



Options for the Upgrade of the Main and North Wagga Levees for Flood Security

Cost Effectiveness Analysis

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Cost Effectiveness Analysis of Options for the Upgrade of the Main and North Wagga Levees for Flood Security

OBJECTIVE

This report summarises the results of cost effectiveness analysis of the alternative options to upgrade the Main and North Wagga Levees for flood security.

The primary objective of this analysis is to evaluate the proposed alternative options and recommend the most cost effective option for upgrading of the Main and North Wagga Levees.

METHODOLOGY

Economic appraisal is a way of systematically analysing all the costs and benefits associated with various management strategies that meet the project objectives to assess their relative desirability.

NSW Treasury Guidelines for Economic Appraisal recommends the following two techniques:

- Cost Benefit Analysis (CBA)
- Cost Effectiveness Analysis (CEA)

CBA is usually adopted where the major costs and benefits of the alternative strategies can be valued in monetary terms.

CEA is adopted when the major costs and/or benefits of a project are not readily measured in monetary terms and the outputs of options are same or similar.

In the current context, as the alternative options are expected to offer same (or similar outcomes), CEA has been adopted for the analysis.

OPTIONS

Based on the Wagga Wagga Levee Upgrade Detailed Design Report - Draft (Report No. DC15012, August 2015), two options have been considered for evaluation for the Main Wagga Levee and the North Wagga Levee, respectively to decide on most suitable solutions:

Main Wagga Levee

- Main Wagga Levee Option 1 – “Maintain the current level of protection” – the current average flood return interval status of 49 years (ARI – 49 years) will continue in this option
- Main Wagga Levee Option 2 – Levee Upgrade for ARI 100 – this option involves carrying out levee upgrade works at a capital cost of \$9,135,788 (2015\$) to provide a definitive 100 year average flood return interval (ARI – 100 years)

North Wagga Levee

- North Wagga Levee Option 1 – “Maintain the current level of protection” – this option will maintain the current average flood return interval of 12 years (ARI – 12 years)
- North Wagga Levee Option 2 – Levee Upgrade for ARI 20 – this option involves carrying out levee upgrade works at a capital cost of \$6,215,524 (2015\$) to provide a definitive 20 year average flood return interval (ARI – 20 years)

The costs of options considered for the cost effectiveness analysis (all values in 2015/16\$) are shown in Table 1 next page.

Annual average flood damage cost has been included as a cost in the project on the premise that this would be the cost to be contributed to a sinking fund annually over the Average Return Interval (ARI) period so that when the flood returns at the end of ARI, the flood damage costs could be compensated. The flood damage for the main levee costs have been adopted from Wagga Wagga Floodplain Risk Management Plan, May 2009 with appropriate adjustment for inflation.

Maintenance Costs

Maintenance of a levee system is deemed to include the cost of

- a. Yearly inspections;
- b. 5-yearly Audits;
- c. 5-yearly crest level surveys

As well as the normal yearly maintenance activities (e.g. tree/shrub removal, erosion repair, pest eradication/repair e.g. rabbit holes, grass mowing, weed eradication etc.).

While a newly constructed levee may not need maintenance, the annual growth of saplings and shrubs means that maintenance needs to commence soon afterwards. As well, if there are levees through high visibility areas (e.g. parks and gardens, town centre) there can be also a cost in maintain them in pristine condition.

As levees age, the deterioration also accelerates thus requiring more maintenance. If maintenance is neglected for a few years, the cost of maintenance actually increases as problems just magnify in size (e.g. removal of a small sapling one year is significantly less than the removal of a tree a few years later). In addition, there is the cost of maintaining the stormwater structures (i.e. pipes, gate valves and pumps).

Taking all the above into consideration, the average cost can be related to a per metre rate of approximately \$2.00/m/year. For the main Wagga levee this equates to approximately \$18,000/year and North Wagga Wagga \$11,000/year.

Table 1: Costs for Main Wagga Levee

Cost (\$)	Option 1 – Maintain current level of protection (2015/16\$)	Option 2 – Levee Upgrade for ARI 100 (2015/16\$)
Capital cost	\$0	\$9,135,788
Maintenance Cost	\$18,000	\$18,000
Annual Average Flood Damage Cost	\$1,664,600	\$245,808
Residual value at the end of 30 years	\$0	\$6,521,052

Table 2: Costs for North Wagga Levee

Cost (\$)	Option 1 – Maintain current level of protection (2015/16\$)	Option 2 – Levee Upgrade for ARI 20 (2015/16\$)
Capital cost	\$0	\$6,215,524
Maintenance Cost	\$11,000	\$11,000
Annual Average Flood Damage Cost	\$1,930,000	\$1,419,000
Residual value at the end of 30 years	\$0	\$4,350,867

Present Value (PV) of Costs

The present values of total costs, total O&M costs the two options at 7% discount rate have been calculated for the purpose of cost effectiveness analysis. A 30-year evaluation period has been considered for the analysis. It has also been assumed that the levee upgrade work will be completed by June 2016.

The residual values of capital costs of options at the end of the 30 years have been included in the analysis assuming the average life of assets built during levee upgrade as 100 years.

The sensitivities of the PVs of total costs of options at a lower and higher discount rate (4% p.a. and 10% p.a. respectively) also have been analysed. A lower discount rates means that the future costs (and benefits) are valued higher (compared to higher discount rates). On the contrary, a higher discount rate means that future costs and benefits are valued lower.

The results of the cost effectiveness analysis are presented for the Main Wagga Levees in Table 3 and for North Wagga Levees in Table 4.

Table 3: Present Value of Costs of Options - Main Wagga Levee

OPTION	CAPITAL COST (\$)	PV of Total Costs @7% with residual value	Sensitivity	
			PV @ 4%	PV @ 10%
1 – Maintain the current level of protection (ARI 49 years)	\$0	\$22,656,898	\$30,907,559	\$17,618,078
2 – Levee upgrade for ARI 100 years	\$9,315,788	\$12,010,556	\$12,149,919	\$11,703,672

Table 4: Present Value of Costs of Options - North Wagga Levee

OPTION	CAPITAL COST (\$)	PV of Total Costs @7% with residual value	Sensitivity	
			PV @ 4%	PV @ 10%
1 – Maintain the current level of protection (ARI 12 years)	\$0	\$26,026,949	\$35,504,837	\$20,238,641
2 – Levee upgrade for ARI 20 years	\$6,215,524	\$24,818,892	\$31,031,678	\$20,876,670

Conclusions and Recommendations

A comparison of present values (PV) of options for both the Main Wagga Levees and the North Wagga Levees indicates that 'Option 2 – Levees upgrade' has lower PV of total costs compared to 'Option 1 – Maintain current level of protection' at the benchmark discount rate of 7% p.a.

The PVs of option 2 remains the lowest also at the sensitivity discount rates of 4% p.a. and 10% p.a. for the Main Levee clearly establishing that the upgrade of Wagga Main Levee is highly cost effective. For North Wagga levees, the PV of Option 2 remains cost effective at lower discount rates and becomes slightly less cost effective than the Option 1 at higher discount rates. This indicates that the levee upgrade option will become less cost effective if the value of the damage costs of future flood events are valued at lower than the current values, which may not often be the case.

Hence, it can be concluded that upgrading both the levees will be preferable as it is cost effective in the long term and offer more benefits.



Public Works
NSW Water Solutions

Level 14 McKell Building
2-24 Rawson Place
Sydney NSW 2000

www.publicworks.nsw.gov.au