

A comparison of the safety barriers and devices (from Chapter 7) and the channel and drop structure improvements (from Chapter 8), and the improvements requested by the CCCFPD are provided in this chapter. Additionally, three other approaches to improving safety that are currently being implemented by the District are also evaluated to show how they compare to the potential improvements from Chapters 7 and 8. Hereafter, the safety barriers, safety devices, the channel and drop structure improvements, and other approaches are collectively called "safety improvements." This chapter includes the following sections:

- Comparison Criteria
- Comparison Matrix
- Ranking of Safety Improvements

10.1 COMPARISON CRITERIA

The comparison criteria are described below. A point range is given for each criterion. The maximum point values for the criteria, varies from 5 points to 20 points. Criterion with higher maximum point values are considered to be more important than criterion with lower maximum point values. For a given safety improvement, a point value of zero means that the improvement provides no significant change related to the criterion in question. Negative point values mean that the safety improvement would result in a worse condition. Positive point values mean that the safety improvement would result in an improved condition. Consequently, positive, high point scores are better than low or negative point scores.

- Relative Safety Enhancement (20 points) This criterion addresses the relative level of increased/decreased safety that would result from implementation of the safety improvement.
- Potential for Decreased Floodwater Conveyance or Increased Flooding (10 points) This criterion addresses the potential for the safety improvement to cause a decrease in the conveyance capacity of the channel or to result in increased water levels in the channel, which could in turn lead to flooding.
- Storm Period Operations and Maintenance (O&M) Requirements (5 points) This criterion addresses the need to perform O&M on the safety improvement during a storm event, when District staff may be very busy with other storm related activities.
- Routine O&M Requirement (5 points) This criterion addresses the need to perform routine O&M on the safety improvement during dry weather periods.
- Private Property and Housing Impacts (10 points) This criterion addresses encroachment into private property or the number of houses or condominiums that would have to be demolished to construct the safety improvement.
- Community Impacts (5 points) This criterion addresses the level of impacts to the community from construction of the safety improvement, including issues such as traffic impacts, noise, etc.



- Environmental Impacts (5 points) This criterion addresses the level of environmental impacts or benefits from the safety improvement, including issues such as providing improved fish passage (versus the existing drop structure which blocks fish), creation of new stream or riparian habitat, etc.
- Proven Technology (20 points) This criterion addresses whether the safety improvement has been used by other communities in conditions similar to the Walnut Creek Channel.
- Cost (25 points) This criterion addresses the cost of implementing/constructing the safety improvement.
- Useful to CCCFPD Rescuers (5 points) This criterion addresses whether the improvement would be useful to the CCCFPD for rescuing a victim from the channel system.
- Fatal Flaw (50 points) This criterion identifies fatal flaws that cause the improvement to be not implementable.

10.2 COMPARISON MATRIX

A comparison matrix of the safety improvements is presented in Table 10-1. For each safety improvement, a brief description is provided related to each criterion. Based on the discussion, a point score is assessed. The point scores are totaled at the right side of Table 10-1. Positive, high point scores are preferable to negative or low point scores. Improvements with scores less than zero should not be considered for implementation. Improvements with scores between 0 and 20 should be considered marginally feasible. Improvements with scores greater than 20 would provide a meaningful increase in safety and should be further evaluated for implementation.

10.3 RANKING OF SAFETY IMPROVEMENTS

Based on the total point scores from Table 10-1, the highest rated improvement are the CCCFPD Requested Facilities with a score of 34 points. With this score, the CCCFPD Requested Facilities should be further evaluated for implementation.

There are several improvements with scores near 10 points, and these improvements are only considered marginally feasible. The tension diagonal (11 points) is a proven technology for rescuing victims from supercritical flow channels, but is it difficult to implement with vertical walled channels and would put the rescuers at risk of being impacted by large debris if they enter the flowing water. It does not rely on a victim being able to self-rescue. The cost is relatively low compared to many of the other safety improvements.

A series of safety cables in the stilling well just downstream of Drop Structure 2 received 11 points. This safety improvement would still result in the victim going over the existing drop structure and would require the victim to self-rescue.



The Other Approaches that are currently in use have scores of 9 to 12 points. The goal of these approaches is to prevent a person from entering the channel at all. Consequently, they represent good approaches for reducing the likelihood of future drownings in the channel system. Also, the costs of these approaches are very low.

The remaining potential improvements have low or negative scores should not be considered feasible.

									Та	able 10-1.	Comparison Matri	x											
	Relative Safety Enhancement		Potential for Decreased	Floodwate	r Storm Period	Routine O&M Requiremen		Private Property and		Housing Community Impac		Environmental Impacts		Proven Technology		Capital Cost		Useful to CCFPD Rescuers		Fatal Flaw			
		Score (20		Score		Score		Score	impuok	Score		Score	Linnonnontari	Score		Score (20	Cupitar	Score		Score		Score	Total Score
Safety Item Safety Devices a	Discussion and Barriers	points)	Discussion	(10 points	s) Discussion	(5 points)	Discussion	(5 points)	Discussion	(10 points)	Discussion	(5 points)	Discussion	(5 points) Discussion	points)	Estimated Cost	t (25 points) Discussion	(5 points)	Discussion	(50 points)) (160 Points)
Escape Ladders	Provides very minimal increase in safety, but provides unauthorized channel entry	2	No Change	0	Would not require storm period O&M	0	Would require periodic inspections and repairs, would require minor clearing of debris	-1	No impacts	0	No impacts	0	No impacts	0	Minimal use in supercritical flow channels	-4	\$20,000	0	Rescuers would install their own ladders	0	None	0	-3
Safety Rack	Could provide some increase in safety, but could also be an attractive nuisance that could lead to injuries	0	Great risk of causing a hydraulic jump, which would result in increased flooding	-5	Could require some storm period O&M	-3	Would require periodic inspections and repairs, would require minor clearing of debris	-5	No impacts	0	Minor construction period impacts	-1	Visually obtrusive facility	-2	Not used in supercritical flow channels	-20	\$2.4 million	-3	Not useful during a rescue	0	Risk of hydraulic jump	-40	-79
Safety Net	Provides no increase in safety and could trap a victim in the net, could also be an attractive nuisance that could lead to injuries	-15	Risk of causing a hydraulic jump, which would result in increased flooding	-3	Could require some storm period O&M	-3	Would require periodic inspections and repairs, would require minor clearing of debris	-5	No impacts	0	Minor construction period impacts	-1	Visually obtrusive structure	-2	Not used in supercritical flow channels	-20	About \$1.6 million	-3	Not useful during a rescue	0	Great risk of causing a victim to drown	-50	-102
Safety Cables	Could provide some potential for self-rescue, but only downstream of Drop Structure 2	2	If used downstream of Drop Structure 2, it would not change floodwater conveyance or increase risk of flooding	0	Would not require storm period O&M	0	Would require periodic inspections and repairs, would require minor clearing of debris	-1	No impacts	0	No impacts	0	No impacts	0	Proven technology in subcritical flow channels like downstream of Drop Structure 2	10	\$8,000	0	Not useful during a rescue	0	None	0	11
Tension Diagonal	Would provide two locations where a victim could be rescued. Does not rely on self- rescue. Very difficult catch and retain a victim in the supercritical flow. Could put rescuers at risk if they enter the flowing water.	10	Would not change floodwater conveyance or increase risk of flooding	0	Would not require storm period O&M	0	Would require periodic inspections and repairs, would require minor clearing of debris	-1	Minimal impacts	-2	Minor construction period impacts	-1	No impacts	0	Successfully used in supercritical flow channels but difficult to implement on vertical walled channels	5	\$50,000	0	Not useful during a rescue	0	None	0	11
Thermal Imaging	Could detect a victim trapped in the channel and notify rescue personnel	10	Would not change floodwater conveyance or increase risk of flooding	0	Would not require storm period O&M	0	Would require periodic inspections and repairs	-1	No impacts	0	No impacts	0	No impacts	0	The technology may not work if victim has been in the water for several minutes.	-5	\$240,000	0	Not useful during a rescue	0	None	0	4
Channel and Dro	op Structure Improvements		1	• T	-+ 		·	•	*	-	•		•	· T	· · · · · · · · · · · · · · · · · · ·		•	*	· · · · ·		1	•	*
Baffle Chute Drop Structure	Eliminates the submerged hydraulic jump, but could cause victim to impact against baffles	-5	Not for upstream supercritical flow channels, could cause some water to jump out of channel.	-10	Would not require storm period O&M	0	Would require periodic inspections and significant clearing of debris	-3	Requires demolition of 11 houses and reconstruction of Bancroft Road Bridge	-3	Significant construction period impacts	-1	Could include fish passage improvements	2	Not for use with upstream supercritical flow channel	-20	\$8.3 million	-10	Not useful during a rescue	0	Not for upstream supercritical flow channels	-40	-90
Multiple Vertical Drop Structure	Would eliminate existing submerged hydraulic jump, but could result in another submerged hydraulic jump.	0	Great risk of causing a hydraulic jump, which would result in increased flooding	-10	Would not require storm period O&M	0	Would require periodic inspections and repairs, would require minor clearing of debris	-1	No impacts	0	Minor construction period impacts	-1	Could include fish passage improvements	2	Used in some supercritical flow channels	10	\$6.3 million	-8	Not useful during a rescue	0	Would cause water level to exceed channel top	-50	-58
Grouted Sloping Boulder Drop Structure	Would eliminate existing submerged hydraulic jump, but a nonsubmerged hydraulic jump would remain	5	Should not decrease floodwater conveyance or increase risk of flooding, but unanticipated problems could occur.	-3	Would not require storm period O&M	0	Would require periodic inspections and some clearing of debris	-2	No impacts	0	Minor construction period impacts	-1	Ideal for improving fish passage	3	Not a proven technology for supercritical flow channels	-10	\$3.8 million	-4	Not useful during a rescue	0	Not a proven technology for supercritical flow channels	-30	-42
Stream Channel Restoration Project	Would eliminate existing submerged hydraulic jump, but would result in many trees and bushes in which a victim could be trapped and drown	0	Would not decrease floodwater conveyance or increase risk of flooding	0	Would not require storm period O&M	0	Would require periodic inspections, significant clearing of debris, and major vegetation maintenance efforts	-5	Requires demolition of about 700 houses/condomini ums and 24 buildings. Major transportation impacts.	-10	Major construction period impacts	-5	Would generate significant stream and riparian habitat and would improve fish passage	5	Stream restoration of channels has been used in many urban environments, but infrequently with channels the size of Walnut Creek	5	\$1.2 billion	-25	Not useful during a rescue	0	Extreme impacts to the community (residential and business) and disruption of transportation system streets and bridges)	-40	-75
CCFPD Rescuer Requested Facilities																							
CCFPD Rescuer Requested Facilities	Increases the ability of CCFPD rescuers to save a victim trapped in the channel.	10	Would not change floodwater conveyance or increase risk of flooding	0	Would not require storm period O&M	0	Would require periodic inspections and maintenance of improvements	-1	No Impacts	0	No impacts	0	No impacts	0	and high point attachments are all items that have been used by rescuers in other locations	20	\$38,000	0	Very useful during a rescue	5	None	0	34
Other Approache	es																						-
Public Awareness and Outreach	Helps prevent people from entering the channel and precludes the need to rescue a victim from the channel	5	Would not change floodwater conveyance or increase risk of flooding	0	Would not require storm period O&M	0	Would require ongoing public outreach and education program	-2	No Impacts	0	Educate community about creeks and channels	1	No impacts	0	People may still enter the channels	5	\$50,000	0	Not useful during a rescue	0	None	0	9
Fence Inspections and Repairs	Helps prevent people from entering the channel and precludes the need to rescue a victim from the channel	3	Would not change floodwater conveyance or increase risk of flooding	0	Would not require storm period O&M	0	Would require periodic inspections and repair efforts	-1	No Impacts	0	No impacts	0	No impacts	0	Highly effective where installed, but fencing is not installed upstream of the concrete channels	10	\$20,000	0	Not useful during a rescue	0	None	0	12
Additional Signage	Helps prevent people from entering the channel and precludes the need to rescue a victim from the channel	5	Would not change floodwater conveyance or increase risk of flooding	0	Would not require storm period O&M	0	Would require very infrequent sign replacement	0	No Impacts	0	No impacts	0	No impacts	0	People may still enter the channels	5	\$20,000	0	Not useful during a rescue	0	None	0	10

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