Benefit-Cost Analysis Methods Summary

2020 FEMA BRIC Grant Application

City of Menlo Park, Menlo Park SAFER Bay

Introduction

A benefit cost analysis (BCA) has been performed by HDR Engineering as part of the FEMA Building Resilient Infrastructure and Communities (BRIC) Grant Application for the City of Menlo Park. The purpose of the application is to obtain federal funds which will support the development of the Menlo Park SAFER Bay project (The Project).

The Project features the construction of a linear flood control infrastructure generally parallel to CA State Route 84 between the coordinates (in decimal degrees): 37.489343, -122.168205 (west end) and 37.495706, -122.133100 (east end). The Project will provide protection to the PG&E Ravenswood Substation located at: Willow Road .5 Mi. W/Dumbarton Bridge in Menlo Park, California. The PG&E substation serves as a critical regional connection for power delivery to the area delivering electricity to nearly 111,000 dwelling units with a total population of approximately 296,000.

The project is estimated to cost $67,675,087 (2020 $'s) for construction.

The FEMA BCA toolkit ver. 6.0 was used to estimate the present value stream of expected annual benefits and costs of The Project.

Benefits considered in the analysis include avoided loss of service, avoided repair and reconstruction costs, and ecosystem services.

The steps inputs to develop the BCA model are outlined below and are followed by a discussion of the findings.

Methodology

The following sections document the primary assumptions related to the level of protection, professional expected damages as a basis for the analysis, and key inputs into the analysis.

All monetary values were updated to current value as needed and adjusted to present value using OMB discount rates (OMB Circular A-94).

Project Useful Life

The proposed levee is assumed to have a 50-year useful life in accordance with Appendix D of the FEMA BCA reference guide, Major Infrastructure (minor localized flood reduction projects), standard value 50.

Level of Protection

EXISTING

The Ravenswood Substation is assumed to flood currently at the 10-year event as indicated in Major Infrastructure (minor localized flood reduction projects), standard value 50.

PROPOSED

The project is estimated to provide protection to the 100-yr with future conditions and 3.5 ft. of sea level rise.

Table 1: Level of Protection and Project Useful Life

Input/Assumption	Value	Source
Project useful life	50 years	FEMA BCA reference guide Appendix D
Existing level of protection	<10-yr recurrence interval	BCA Attachment 4 - Menlo Park SAFER Bay - Ravenswood Substation Hydraulic Analysis Technical Memo
Assumed level of protection (post mitigation)	100-yr recurrence interval + 3.5 ft. sea level rise	As noted in Scope of Work section, the selected project alternative will design for the 100-year recurrence interval and 3.5 ft. of sea level rise.

Damages Estimates

The FEMA BCA toolkit ver. 6.0 was setup to estimate damages using Professional Expected Damages as historical information was not available. The BCA analysis was conducted using detailed information collected for the Project. Key inputs in the analysis are shown below in the following sections.

Table 2 provides a breakdown of general impacts to the Ravenswood Substation. The FEMA standard value for loss of electrical utility service was used in the analysis. Additionally, PG&E provided the population served by the regional substation.

Table 2: Ravenswood Substation Impact Assumptions

Input/Assumption	Value	Source
Loss of Wastewater Service	$174	FEMA BCA toolkit 6.0, standard value
Number of Customers Served	296,183	BCA Attachment 5 - Menlo Park SAFER Bay - PG&E Ravenswood Substation Flood Impact Technical Memo

Durations for loss of service were estimated for existing conditions and for future conditions with 3.5 ft. of sea level rise (SLR), for each of the 10-, 50-, 100-, and 500-yr recurrence intervals (Table 3). Engineering estimates of coastal flood events translated inundation depth into event duration days. Drainage duration was then estimated for each flood event. PG&E estimated

repair time to be 1 days for flooding equal to or less than 1.5 ft. and 2 days for flooding in excess of 1.5ft. For a detailed explanation of the hydraulic analysis and service impact assessment see BCA Attachment 4 - Menlo Park SAFER Bay - Ravenswood Substation Hydraulic Analysis Technical Memo and BCA Attachment 5 - Menlo Park SAFER Bay - PG&E Ravenswood Substation Flood Impact Technical Memo, respectively.

The flood benefits in the BCA toolkit submitted with the grant application were estimated using future conditions with 3.5ft of SLR. Existing conditions were also evaluated as a sensitivity analysis to ensure that the benefit cost ratio remained greater than 1.0.

Table 3: Estimated Loss of Service Due to Flood Inundation

Existing conditions					
Recurrence Interval	**PG&E Ravenswood Substation inundation depth, ft.**	**Event duration, days**	**Drainage duration, days**	**Repair time, days**	**Total loss of service time, days**
10-yr	1	1	2	1	4
50-yr	1.5	2	4	1	7
100-yr	2	3	5	2	10
500-yr	2	3	5	2	10
Future conditions w/3.5 ft. SLR					
Recurrence Interval	**PG&E Ravenswood Substation inundation depth, ft.**	**Event duration, days**	**Drainage duration, days**	**Repair time, days**	**Total loss of service time, days**
10-yr	2	1	5	2	8
50-yr	2	2	5	2	9
100-yr	2	3	5	2	10
500-yr	2	3	5	2	10

Assumptions:

1. Inundation depths are just for PG&E substation, with approx. elevation of 9 ft. NAVD.
2. Event duration based on January 1983, when three successive days had high water marks approaching the 1% ACE SWL
3. Maximum inundation depth is set by external levee crest elevation's capacity to hold water, so 1% ACE and 0.2% ACE have same inundation depth
4. Future conditions with 3.5 ft. SLR assume no change to the levee elevations that detain water after the event.
5. Repair time changes from minor (1 days) to major (2 days) for inundation depth greater than 1.5 ft.

Finally, environmental benefits were also included in the BCA framework. Table 4 below shows, key inputs for the ecosystem services benefits estimates in the toolkit.

Table 4: Ecosystem Service Inputs

Input/Assumption	Value	Source
Project Area (Acres)	36.8	Estimated from project conceptual designs (SOW Attachment 4 – Menlo Park SAFER Bay_Site Plans and Sections) based on total length of ecotone levees and transition zone slope of 30:1, plus oyster shell habitat enhancement.
Wetland Area (Acres)	32	Estimated from project conceptual designs (SOW Attachment 4 – Menlo Park SAFER Bay_Site Plans and Sections) based on total length of ecotone levees and transition zone slope of 30:1.
Percent Wetland Area	87%	
Oyster Habitat (Acres)	4.8	Loss of habitat from construction of levee along Pond R3 is estimated at 1.6 acres (SOW Attachment 4 – Menlo Park SAFER Bay_Site Plans and Sections). Habitat restoration is estimated based on a standard 3:1 ratio.
Percent Oyster Shell Habitat (Marine & Estuary)	13%	