD		
Stormwater Pumping Stations in Liquefaction Zones	<ul style="list-style-type: none"> • 6 stations likely to encounter liquefaction hazard • stations will tilt or shift 	<ul style="list-style-type: none"> ➤ investigating strengthening 5 stations, (one to be decommissioned)
Large Pipe Connections to Stormwater Pumping Stations	<ul style="list-style-type: none"> • joint at pumping station vulnerable to differential movement 	<ul style="list-style-type: none"> ➤ City Design engineers investigating ways to make joints flexible
“Brick Barrel” Pipelines	<ul style="list-style-type: none"> • 90-100 yr old pipelines are brittle, • likely to collapse in places 	<ul style="list-style-type: none"> ➤ videoing of pipelines completed ➤ replacement programme being formulated
Liquefaction of Stopbanks	<ul style="list-style-type: none"> • Avon River stopbanks downstream of Kerrs Reach generally lie over liquefiable layers • Stopbanks will subside and crack in a large earthquake 	<ul style="list-style-type: none"> ➤ Areas subject to damage are being mapped with greater accuracy. ➤ Initial indications are that preventative measures are very expensive and unlikely to be economic. ➤ Being considered in Avon Floodplain Management Strategy ➤ See above
Stormwater Pumping Station Components	<ul style="list-style-type: none"> • Low lying areas (Bexley, Brighton) subject to tidal flooding. • Heathcote River stopbanks likely to be similarly affected. • Kobe & LA experience suggests components need secure attachment. 	<ul style="list-style-type: none"> ➤ Risk assessment initiated

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Utility Component	Issues	Progress
OTHER HAZARDS		
River Bank Damage Due to Liquefaction	<ul style="list-style-type: none"> ● River banks can move due to “slippery” liquefiable layer beneath. ● Roads, pipelines and houses would move too. ● Displacement of approx 0.5m within 50m of river bank. ● Displacement 0.1-0.2m within 200m of river bank. 	<ul style="list-style-type: none"> ➤ Initial indications are that preventative measures are very expensive and unlikely to be economic
Flooding Due to Tsunami	<ul style="list-style-type: none"> ● Preliminary modelling suggests significant stopbank overtopping at Bexley/Brighton from a large tsunami 	<ul style="list-style-type: none"> ➤ Risk will probably always exist ➤ Options being considered under Avon Floodplain Management Plan.
River Stopbank Damage During a Tsunami	<ul style="list-style-type: none"> ● Significant stopbank overtopping might cause stopbank damage. 	<ul style="list-style-type: none"> ➤ Damage unlikely
Tsunami Damage to Stormwater Pumping Stations	<ul style="list-style-type: none"> ● 4-6 stormwater pumping stations expected to be inundated by sea water during a major tsunami event. 	<ul style="list-style-type: none"> ➤ Risk assessment initiated
Loss of Power Supply	<ul style="list-style-type: none"> ● Power supply to pumping stations could be lost in some natural hazard events. ● Loss of power more likely during storms. 	<ul style="list-style-type: none"> ➤ Risk assessment initiated

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WATER SUPPLY LIFELINES

At the recent seminar on Lifelines activity within the City Council's infrastructure-based services the measures being taken to improve water supply security during and following a major natural disaster were described.

The approved 10-year Capital Works Programme shows \$30,000 per year for this work but as investigations confirm the priority and necessity for the work funding will be sought to address any shortfall.

WATER SUPPLY SYSTEM

	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07
1 Complete reservoir isolation and automatic operation project	21,000	20,000	20,000						
2 Secure fittings in pumphouses									
3 Fix flexible joints at critical reservoirs		30,000	22,500	22,500	22,500	22,500	22,500	22,500	
4 Fix flexible joints at critical pump stations	9,000	15,000	22,500	22,500	22,500	22,500	22,500	22,500	
5 Install isolation valves at bridges						10,000	10,000		
6 Fix flexible joints at critical bridges (below ground)				20,000	20,000	20,000	20,000	20,000	20,000
7 Waterproof vulnerable pump stations									
8 Replace 300 dia. Pipe in Ferry Road from Charlesworth Street to Tunnel Road								20,000	80,000
Totals	30,000	65,000	65,000	65,000	65,000	75,000	75,000	85,000	100,000

RESPONSE PLANS

There are three aspects of Response Planning that the new Emergency Management Planning Officer will be required to address. These are as follows:

1. City Disaster Recovery Plan.
2. Business Unit Emergency Management Plans.
3. Engineer Headquarters and Rescue Headquarters Emergency Management Plans.

CITY DISASTER RECOVERY PLAN

Issues that need to be considered in the establishment of a City Disaster Recovery Plan are:

- Identify the likely scenarios, and the scale and type of damage from which the City will need to recover.
- Identify and clarify structures and responsibilities for recovery co-ordination, taking into account the roles of this Council, Canterbury Regional Council, and the pending Emergency Management Review changes.
- Identify the scale of restoration of essential utility services.
- Consider assessments of building safety and administration of approval processes for repair and reconstruction.
- Consider social recovery issues (housing, health etc) and economic recovery issues (materials, employment, professional services, funding etc).
- Consider what opportunities are likely for re-planning/re-organising the layout and distribution of the City and services.
- Consider hazard mitigation (ie. what can be do before the event to reduce the recovery issues?).

BUSINESS UNIT EMERGENCY MANAGEMENT PLANS

Business Units will be required to establish an individual plan that can be used at the time of a disaster in order to maintain/restore the delivery of the services they provide. As for the City Disaster Recovery Plan each unit will need to identify the likely scenarios and the scale and type of damage to their assets/operations and how they will maintain/restore services. It is proposed initially to establish emergency contingency plans that focus on problems that may arise as a result of Y2K and build upon these to create a complete Unit Emergency Management Plan.

CIVIL DEFENCE ENGINEER HEADQUARTERS AND RESCUE HEADQUARTERS EMERGENCY MANAGEMENT PLANS

These plans are to focus specifically on the functions of the Engineer Headquarters and Rescue Headquarters, once a civil defence emergency has been declared. The plans will identify the roles of those staff manning the two Headquarters, resources required to keep the Headquarters operational and the liaison roles with Civil Defence Regional Headquarters at the Canterbury Regional Council. Some very good work has already been undertaken in this area with the production of the Engineer Headquarters Emergency Plan.

Recommendation: For discussion.

Chairman's

Recommendation: Not seen by Chairman.