

Northwest Hydraulics Consultants Analysis/Recommendations for Correction of Duncan Creek Fish Blocking Culvert

There are two culvert replacement options. The completion of county storm water projects in Manchester are essential in order to reduce the volume of storm water currently entering Duncan Creek. Neighboring properties that abut Duncan Creek will continue to flood and may flood worse unless the current volume and flow of storm water entering and exiting Duncan Creek are reduced and stabilized. Reduction flow and volume of water exiting Duncan Creek to the sound must be resolved prior to removal and replacement of the current fish blocking culvert. The Duncan Creek Concept Plan produced the North West Hydraulic Consultants (NWC) was commissioned by Kitsap County in 2017 at a cost of approximately \$70,000. The study conducted was comprehensive and included measurement of and location of existing sources of storm water throughout the Manchester Watershed and drainage basin. Stream modeling was conducted and a 39 page study was produced by NWC. This study quantified and qualifies how much and how the current volume of storm water entering Duncan Creek can be better managed and thus reduced. The full study is posted at the end of this introduction to the Duncan Creek Culvert Replacement Plan.

The Kitsap County Commissioner selected the 'best' options from this study that they felt were both cost effective and would facilitate the underlying project of replacing the fish blocking culvert on Duncan Creek.

Selection and Analysis of a Preferred Alternative.

On May 4, 2017, NHC and Kitsap County storm water program staff met to discuss project alternatives discussed above. Based on considerations of cost, permitting feasibility, neighborhood acceptance, and compatibility with installation of a fish passable culvert under Colchester Drive, alternatives that incorporate high flow bypasses directly from Duncan Creek were excluded from further consideration. Additionally, construction of detention storage behind the Colchester Drive was

also determined to have low compatibility with fish passage and high impact on property owners. This left storm water bypasses, enhancement of detention storage at the Alaska Avenue Pond, and conveyance improvement in the flood-prone reach for further consideration. Among the storm water bypass alternatives, the Alaska Avenue Pond overflow bypass was considered least feasible due to the need to acquire easements and build a pipe to connect pond overflows with storm drain conveyance along Puget Drive. General channel widening coupled with habitat enhancement along the entire length of the channel downstream of Colchester Drive was discarded as an option because it would require removal of mature trees and hard landscape improvements, and would not be acceptable to the property owner. However, some measure of improvements to this reach remain an option, but would need to be implemented by the property owner, likely in collaboration with the Kitsap Conservation District. Possible measures include targeted conveyance improvement and low flood walls to reduce the frequency of flooding under existing conditions. Kitsap County would not undertake such a project since both sides of the creek are privately owned. However, these improvements can be suggested to the owner along with any appropriate assistance programs.

The County Ranked the Options as follows.

County Commissioner Ranking of Proposed Storm Water Control Options

Table 3: Effect of preferred concepts combined with culvert replacement on peak flow quantiles downstream of Colchester Dr

Avg. Annual Recurrence (yrs)	Peak Quantile Existing (cfs)	Peak Quantile all projects including Colchester Culver replacement (cfs)	Increase over existing
2	22.2	11.4	-48.6%
5	34.0	19.7	-42.1%
10	43.0	27.3	-36.5%
25	56.0	40.1	-28.4%
50	66.8	52.3	-21.7%
100	78.6	67.4	-14.2%

Table 1: Ranking of storm water control concept alternatives

		Enhance Stream quality/stability	Relieve Flooding	Compatibility with Fish Passage	Feasibility (permitting & cost)	Impact to property owners	Total Score	Preferred by County
4.1.1	Creek Bypass to new Hemlock Outfall	2	2	1	1	1	7	No
4.1.2	Creek Bypass to new/old Spruce Outfall	2	2	1	1	1	7	No
4.2.1	Storm bypass – Alaska Ave. Improvement Project	2	2	3	3	2	12	Yes

Avg. Annual Recurrence (yrs)	Peak Quantile Existing (cfs)	Peak Quantile Stream Simulation		Increase over existing
			(cfs)	
2	22.2		22.2	0.0%
5	34.0		34.4	1.2%
10	43.0		44.2	2.8%
25	56.0		58.6	4.6%
50	66.8		70.8	6.0%
100	78.6		84.5	7.5%

4.2.2	Storm bypass-Puget Dr. and Colchester Dr.	2	2	3	3	2	12	Yes
4.2.3	Storm bypass- Hemlock St	2	2	3	3	2	12	Yes
4.2.3	Storm bypass-Puget Dr. and Colchester Dr.	2	2	3	3	2	12	Yes
4.2.4.	Storm Bypass- Alaska Ave Regional Detention overflow	2	2	3	2	1	10	No
4.3.1.	Expand Detention- Alaska Ave Regional Pond Retrofit	3	3	3	2	3	14	Yes
4.3.2	Expand Detention- Colchester Drive Rd fill	2	3	1	2	1	9	No
4.3.1	Bioretention swale for Hemlock Street flow	2	2	3	3	2	12	Yes
4.4.1.	Stream Conveyance-enlarge entire stream channel	2	2	3	1	1	9	Yes ¹
4.4.2	Stream Conveyance-relieve choke points, flood proof.	2	1	3	3	2	12	Yes ¹

¹This would not be a County project as both sides of the creek are privately owned.

NHC Recommendations:

Working with the County staff, NHC identified a series of preferred basin-wide projects involving increased regional detention capacity at the Alaska Avenue Facility, diversion of stormwater runoff from several basin areas to the Manchester Stormwater Park or nearby marine outfalls, and bioretention of runoff with the project footprint. Modeling demonstrates that the cumulative hydrological impact of these preferred projects in combination with removal of the rock weir in the flood-prone channel and installation of a stream simulation culvert would reduce the frequency of incipient flooding from less than 1 occurrence in 2 years on average to approximately 1 occurrence in 25 yrs.

Based on this study of Duncan Creek basin, NHC recommends the following:

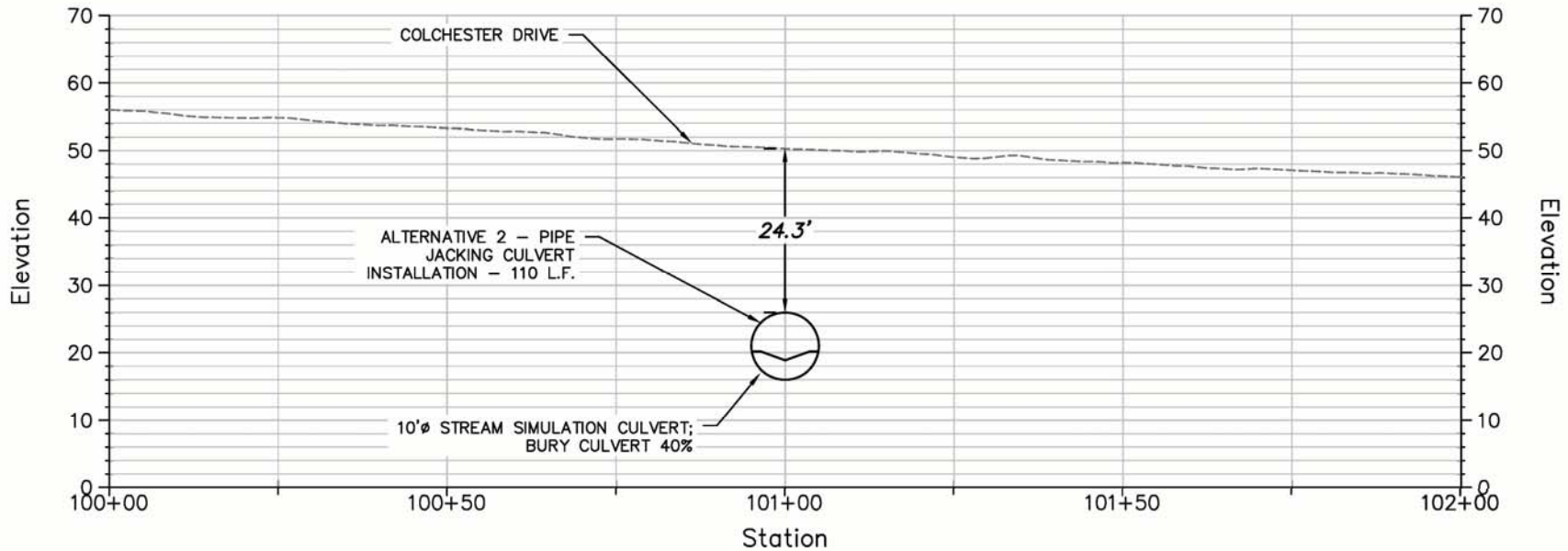
1. Encourage the property owners experiencing flooding, located downstream of Colchester Drive, to remove the hydraulic constriction caused by the rock weir in the vicinity of the downstream footbridge and do some targeted flood proofing.
2. Replace the Colchester Drive culvert with a 10-ft. diameter stream simulation culvert in conjunction with the implementation of one or more of the preferred projects that reduce peak flow in the cree

Duncan Creek Culvert Installation Options

Preferred Option No. 1

Pipe Jacking

This method would require pushing a 10' - 12' diameter culvert pipe directly through the Colchester Drive road bed. The pipe would need to be pushed approximately 110 lineal feet. There is possibility that obstructions might be encountered that would make pushing the pipe through impossible. There could be large boulders, stumps, or other material used as fill when Colchester Drive was constructed.



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DUNCAN CREEK ALTERNATIVES

PROPOSED CULVERT - JACKING ALTERNATIVE
SECTION VIEW

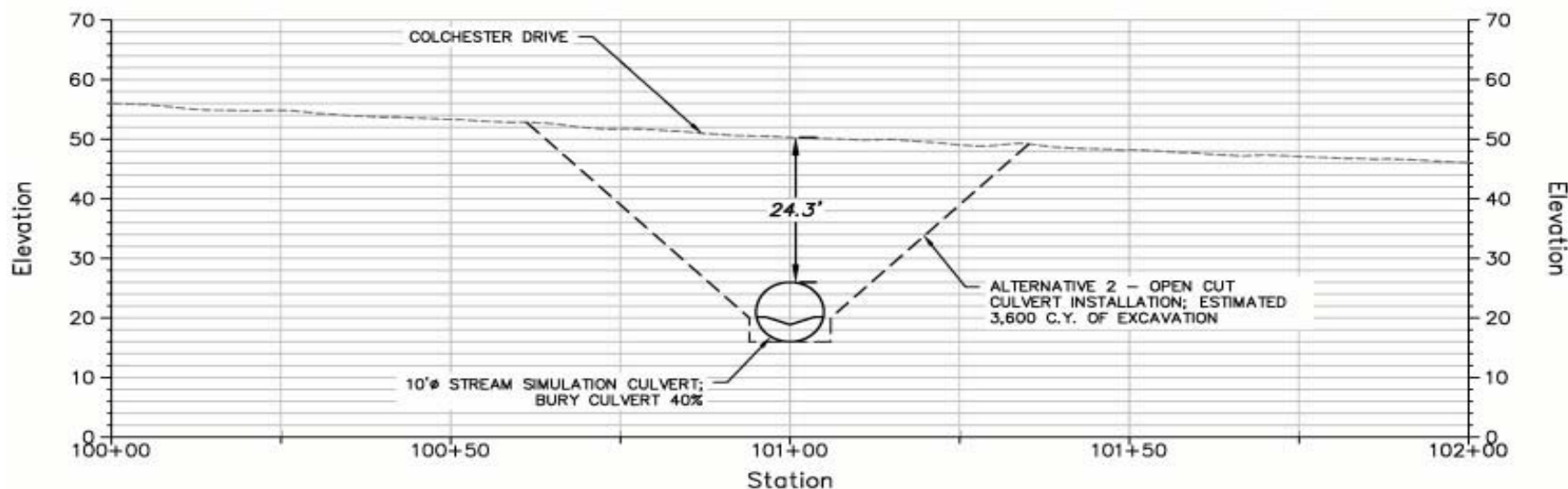
FIGURE A3

Duncan Creek Culvert Installation Options

Culvert Replacement Option No. 2

Open Cut

This method would require cutting a 24 foot wedge down through Colchester Drive to the level of the current streambed. This method would involve excavating approximately 3,600 cubic yards of material. Doing the "cut an fill" method would necessitate closing Colchester Drive between the North end of Puget Drive to Hemlock Street. The cost could be considerably more than Pipe Jacking (option No. 1).



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DUNCAN CREEK ALTERNATIVES

PROPOSED CULVERT - OPEN CUT ALTERNATIVE
SECTION VIEW

FIGURE A2

Duncan Creek Culvert Replacement Proposed Plan & Profile

