

Figure 3-1: Risk Matrix ⁽¹⁾

CONSEQUENCE OF FAILURE	Severe	10	20	30	40	50	60	70	80	90	100
		9	18	27	36	45	54	63	72	81	90
	Moderate	8	16	24	32	40	48	56	64	72	80
		7	14	21	28	35	42	49	56	63	70
		6	12	18	24	30	36	42	48	54	60
	Low	5	10	15	20	25	30	35	40	45	50
		4	8	12	16	20	24	28	32	36	40
		3	6	9	12	15	18	21	24	27	30
	Negligible	2	4	6	8	10	12	14	16	18	20
		1	2	3	4	5	6	7	8	9	10
		Negligible		Possible				Likely		Very Likely	
LIKELIHOOD OF FAILURE											

Notes:

(1) Based on guidance from an example risk matrix in NACWA, 2007 Implementing Asset Management: A Practical Guide (Exhibit 4.5).

4 References

National Association of Clean Water Agencies, Association of Metropolitan Water Agencies and Water Environment Federation

2007 Implementing Asset Management, A Practical Guide.

Table 2-1: Consequence Matrix

Category	Goal	Objective	Weight	Indicator	Consequence Score								
					2	3	Low = 4	5	6	Moderate = 7	8	9	Severe = 10
Environmental Responsibility – Potential for Large SSO (Figure A-5)	Protect public from pathogens and toxins	Minimize the potential for large spills	40%	Size of sewer	Less than 6-inch 6-inch, no pipes upstream 8-inch, no pipes upstream	6-inch, one to three pipe segments upstream 8-inch, one to three pipe segments upstream	6-inch, more than three pipe segments upstream	8-inch, more than three pipe segments upstream	6-inch, in hydraulic model 8-inch in hydraulic model 10"		12" to 14"	15" to 21"	24" and greater
Impacts to Community (Figure A-6)	Minimize nuisance impacts and impacts to customers	Minimize impacts to commuters and areas serving key customers or large number of people or providing critical services.	30%	Impacts to commuters based on type of road			Residential Roadway; and, No Commuter Impact	Impact to Primary Roadway (Collector Road)		Impact to Major Roadway			Freeway; Highway; Expressway; and, Railroad
				Impacts to land use areas.			Open Space; Park; and, Agricultural	Residential - Low to Medium Density	Recreational; Utility; Transportation; and, Residential–High Density	Commercial	Commercial-Heavy; Industrial; Manufacturing; and, Professional	Public, Institutional, and, Church	Water Supply; Hospital, Library; and, School
Environmental Responsibility – Distance to Surface Water (Figure A-7)	Meet environmental regulations; Protect the public from pathogens and toxins	Minimize spill volume to surface waters	30%	Spill travel distance to surface water		Greater than 1,500 feet		701 to 1,500 feet		301 to 700 feet	101 to 300 feet	26 to 100 feet	25 feet and less

Table 2-2: Likelihood Matrix

Likelihood Category	Weight	Source	Likelihood Score									
			Negligible = 1	Unlikely = 2	3	Possible = 4	5	6	Likely = 7	8	9	Very Likely = 10
Physical Condition (Figure A-1)	40%	CCTV Data – WVSD Coding	Max Str TV >= 1 to 2; Adj = 0	Max Str TV >= 5 to 10; Adj = 0 Max Str TV >= 1 to 2; Adj = 1	Max Str TV = 20; Adj = 0 Max Str TV >= 5 to 10; Adj = 1 Max Str TV >= 1 to 2; Adj = 2	Max Str TV = 25; Adj = 0 Max Str TV = 20; Adj = 1 Max Str TV >= 5 to 10; Adj = 2	Max Str TV = 30; Adj = 0 Max Str TV = 25; Adj = 1 Max Str TV = 20; Adj = 2	Max Str TV = 50; Adj = 0 Max Str TV = 30; Adj = 1 Max Str TV = 25; Adj = 2	Max Str TV >= 70 to 75; Adj = 0 Max Str TV = 50; Adj = 1 Max Str TV = 30; Adj = 2	Max Str TV >= 100 to 130; Adj = 0 Max Str TV >= 70 to 75; Adj = 1 Max Str TV = 50; Adj = 2	Max Str TV >= 100 to 130; Adj = 1 Max Str TV >= 70 to 75; Adj = 2	Max Str TV >200; Any Adj Value Max Str TV >= 100 to 130; Adj >= 2
		CCTV Data – PACP Coding	Max PACP Str = 1; Adj = 0	Max PACP Str = 2; Adj = 0 Max PACP Str = 1; Adj = 1	Max PACP Str = 1; Adj = 2 Max PACP Str = 2; Adj = 1	Max PACP Str = 3; Adj = 0 Max PACP Str = 2; Adj = 2	Max PACP Str = 3; Adj = 1	Max PACP Str = 3; Adj = 2	Max PACP Str = 4; Adj = 0	Max PACP Str = 4; Adj = 1	Max PACP Str = 5; Defects codes B, SRV family, DV, H, DH, DI; Adj = 0; Max PACP Str = 4; Adj = 2	Max PACP Str = 5 Defect codes BSV, BVV, CH family, D, FH family, HSV, HVV, SMW family, SRC family, X family; Any Adj Value Max PACP Str = 5; Defect codes B, SRV family, DV, H, DH, DI; Adj = 1;
		Pipe Age (pipes w/ no CCTV data)	8 years and less	9 to 17 years	18 to 26 years	27 to 35 years	36 to 43 years	44 to 52 years	53 to 61 years	62 to 70 years	71 to 79 years	80 years and greater
		Pipe Material (pipes w/ no CCTV data)										Unlined ACP; Unlined Terracotta Unlined, Pre-1950s VCP
Blockage Failure Likelihood (Figure A-2)	20%	SSO/ Stoppage/ Maintenance History	No history of maintenance issues	Normalized Clean Score >= 0 to 1	Normalized Clean Score >= 1 to 1.5	Normalized Clean Score >= 1.5 to 2	Normalized Clean Score >= 2 to 2.5	Normalized Clean Score >= 2.5 to 3	Normalized Clean Score >= 3 to 4	1 stoppage; Normalized Clean Score >= 4	1 SSO; 2 or more stoppages	2 or more SSOs
Capacity (Figure A-3)	40%	Capacity Model Results		Model indicates flow is below springline during 10-year storm or pipe not in model (small diameter).	Model indicates flow in pipe above springline during 10-year storm	Pipes likely to surcharge only under future conditions (both DWF and WWF) when loads become higher due to intensified land use or population increase.	Pipes likely to have surcharge, but <u>more than 5'</u> of freeboard ⁽¹⁾ available during 10-year storm	Pipes likely to have surcharge, but <u>more than 5'</u> of freeboard ⁽¹⁾ available during peak dry weather	Model indicates surcharge of <u>over 1'</u> and <u>less than 5'</u> of freeboard ⁽¹⁾ .in 10-year storm. Relief or replacement sewer required.	Model indicates surcharge with <u>1 to 5 feet</u> of freeboard ⁽¹⁾ .in peak dry weather. Sewer relief or replacement required.	Model indicates SSO under a 10-year storm	Model indicates SSO under peak dry weather

(1) Pipe segments that are lined after the last CCTV inspection are given a value of 1 for Physical Condition Likelihood of Failure.

(2) Freeboard = Difference between ground level and water level.