

Thayer Creek Fish Passage Assessment

2/19/2013

Prepared For: King County

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1.0 INTRODUCTION

On November 25 2013, Wild Fish Conservancy (WFC) entered into a contract with King County to provide technical assistance on behalf of the Snoqualmie Forum in their effort to assess fish passage and identify culvert replacement opportunities which would increase access to available habitat for native fish species in the Thayer Creek Watershed. To assess current conditions in Thayer Creek Wild Fish Conservancy was asked to complete the following Tasks:

Task 1 - Collect data and photos necessary to complete a Level A barrier evaluation assessment using the protocol described in the Washington Department of Fish and Wildlife's (WDFW) *Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual* (December 2009; hereinafter "WDFW Manual") on the Thayer Creek trail culvert and NE 143rd Place culvert in Duvall, WA. Conduct a visual inspection of the SR203 crossing.

Task 2 - To the extent possible given site conditions, collect data necessary to complete a Level B barrier evaluation using the protocol described in the *WDFW Manual* on the Thayer Creek trail culvert and NE 143rd Pl culvert, Duvall, WA.

Task 3 – Walk the Thayer Creek channel from the SR203 culvert upstream to the first full man-made barrier (at a minimum) and collect qualitative information necessary to determine the benefit to fish of correcting the two barriers assessed under Task 1. Watershed information to be collected during Task 3 includes: estimated length of potential fish-bearing habitat, basin area, stream flow (if perennial or intermittent at the time of the survey), known upstream barriers, range of gradient upstream, predominant land use, estimated overhead, and instream cover.

Task 4 – Summarize the data

2.0 METHOD OVERVIEW

Task 1 – Level A Barrier Assessment and Evaluation

The Thayer Creek trail culvert and NE 143rd Place culvert were evaluated using the general protocol provided in the *WDFW Manual*. Culvert field measurements included structure type, culvert length (measured with a tape or auto level); culvert slope (measured with an autolevel); culvert span (measured with stadia); culvert 20% countersunk (yes or no); gradient downstream and upstream (measured with an autolevel or hand level); stream bankfull widths (measured with a stadia outside the influence of the culvert); outfall drop; (perch height measured with a stadia); and plunge pool characteristics (measured with a stadia). The location of the culvert or structure was documented with a DeLorme PN40 Global Positioning System unit. The presence or absence of substrate within the culvert, debris blocking the culvert, and other maintenance issues were noted and upstream- and downstream-facing photographs of each culvert surveyed were taken. In addition to the WDFW Level A fish passage assessment conducted at the Thayer Creek trail and NE 143rd Place culverts, the SR 203 culvert was also visually inspected and photographed.

Wild Fish Conservancy determined the barrier status of each culvert surveyed (i.e. "barrier", "partial barrier" or "non-barrier") using the WDFW assessment protocol. When culverts could not unequivocally be designated as "barrier" or "non-barrier" using the WDFW Level A or Level B protocol, barrier status

was recorded as “unknown” as directed by WDFW protocol. These culverts must be reassessed by WDFW technical staff for a final barrier status determination. Barrier status on the SR203 culvert could not be designated as a “barrier” or “non-barrier” using the WDFW Level A or Level B protocol. An “unknown” barrier status was also assigned to culverts which were examined but not formally assessed or which could not be surveyed due to conditions at the site.

Task 2 – Level B Culvert Assessments

A Level B culvert assessment was not needed to determine barrier status of the NE 143rd Place culvert. The Thayer Creek trail culvert was evaluated using the Level B protocol described in the *WDFW Manual*. Once data was collected, a Level B analysis was performed utilizing the LvlBEng.xls spreadsheet obtained from the WDFW.

Task 3 – Stream Classification and Qualitative Habitat Assessment

Wild Fish Conservancy reviewed the *Stream Habitat Assessment for the City of Duvall, Washington Existing Conditions Report* (Herrera Consulting, 2006) and conducted a qualitative instream habitat reconnaissance from mitigation pond #2 upstream to NE 140th St. (a.k.a. Old Big Rock Road) to characterize salmonid habitat conditions in Thayer Creek and confirm accuracy of the existing stream classification and stream length. Surveys generally followed the state-sanctioned water typing protocols described in WAC 222-016-031 and Section 13 of the Forest Practices Board Manual, with the following modifications:

- 1) Surveys were conducted outside the water typing window which extends from March 1 – July 15.
- 2) Qualitative habitat information describing predominant land use and estimated overhead and instream cover was included in the survey.
- 3) Basin area for culvert assessments was determined using Stream Stats at <http://water.usgs.gov/osw/streamstats/>. This data has been placed in Appendix B of this document.

Data Point and Photo Documentation Methods

Channel habitat, unique channel features, channel barriers, culvert structures, and wildlife were photographed to help document existing channel conditions and channel use. A global position system (GPS) point obtained with a DeLorme PN40 Global Positioning System was collected at each photo point to tie current channel and culvert conditions into specific stream locations. These photographs and an accompanying map which incorporates Wild Fish Conservancy and WDFW culvert passability status evaluations have been included in an Appendix A to this report to provide a visual illustration of the Thayer watershed from the Thayer Creek trail culvert to its headwaters.

Existing Data

Prior to conducting the fish passage barrier assessment, the following sources were contacted or referenced for existing data on fish passage in the watershed and to determine known and assumed fish presence: Wild Fish Conservancy Fish Passage Database; Herrera Consulting’s *Stream Habitat Assessment for the City of Duvall, Washington Existing Conditions Report*, 2006; Department of Ecology *Lakes of Washington*, 1973; WDFW SalmonScape website <http://wdfw.wa.gov/mapping/salmonscape/>; Washington Department of Fisheries *A Catalog of Washington Stream and Salmon Utilization*, 1975 (hereinafter, referred to as WDFW Stream Catalog); and Washington Department of Natural Resources (WDNR) Forest Practice Application Review System (FPARS) maps.

Task 4 – Report

Agreement deliverables for this project include a written report of the activities performed under the agreement, including maps of streams visited and fish presence findings or lack of findings. This report is being submitted as a deliverable and should be considered the final report. Although Wild Fish Conservancy has conducted a thorough survey of Thayer Creek as described in the Tasks listed above,

there may be culverts, sections of Thayer Creek, or potential tributary channels in the Thayer Creek watershed, that may have been missed, or intentionally not surveyed according to WDFW protocol, due to scope of work or lack of access. As these culverts and streams are classified and as new streams are identified this report will need to be updated to remain useful.

3.0 Results

Culvert Assessments

Between 2003 and 2013 four separate fish passage barrier assessments have been conducted on culverts in Thayer Creek watershed using the protocols found in the *WDFW Manual*.

Fish passage barrier/impediment results from the WDFW 2003 and 2010 surveys, and the current WFC 2013 Thayer Creek surveys have been incorporated into Map 1.

In total, 20 anthropogenic structures were identified.

- (a) the bridge crossing the access road downstream of the Snoqualmie Trail (Map 1, Photo Pt **A**)
- (b) the Thayer Creek/trail culvert crossing (Photo Pt **B**)
- (c) the bridge crossing the access road crossing upstream of the Thayer/ trail crossing (Photo Pt **C**)
- (d) SR203 crossing (Photo Pt **D**)
- (e) NE 143rd Place crossing (Photo Pt **E**)
- (f) outlet of pond #1 (Photo Pt **F**)
- (g) outlet to pond #2 (Photo Pt **G**)
- (h) Big Rock Road crossing (Photo Pt **I**)
- (i) Outlet to pond #3 (Photo Pt **L**)
- (j) Old Big Rock Road crossing (**Q**)
- (k) drainage culvert located at the sewage plant (**R**)
- (l) drainage culvert crossing SR203 at the sewage plant (**S**)
- (m) Five ditchline culverts (no photos) and a driveway culvert which collect flows on the north side of NE 143rd Place (**T**)
- (n) SR 203 crossing of Cleo Clemons Creek (**V**)
- (o) the bridge crossing the Snoqualmie trail south of the Cleo Clemons Creek and north of Thayer (**X**)

Passage status and data for each individually assessed culvert and/or fish passage impediment identified by WFC is presented along with its corresponding photo point in Appendix A. Of the eighteen anthropogenic sites identified, two were formally assessed during the culvert surveys conducted by WFC in December 2013 (Photo Points B and E). Thirteen structures were viewed and/or photographed (Photo Points A, C, D, E, I, L, Q, R, T, and X), but not formally assessed. Lack of access prevented WFC from viewing the outlets of mitigation pond #1 and pond #2, Photo Points F and G. Consequently, photos from the 2010 WDFW survey have been incorporated into this report to describe these sites. The locations for three pipes which drain the ditch paralleling NE 143rd Place between Photo Point E and T and two additional pipes adjacent and east of Photo Point T were documented but were not photographed or assessed. These unsurveyed pipes are documented as barriers on SalmonScape. WFC was unable to establish a direct connection between the two pipes east of Photo Point T and Thayer Creek during the original survey; however, data obtained from WDFW indicate that these culverts are within the fish-bearing water of Thayer Creek.. These two pipes may warrant further investigation in future surveys.

Fish Passage Impediments were identified by WFC at the following three locations along mainstem Thayer Creek (Appendix A, Map 1):

1. The THAY-04 culvert at the SR203 crossing (Photo Point D) does not meet the WDFW span/channel width recommendation of 0.75 indicating that the culvert may be undersized. Passability through the culvert is further compromised by a lack of internal roughness, and a culvert slope likely greater than 1.0% created by a separation in the culvert sections. According to WDFW protocol a structure with an internal slope break must be classified as an “unknown” passage barrier and further assessed by WDFW. WFC conferred with WDFW (who had assessed this culvert in 2003) about this culvert; WDFW personnel stated that the internal slope break indicates that the culvert is failing and compromising the road prism. Although a passability status at this point is incompatible with the fish passage assessment method, both WFC and WDFW staff agree that the culvert should be replaced as it more than likely exceeds the WDFW hydraulic standards for fish passage, and most definitely is failing.
2. The THAY-05 culvert at the NE 143rd Place road crossing (Photo Point E) has no internal roughness and is set at a slope >1% (1.86%) exceeding WDFW hydraulic standards and creating a partial barrier.
3. The ~30ft long by 1.0ft diameter concrete culvert at the outlet of pond #3 (Photo Point L), is blocked by cement debris, has no internal roughness, and appears to be set at a slope ~4.0%. The pond dam appears to be partially composed of cement rip rap which blocks access to the culvert. Water appears to seep through the pond dam and flows through the cement debris approximately 6.0ft north of the pond outlet culvert. Although a trickle of water seeps under the existing culvert structure, internally the culvert is completely dry. Because the culvert could not be accessed, WFC has assigned an “unknown” passability to the culvert; nevertheless, the culvert should be replaced as it is currently nonfunctional. This culvert was identified as a barrier by WDFW in 2010.

Stream Classification and Qualitative Habitat Assessment

Wild Fish Conservancy reviewed the following sources for information on assumed and documented fish presence and stream classification of Thayer Creek: (1) Washington Department of Fisheries *A Catalog of Washington Stream and Salmon Utilization*, 1973; (2) Wild Fish Conservancy stream data (3) *Stream Habitat Assessment for the City of Duvall, Washington - Existing Conditions Report*, Herrera Consulting, 2006; (4) *Lakes of Washington*, Department of Ecology, 1973 and (5) WDFW SalmonScape website.

Mainstem Thayer Creek is currently classified as F (fish-bearing) or Type 3 from its mouth upstream to SR203 and N (non-fish-bearing) from SR203 to a short distance upstream of NE 143rd Place on existing WDNR FPARS maps. This report confirms that downstream of SR203, the channel is correctly classified but mapped incorrectly, and upstream of SR203, both incorrectly classified and mapped.

WFC observed the mainstem channel downstream of SR203 at Photo Points A, B, C, and D (Map 1) on 12/04/2013 and on 12/19/2013. Three distinct habitat unit types (glide, riffle, and pool) were observed. From approximately 100ft downstream of the access road bridge (where the WFC survey began) upstream to the Thayer Creek and Snoqualmie Trail culvert outlet (Map 1, Photo Point B), Thayer Creek has a 2% gradient and average bankfull width of 10ft. Substrate is dominated by fines in this reach where a deep glide extends nearly the entire distance from the start of the survey upstream to the trail culvert outlet. The ~70ft long by 3.0ft diameter culvert crossing under the Snoqualmie Trail (Photo Point B) is backwatered by the glide and passable to fish. Immediately upstream of the Snoqualmie Trail crossing the mainstem channel narrows as it turns south and parallels the Snoqualmie trail for a short distance prior

to heading east, but maintains a low gradient and bankfull width greater than 2.0 ft. WFC crews netted coho salmon fry from the Snoqualmie culvert inlet (Photo Point B) confirming fish presence in this reach of the channel.

The second upper access road bridge (Photo Point C) crosses the channel approximately 300ft upstream of Snoqualmie Trail. WFC observed approximately 30ft of channel downstream of the bridge and ~75ft of channel upstream of the bridge. Although habitat is dominated by riffle, small scour pools and potential spawning gravels are also present. Average gradient in this reach was 3.0%. Average bankfull widths ranged from 5.0ft to 8.0ft. Instream wood is scarce.

Wild Fish Conservancy crews did not observe the channel from approximately 75ft upstream of the upper access bridge (Photo Point C) upstream SR203 culvert outlet. However, the Herrera (2006) report describes this reach as follows:

“The best spawning habitat in Thayer Creek is located in segment 3 that extends 1,295 feet from the access road culvert to the culvert underneath Highway 203. The lower 210 feet of this segment (reaches 27-34) between the access road culvert and the confluence of tributary 1 consists of low gradient riffles, run, and dammed pools...The mainstem channel upstream of the tributary 1 confluence has a higher gradient and consists of low gradient riffle, high gradient riffle, cascade, run, and dammed pool habitat. The remaining portion of this segment up to Highway 203 (reaches 45-50) has a lower gradient and the channel is clogged with Himalayan blackberry and reed canarygrass. In segment 3 the average wetted width ranges from 2.4 to 8.0 feet, the average wetted depth ranges from 0.4 to 1.3 feet, and the maximum pool depth ranges from 1.0 to 1.6 feet”.

The SR 203 culvert has an internal slope break, has no internal roughness, and is failing. Consequently, this culvert has been identified as a barrier by the WDFW. The channel and banks extending from the SR203 culvert inlet to the NE 143rd Place culvert outlet appear to have been artificially altered. Although the gradient upstream of the SR203 culvert is low ~5.0%, it quickly increases to 8.5% prior to reaching the NE 143rd Place culvert outlet (Photo Point E). The average bankfull width between the two culverts varies from 3.5 to 3.9ft. Habitat is dominated by riffles and step pools. Substrate is composed predominately of clay. Land use is dominated by open pasture. Instream and riparian cover are sparse.

The 60 long NE 143rd Place culvert is a partial fish passage barrier with an estimated 67% passability status due to lack of internal roughness and a slope greater than 1.0%. WFC crews were unable to secure access beyond the road right-of-way upstream of the culvert inlet; however, with an average bankfull width of 5.2ft and gradient of 5.0% within the right-of-way, the channel meets the physical criteria necessary to be classified as F or potential fish-bearing waters. Data collected during the Herrera (2006) survey documented a stream width ranging from 4.0 to 8.0 feet, and indirectly documents (through habitat type classifications) a gradient lower than 16% which extends from the NE 143rd Place culvert upstream to the pond #1 (first mitigation pond; Photo Point F , Map 1). The Herrera report further indicated that the 14” pipe draining Pond #1 was undersized and a barrier to fish passage. More recent 2010 WDFW survey data indicates that the berm at the pond exit has been breached allowing fish passage (Photo Point F). Both WDFW and Herrera confirm that the berm at the downstream end of pond #2 has also been breached allowing passage between mitigation pond #1 and mitigation pond #2.

On 2/5/2014, WFC crews surveyed the channel from the upstream end of Pond #2 to the headwaters of Thayer Creek (Map 1). Pond #2 is approximately 85ft long by 50ft wide. The channel is narrow as it enters the mitigation pond but within 30ft braids and broadens to 16.4ft as it flows through a small wetland downstream of NE Big Rock Road (Photo Point H). Habitat through this reach is dominated by riffle pool sequences; stream gradient is ~3.0%. Instream wood is present, but sparse. The riparian

corridor on the left bank has been cut with exception of a narrow 10ft strip of alders. Although native trees and shrubs have been planted during mitigation efforts for safeaway, these trees are still young and provide minimal canopy cover. The right bank is dominated by reed canarygrass and young deciduous shrubs Canopy cover provides approximately 20 to 30% cover. Development encompasses the land use beyond the riparian corridor on the left bank, whereas land use on the right bank is predominantly timber.

The NE Big Rock Road culvert has internal substrate and appears to be passable. The channel extending from the NE Big Rock Road upstream to the third mitigation pond, Photo Points I, J, K, and L, (Appendix A, Map 1) is dominated by riffle habitat. Pools are lacking, consisting of about 5% of the habitat. Instream wood is sparse and with exception to one decaying log nearly 30 inches in diameter is very small (<4.0" DBH). Although some instream cover is provided by overhanging grasses, overall, instream cover is minimal. Stream gradient varies between 2.0 and 4.0%. Substrate is dominated by silt (95%) with a few cobbles present near the NE big rock road crossing. Average bankfull width range from 2.4ft to 9.8ft; the riparian corridor, is composed primarily of big leaf maple, alder, and western red cedar in low to moderate abundance. The understory is composed of Himalayan blackberries (which are beginning to form dense thickets in some areas), salmonberry, and ferns. Overall, the riparian corridor is moderately intact providing 20-40% canopy cover during the winter months. Canopy cover during the summer months likely increases considerably downstream of Pond #3 as more than half the riparian corridor is dominated by deciduous species. Land use on the left bank beyond the riparian corridor is characterized by development. Land use on the right bank is characterized by timber intermixed with open space.

A small trickle of water passes under the 12" diameter concrete culvert draining the third mitigation pond. The majority of the flow seeps through the berm approximately 6.0ft east of the culvert. WFC biologists were unable fully access the culvert due to large concrete slabs which have been placed in front of the culvert; however, WDFW identified the culvert as a complete barrier to fish passage during their 2010 culvert assessment. Pond #3 is <0.5 acres in size and appears to be less than 10.0ft in depth.

A small tributary enters mainstem Thayer approximately 50ft upstream of pond #3 (Photo Point N, Map 1). The tributary is spring fed and extends approximately 120ft to the northeast. This tributary meets the physical criteria to be classified as Type 3 or F, potential fish-bearing habitat. An additional spring upwelling (Photo Point O) feeds into mainstem Thayer Creek upstream of pond#3. Although the channel narrows slightly for a short distance upstream of the upwelling it maintains an average bankfull width greater than 2.0ft; gradient remains low, ~3%. The channel splits and becomes less defined approximately ~130 ft downstream of NE 140th St., a.k.a. Old Big Rock Road (Appendix A , Photo Point P) as it meanders through a shallow forested wetland at the headwaters of the channel. The wetland is approximate 75ft wide and fed by several seeps and at least one spring on its east side. The wetland is moderately shaded by a mixed deciduous / conifer forest and by reed canarygrass. A piezometer has been placed at the downstream end of the wetland. A 30ft long by 0.5ft precast concrete culvert crossing NE 140th Street (Photo Point Q) acts as an equalizer for the forested wetland which extends beyond NE 140th Street and continues on the south side of the road. WFC did not have access to the property south of NE 140th Street and ended our survey at the road crossing. Data from WDFW confirms this culvert is the end of Type F waters (Appendix C).

Mainstem Thayer Creek Channel Summary

Downstream of SR203, Thayer Creek provides rearing and spawning habitat and potentially some overwintering habitat in deeper glides and pools. The reach extending from NE 143rd Place upstream to the NE Big Rock Road may provide some spawning habitat and resting pools, and provides overwintering rearing habitat in the mitigation ponds. The channel upstream of NE Big Rock Road lacks resting pools and is inadequate for spawning salmonids due lack of gravels. If access were available,

pond #3 could provide additional over winter rearing habitat. Although the pond is shallow, temperature in this pond is likely modulated by cool waters from headwater springs upstream and canopy cover provided by the riparian corridor. Thus, this pond may provide some late spring or summer rearing habitat also.

Tributaries Channels

A small right bank tributary formed by road drainage (pers. comm., Duvall Public Works, 2013) enters Thayer Creek *via* the culvert system extending from Photo Point R to Photo Point S (Appendix A, Map 1). All but a small section of the channel is piped through the culvert which outlets at Photo Point R. Although a formal assessment of the culvert system has not been conducted, the culvert at Photo Point R has a perch >5.0ft and is clearly a barrier culvert. Replacement of this culvert is not recommended as the cost:benefit ratio is high and would not result in a significant reach of habitat gain. Additionally, although the very short section of channel viewed meets the physical requirements to be classified as a Type F channel at the time of the survey, WFC did not find a perennial water source upstream and the channel as described by Duvall Public Works is likely seasonal.

A second right bank tributary enters Thayer Creek at NE 143rd Street culvert outlet Photo Point E (Appendix A, Map 1) *via* the ditch on the north side of NE 143rd Street. The Type F (potential fish-bearing habitat) on this channel extends upstream to the inlet of the culvert. Grass along the ditch provides some cover to the channel. WFC did not survey the three ditchline culverts between Photo Point E and west of Photo Point T; however, WDFW classified these culverts as full barriers during their 2010 survey. Information on these three culverts is available upon request from WDFW. WFC surveyed the tributary channel upstream to the driveway culvert outlet at Photo Point T, but lost the channel upstream of this point. At the time, WFC crews assumed the driveway culvert outflow originated from drainage tiles placed in the parcel to the north of the driveway. The bankfull width of the channel downstream of the driveway culvert was altered when it was ditched, but is currently ~3.0ft in width. The driveway culvert was not formally surveyed by WFC, but was designated as a full barrier by WDFW in 2010. WFC was unable to establish a direct connection between these two pipes and Thayer Creek during the original survey. However data obtained from WDFW indicate that these culverts are within the fish-bearing water of Thayer Creek.. These two pipes may warrant further investigation in future surveys.

The following are the field notes for the fish-bearing portion of the tributary channel east of the driveway culvert Photo Point T as described by WDFW in 2010 and e-mailed to WFC on 2/18/2014.

474	Outlet of PVC culvert under driveway.
481.9	US end of site 931493, barrier . Canopy increases.
490.3	Outlet for PCC culvert under county road.
507.2	Junction box.
510.9	Inlet for culvert site 931494, barrier. Reach Break.
Reach 3	
518	Begin sample.
530	Thick algae in channel. Fenced horse pasture on RB. Continues to flow in roadside ditch.
570	Increase in grass in channel. Channel begins to shallow.
624.7	Outlet of PCC culvert. Inlet of culvert is NFB road ditch. End of fish use.

Based on the notes provided by WDFW, WFC has extended the Type F length on this channel east to the 272nd PL NE road ditch and will resurvey this section of the channel in the future.

A third channel enters Thayer Creek on the right bank downstream of the Big Rock Road culvert outlet (Photo Point E, Map 1). This channel was intermittent dry when visited by WFC and is believed to contain seasonal storm drainage only. This channel was not investigated further for this report.

As previously mentioned in this report, a right bank tributary channel enters Thayer at Photo Point N (Appendix A, Map 1). This channel originates from a spring approximately 120ft upstream (Photo Point T, Map 1). The channel has a bankfull width of 2.9ft and 3% gradient meeting the physical criteria to be classified as F or Type 3 potential fish-bearing waters.

While investigating the potential habitat upstream of the Snoqualmie Trail culvert (Photo Point B, Map 1), WFC discovered that deposition downstream of the SR203 Cleo Clemons Creek culvert outlet has forced most of Cleo Clemons Creek to drain southwest to Thayer Creek. WFC observed Cleo Clemons at Photo Points V, W, and X (Map 1), but did not walk or map this portion of Cleo Clemons channel as access was not secured at the time of the survey and because plans are being made to redirect Cleo Clemons into its natural channel. Photos taken at Photo Points V, W, and X are presented in Appendix A.

4.0 Recommendations

Stream Classifications

- WFC recommends that the channel upstream of SR203 currently classified on WDNR maps as N (non-fish-bearing) be reclassified as F (fish-bearing) waters upstream to Old Big Rock Road. While WFC's survey was not conducted during the normal water typing window extending from March to July 15, documentation of this channel during WDFW habitat surveys on 6/16/2010 confirms this channel had perennial flow during the normal water typing window (Appendix C)
- The unclassified right bank tributary channel extending from Photo Point R to S (Map 1), should be examined during low flows to determine if there is a potential perennial source that has been overlooked. If so, the channel should be classified as F (potential fish-bearing) habitat. If not, the channel should be classified as Ns (non-fish-bearing-seasonal) habitat.
- The unclassified right bank tributary channel extending from Photo Point N on NE 143rd Place to the 143rd Place and 272nd Place NE road intersection should be classified as F (potential fish-bearing) habitat. While WFC's survey was not conducted during the normal water typing window (March to July 15), WFC's survey confirms this channel originates from headwater springs; documentation of this channel during WDFW habitat surveys conducted on 6/16/2010 (Appendix C) confirm this channel had flow during the normal water typing window.
- The unclassified right bank channel located on the north side and paralleling NE Big Rock Road could not be unequivocally classified during the surveys for this report. This channel should be examined during the water typing window to confirm a Ns non-fish-bearing seasonal classification.
- The unclassified channel located ~50ft upstream of pond #3 and extending from Photo Points N to U should be classified as F, potential fish-bearing waters.

Culvert Recommendations

- The Thayer Creek/Snoqualmie Trail culvert is fish passable. WFC does not recommend that this culvert be replaced for fish passage; however, King County should consider replacing this culvert in the future to improve flow equalization and to improve large woody debris passage.
- The SR203 culvert and NE143rd Place culverts should be replaced with larger box culverts. Box culverts are recommended because they can be set with no cover and because utilities can be passed through the culvert reducing cost. WFC recommends a 500ft longitudinal and cross section profile should be conducted upstream and downstream of each of these culverts to appropriately size the replacement culverts. The following data should be collected:
 1. Culvert diameter, type of culvert, and width of wing walls and/or apron if present
 2. Culvert invert elevation at inlet and outlet
 3. Road centerline profile (at least 50 feet each above and below stream crossing)
 4. Edge of road pavement/gravel on each side of road
 5. One cross section of creek at each end (upstream and downstream) across face of culvert and parallel to road edge
 6. One cross section of creek ~5 feet upstream and downstream of each end of culvert and parallel to road edge
 7. At least 2-3 additional cross sections at 10-20 ft intervals above and below each end of culvert, spaced so as to capture variation in existing channel geometry
 8. Long profile of thalweg at least 500 feet upstream and downstream of road crossing; further if there is significant variation in streambed profile or if down-cutting or adjustments in channel bed elevation are expected following culvert replacement
 9. Survey location of any large trees (≥ 8 " DBH) within close proximity of culvert crossing
 10. Survey location of any buried or above-ground telephone or fiber optic lines, electrical transmission lines, utility poles, water supply pipelines, other cables, sewer lines, etc., or markers that are evident within the project area
 11. If there is a scour pool at upstream or downstream end then additional shots of the top of bank and toe of bank may be needed to estimate cut and fill volumes for new culvert or bridge replacement above and below existing road
 12. Cross section and elevation of roadside drainage ditch if present
 13. Location and diameter or cross sectional geometry of other side channels, tributaries, ditches or drainage pipes within project vicinity
 14. Estimate of bankfull width downstream (must be beyond hydraulic influence of existing culvert); note that bankfull width can vary substantially in some streams so it is good to measure multiple locations
 15. Pebble count above and below culvert for sizing of imported spawning gravel: see MacDonald et. al. Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska, Section 5.6, pp. 118-130.
 16. Note any large logs (LWD) present upstream or immediately downstream of culvert

Replacement of these culverts is likely expensive. The City of Duvall should initiate help from WDFW to complete these surveys if landowner access is not granted. These surveys should include visiting the outlets to ponds #2 and #3 to confirm passability at these locations is still adequate. The City of Duvall should consider partnering or subcontracting WFC engineers if assistance is needed completing these surveys. Invasive blackberries downstream of SR203 should be removed and replaced with native species.

- The culvert exiting pond #3 should be replaced with a fish ladder or weirs which would maintain the current dam elevation. Invasive blackberries from NE Big Rock Road upstream to the headwaters should be removed and replaced with native species.

Habitat Gain

Replacement of the SR203 culvert would result in the following potential fish habitat gain:

Mainstem Thayer Creek – 2110ft

Right bank Tributary beginning at Photo Point E – 2049ft

Right bank Tributary beginning at Photo Point N – 120

Total habitat gain = 4279 ft. (+/-5%).