Assessment of Potential Barriers to Fish Passage in North Clackamas Watershed Council Area Streams

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Contents

Executive Summary

The assessment of potential barriers to fish passage in North Clackamas area streams identified stream crossings that either complete, partial, or non-barriers to passage of migratory fish. Several of these stream crossings are not currently identified on the ODFW Statewide Barrier database (see Table 1 below). It is clear from the assessment that many crossings partially or completely limit passage to migratory fish seeking to access spawning and rearing habitat upstream. Complete barriers are present on Dean, Phillips, Boardman, River Forest, and Rinearson creeks. The partial barriers on Mt. Scott Creek likely restrict passage at high stream flows as the crossings are undersized leading to high velocity flow through the crossing.

Priorities indicated are based on the length of stream and quality of habitat upstream of a particular crossing. Water quality in streams where passage barriers are known is a significant factor in determining priorities for future replacement.

Table 1. *Stream crossings included in the assessment. Status of fish passage and priority indicated. Crossings that are not currently on the ODFW barrier database are indicated by an "X".*

SITE #	CROOSING NAME	PASSAGE STATUS	PRIORITY	LATITUDE	LONGITUDE	ADD TO ODFW DATABASE
1	Kellogg Creek @ Kuehn Rd	Partial passage	Low	45.42393197	-122.613827	
2	Kellogg Creek @Rock Weir Upstream Kuehn	Partial passage	Low	45.423989	-122.613686	X
3	Mt Scott Creek @ Highway 224	Passable	Low	45.4282586	-122.6028226	
4	Mt Scott Creek @ Rusk Road	Passable	Low	45.42919908	-122.6012649	
5	Mt Scott Creek @ Lake Rd	Passable	Low	45.429975	-122.600106	
6	Mt Scott Creek @ 3 Creeks Downstream R/R	Passable	Low	45.431368	-122.596961	X
7	Mt Scott Creek @ 3 Creeks - Concrete Weir	Partial passage	Medium	45.43149188	-122.5966438	X
8	Mt Scott Creek @ 3 Creeks Water Control Structure	Passable	Medium	45.43055322	-122.5927678	X
9	Mt Scott Creek @ 3 Creeks Upstream RR	Passable	Low	45.42693603	-122.5805598	X
10	Mt. Scott Creek @ SE 84th Ave	Partial passage	Medium	45.42710943	-122.5731016	X
11	Mt Scott Creek @ R/R near SE 82nd Ave	Partial passage	Low	45.42617043	-122.5773592	X
12	Mt Scott Creek @ Interstate 205	Passable	Low	45.42791742	-122.5665922	
13	Mt Scott Creek @ Upstream I205 Boulders	Partial passage	Low	45.42811263	-122.5655638	X
14	Mt Scott Creek @ Upstream I205 Step	Partial passage	Low	45.42831672	-122.565395	X
15	Mt Scott Creek @ SE 129th	Passable	low	45.442683	-122.531824	X
16	Mt Scott Creek @ US of SE 129th	Passable	Low	45.442601	-122.531457	
17	Dean Creek @ Confluence w/Mt Scott	Partial passage	High	45.426748	-122.580614	X
18	Dean Creek @ Sunrise Multi-Use Path	Passable	Low	45.422128	-122.570624	
19	Phillips Creek @ SE 82nd Ave.	Partial passage	Medium	45.427847	-122.578532	
20	Phillips Creek @ SE 84th Ave.	Partial passage	Medium	45.428148	-122.57693	X
21	Phillips Creek @ Costco Access Rd	Passable	Low	45.428952	-122.576779	X
22	Phillips Creek @ Sunnybrook Blvd.	Non passable	Low	45.429951	-122.576742	
23	Phillips Creek @ Sunnyside Blvd.	Non passable	Low	45.43304	-122.577611	
24	River Forest Creek @ SE River Forest Dr	Non-passable	High	45.41574773	-122.6543307	X
25	Rinearson Creek @ Bedrock Cascade	Non-passable	Low	45.37939188	-122.6108539	X
26	Rinearson Creek @ Rock Weir	Non-passable	Low	45.37943335	-122.6112707	X
27	Boardman Creek @ Willamette Confluence	Partial passage	Low	45.395123	-122.628151	X

Background

Decades of development in watersheds contained within the North Clackamas Watershed Council's (NCWC) area of interest has led to a significant number of roads, rail lines, and other urban infrastructure that can impact area streams by impeding upstream migration of fish. The Kellogg-Mt. Scott Creek (KMS) watershed is crossed by three different highways (Hwy 99E, Hwy 224, I-205) as well as several other main arterials that carry a substantial amount of traffic across these streams daily. Streams such as Minthorn Creek and Phillips Creek have multiple stream crossings that include very long culverts that carry stream flows under parking lots or highways.

What is a barrier? "A barrier is anything that prevents or reduces the ability of aquatic species to move where needed to survive and complete their life cycle. This includes physical barriers, such as dams, culverts, and levees, and environmental barriers such as excess sediment, poor water quality, and temperature or flow variations." (USFWS, 2023). The focus of the assessment was to identify potential physical barriers to fish passage that can be prioritized for improvements and repaired. Removal of many of these barriers will be leveraged by the the future removal of the most significant barrier in the watershed, Kellogg Dam.

Dams, culverts, bridges, and other physical structures in streams can impede upstream and downstream passage of fish through creation of elevation differences that are too great for fish to jump, water velocities that are too high for fish to swim, or flow depths that are too low for fish to effectively use their primary mode of propulsion, their caudal (tail) fin. In most instances where physical structures impede flow through narrowing of the natural, active channel, upstream passage may be impeded due to flow velocities that are too high. Physical structures that do not contain natural streambeds throughout their length are often barriers due to higher water velocities and lack of resting spots for fish migrating through longer structures.

There are several species of migratory fish that might occupy habitat in the North Clackamas watersheds including coho salmon, fall Chinook and chum salmon (both currently extirpated), winter steelhead, cutthroat trout, and Pacific lamprey. Adult and juvenile migratory fish require upstream and downstream access to critical habitats in order to maintain productivity and diversity of the population found in the region.

Methodology

We assessed barriers (see Figure 1) that are known to exist (noted in Oregon Fish Passage Barrier Database) but that have not been assessed for their extent in blocking passage (juvenile/adults, full/partial, seasonal, species specific, etc.) in North Clackamas Watershed Council (NCWC) area streams. In addition, several known barriers are not listed on the Oregon Fish Passage Barrier Database were also assessed.

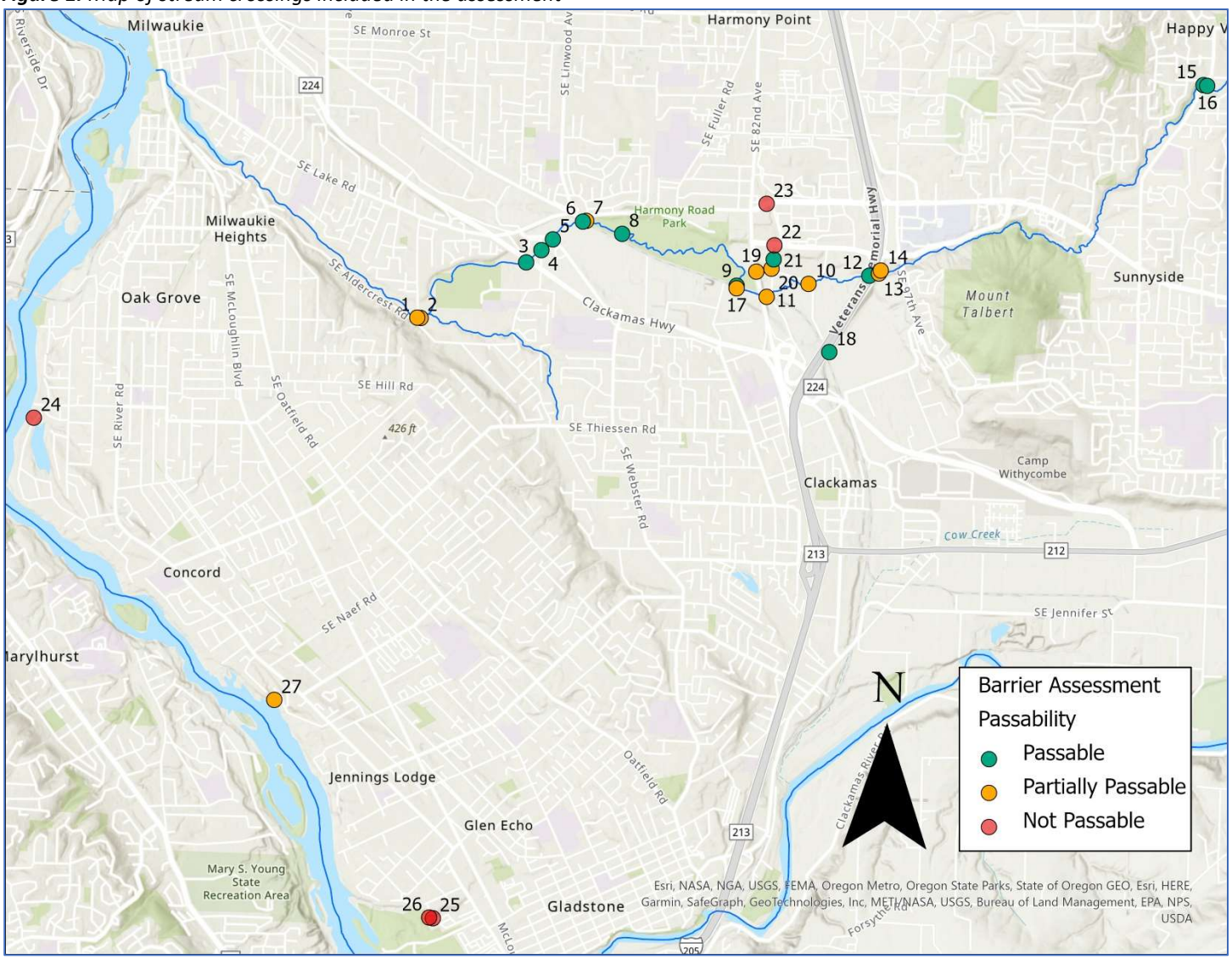
Assessment Methodology:

1. Assembly of existing information (ODFW, Clackamas County DTD, City of Milwaukie, City of Happy Valley, Clackamas Water Environment Services, ODOT)
2. Protocol based on the Washington Dept. of Fish & Wildlife's Fish Passage Barrier & Surface Water Diversion Screening Assessment & Prioritization Manual (WDFW, 2009) Level A Assessment. The purpose of the Level A culvert assessment is to collect basic information about culverts in potentially fish bearing waters (e.g., structural dimensions), and to make a barrier determination on culverts that are obviously barriers or the most obvious non-barriers. Most culverts can be classified as barriers or non-barriers using just the Level A culvert assessment.
3. It generally takes about 20 minutes to complete the Level A data collection in the field. Site-specific factors that may increase the time needed for a Level A assessment include high traffic volume, deep road fill, multiple non-

overflow culverts at a single water crossing, long culverts, dense vegetation, and other conditions that require moving the elevation surveying equipment or limit accessibility to the structure.

4. Modifications to this protocol based on site constraints will be created and refined in consultation with Oregon Dept. of Fish & Wildlife.
5. This methodology mirrors the successful fish barrier assessment process used recently by Johnson Creek Watershed Council (JCWC) recently, on watersheds just to the north and with similar watershed issues. The Council and JCWC operate in neighboring jurisdictions for road crossings, water control structures, etc.

Figure 1. *Map of stream crossings included in the assessment*



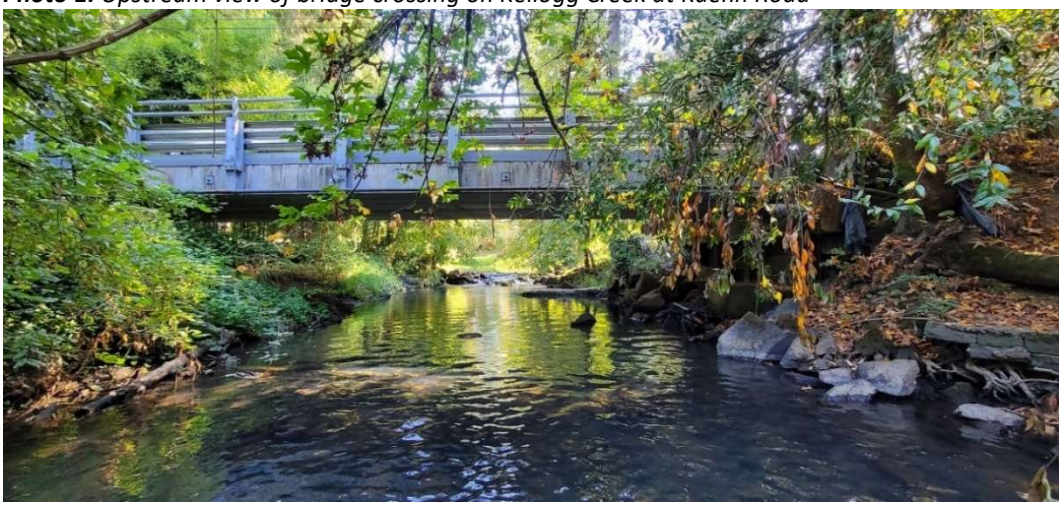
Stream Crossings Assessed

Kellogg Creek at Kuehn Road

Kuehn Road Bridge
[Location: 45.423952, -122.613997; Documented in ODFW barrier database]
Owner: Clackamas County

The Kuehn Road crossing of Kellogg Creek is a bridge that fully spans the bed and banks of Kellogg Creek. The bridge abutment on the left bank (to the right on the photo) is at the channel margin and could be at risk of being undermined due to the channel thalweg being present along the toe of the abutment. Angular rock is protecting the abutment but can be seen downstream in the middle of the channel indicating movement at some flows. The Kuehn Road Bridge is documented on the ODFW Statewide Barrier Database, but it does not describe it as a barrier to any fish life stage or species. All life stages of native migratory fish can pass upstream and downstream at all fish passage flows[1].

Photo 1. *Upstream view of bridge crossing on Kellogg Creek at Kuehn Road*



Rock Weir Upstream of Kuehn Road
[Location: 45.423989, -122.613686; Not documented in ODFW barrier database]
Owner: Clackamas County

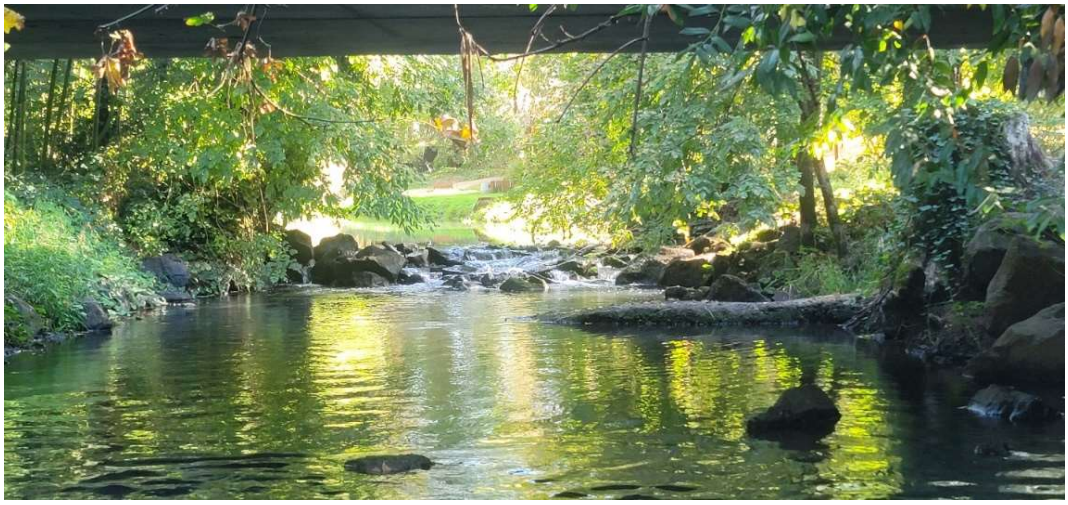
The rock weir located upstream of Kuehn Road is a structural component of a pipeline crossing beneath Kellogg Creek. The rock weir protects the pipeline from being damaged by or undermined by natural stream processes. The rocks used for pipeline protection are 2-3' diameter angular basalt.

It is likely that all life stages of native migratory fish can pass upstream past this weir but there may be times when upstream passage is limited by exceptionally low flows. Adult coho migrating upstream in fall months may be challenged to pass this structure at low flows due to lack of jump pool and flat angular rock that limits their ability to successfully swim over the rock structure. The weir is not documented on the ODFW barrier database.

[1] High Fish Passage Flow: 10% exceedance flow during migration period: species specific. Approximate by Q10% = 0.18*(Q2)+36 where Q2>44 cfs. where Q2<44 cfs use Q2; Low Fish Passage Flow: 2-yr, 7-day low flow or 95% exceedance flow for migration period: species specific

Structural improvements could be made to the rock weir which would facilitate passage at low flows. These include creation of a jump pool downstream of the weir which would allow adult migratory fish to gain the speed they need to make jumps over structures such as the rock weir. In combination with creation of a jump pool, a low flow channel could be developed to confine flows to a single channel that would be deeper and allow adults to utilize their caudal fins to swim over structures.

Photo 2. *Rock weir upstream of Kuehn Road*



Mt. Scott Creek at Highway 224

[Location: 45.4282586, -122.6028226; Documented on ODFW barrier database]
Owner: Oregon Department of Transportation

The Highway 224 crossing of Mt. Scott Creek is a bridge structure that fully spans the active channel of Mt. Scott Creek. Natural streambed substrate is present throughout the length of the crossing and there are no structure bridge component impeding flow.

All life stages of native migratory fish would not be impeded as they migrate upstream or downstream past this structure.

Photo 3. *Upstream view of the Highway 224 crossing of Mt. Scott Creek. Bridge fully spans natural stream channel below.*

Mt. Scott Creek at SE Rusk Road

[Location: 45.42919908, -122.6012649; Documented in ODFW barrier database]
Owner: Clackamas County

The Rusk Road crossing of Mt. Scott Creek is a bridge structure that is narrower than the natural active stream channel. Abutments on both sides of the stream channel are in direct contact with water at low flows. There does not appear to be any erosion or undermining of the abutments but there is minor damage to wingwalls on the downstream end of the left bank abutment.

Despite stream flows being slightly impeded by abutments on both side of the stream there does not appear to be any passage limitation due to the presence of natural streambed material and relative short length of the crossing over the stream.

Photo 4. *Rusk Road bridge crossing of Mt. Scott Creek. View looking upstream at full spanning bridge. Bridge abutments slightly impede flows as they are near the active channel width. Coarse bed material is present through the structure.*

Mt. Scott Creek @ SE Lake Road

[Location: 45.429975, -122.600106; Documented in ODFW barrier database]
Owner: Clackamas County

The SE Lake Road crossing of Mt. Scott Creek is a bridge structure that does not fully span the creek channel and does impede stream flow as evidenced by deposition and scour patterns upstream and downstream of the structure. The low head height of the bridge can create challenges for larger trees or debris from passing through and providing for instream habitat structure, if they are mechanically removed by local road departments.

There does not appear to be any significant impediment to upstream passage of fish but the structure should be monitored to assess annual deposition wood and sediment that mat be impacting the crossing by reducing cross sectional area beneath the structure. If wood is present in the channel that is impacting the crossing all efforts should be made to maintain the wood in the channel downstream of the structure.

Photo 5. *View looking upstream at the SE Lake Road crossing of Mt. Scott Creek. Bridge abutments are within active channel, but they appear to have limited potential to impact upstream migration.*

Mt. Scott Creek @ 3-Creeks Natural Area

Railroad Bridge Crossing at Downstream End of 3-Creeks Natural Area
[Location: 45.431368, -122.596961; Not documented in ODFW barrier database]
Owner: Union Pacific

A railroad bridge crossing at the downstream end of the 3-Creeks Natural Area partially impedes flow due to bridge abutments being narrower than the stream channel is wide. It is not likely that fish passage is restricted at this time, but it is located within 200 feet of the next obstruction upstream, a failing concrete weir.

*Photo not available.

Concrete Water Control Structure at Downstream End of 3-Creeks Natural Area
[Location: 45.43149188, -122.5966438; Not documented on ODFW barrier database]
Owner: Clackamas County

A failing concrete water control structure (weir) located near the downstream end of the 3-Creeks Natural Area impedes flow and natural movement of streambed material in Mt. Scott Creek. Ownership or original intent of the weir is not known at this time. The weir combined with a railroad crossing less than 100 feet downstream may create a flow dependent barrier to upstream passage of adult and juvenile fish. The railroad crossing is narrower than the stream is wide at this location and the weir creates an unnatural jump and potential velocity barrier due to partial failure of the weir on the left bank.

Photo 6. *View looking upstream at concrete water control structure.*

Photo 7. *Water control structure. Notice damage to structure at far bank. The left bank is eroding at an unnatural rate because of the failing structure. It is not clear the purpose of the structure or who built it.*

Dam/Water Control Structure at 3-Creeks Natural Area
[Location: 45.43055322, -122.5927678; Not documented in ODFW barrier database]
Owner: Clackamas Water Environment Services

A concrete dam/water control structure is present within the 3-Creeks Natural Area which is used to control flooding downstream in the City of Milwaukee and surrounding area. The structure consists of a constant flow bypass (Photo 8) and three gates (Photo 9) that are operated to control the amount of flow allowed to bypass the structure. A pool downstream of the structure controls the water level and to some extent flows through the culvert but it is unclear whether the velocity of water through the stucture is too high when flows in Mt. Scott are also high and the culvert is at capacity.

The flow control gates are operated during flood events to control the amount of flows and corresponding flooding in lower reaches of Mt. Scott Creek downstream of 3-Creeks. Further analysis is necessary to determine if either the gates or bypass pipe create any impediment to upstream passage. It does not appear that downstream passage is impacted by the dam or control gates as is the case with other dam structures.

Photo 8. *Concrete culvert bypass at 3-Creeks*

Photo 9. *Three control structure gates at 3-Creeks*

R/R crossing at Upstream End of3-Creeks Natural Area
[Location: 45.42693603, -122.5805598; Not documented in ODFW barrier database]
Owner: Union Pacific

A railroad crossing at the upstream end of the 3-Creeks Natural Area is a low height crossing that likely impedes natural movement of woody material in the stream. Wood removal is evident in the area as is typically the case with crossings that have limited height to allow movement of materials that might be coming downstream. There does not appear to be any passage limitation, but excessive loading of material could create higher velocity flow through this narrow crossing.

Photo 10. *Railroad crossing at upstream end of 3-Creeks Natural Area*

Mt. Scott Creek at SE 84th

[Location: 45.42710943, -122.5731016; Not documented in ODFW barrier database]
Owner: Clackamas County

The SE 84th Avenue crossing of Mt. Scott Creek is a three-barrel culvert that conveys flows beneath SE 84th Avenue. The combined culvert widths are less than the active channel width of the stream and two of the culverts are partially filled with streambed sediments reducing cross sectional area. Filling of the culverts with streambed material reduces their cross-sectional area and forces most of the stream flow through one of the three culverts. High stream flows typical of fall and winter migration periods may partially restrict passage of adult spawners and rearing juvenile fish.

Photo 11. *SE 84th Avenue crossing of Mt. Scott Creek (between Costco and OSP Crime Lab)*

Mt. Scott Creek at I-205

[Location: 45.42791742, -122.5665922; Documented in ODFW barrier database]
Owner: Oregon Department of Transportation

The I-205 crossing of Mt. Scott Creek is a 408-foot-long x 15-foot-wide round culvert that conveys water beneath I-205. The original construction of the I-205 culvert did not include baffles which resulted in a culvert with flows that likely

exceeded the abilities of most migratory fish. The long length of the culvert combined with lack of resting spots for upstream migrating fish created a barrier that few fish were effectively able to pass. Baffles (Photo 13) were installed in the culvert in 2003 that slowed flows through the culvert and created pools that allow fish to rest and jump over the 6" height differential between weirs. It does not appear that fish passage is restricted through this crossing due to installation and effective operation of the weirs.

Photo 12. *Upstream view of the Mt. Scott Creek crossing beneath I-205.*

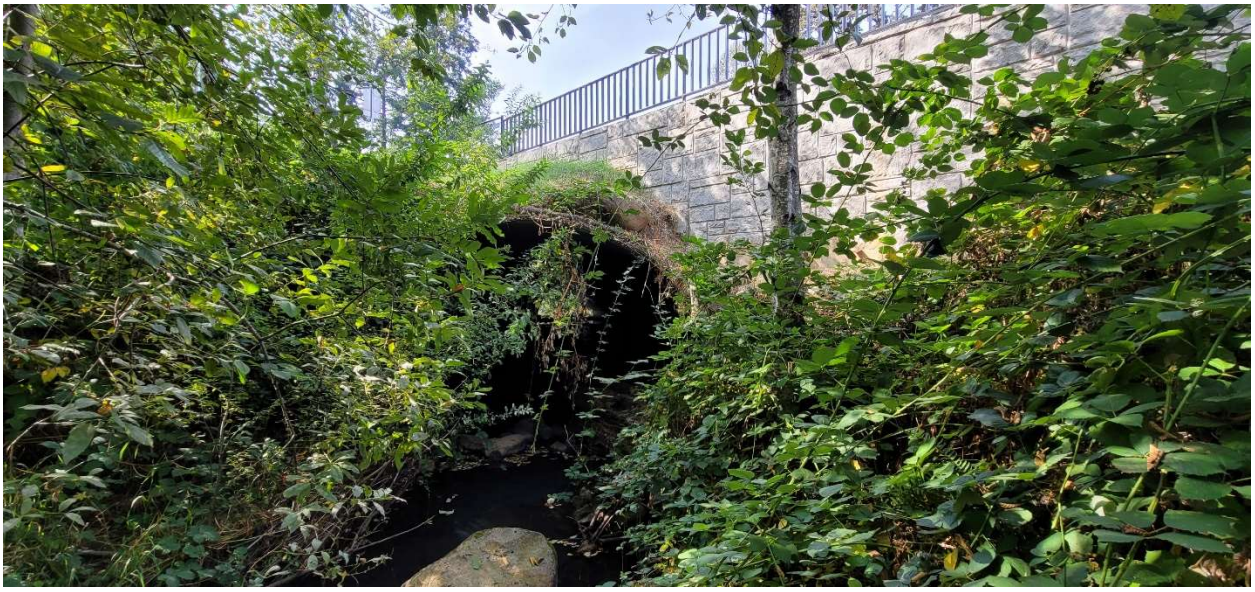


Photo 13. *I-205 culvert showing baffles installed to improve upstream passage (upstream view)*

Photo 14. *View downstream into the I-205 crossing of Mt. Scott Creek.*

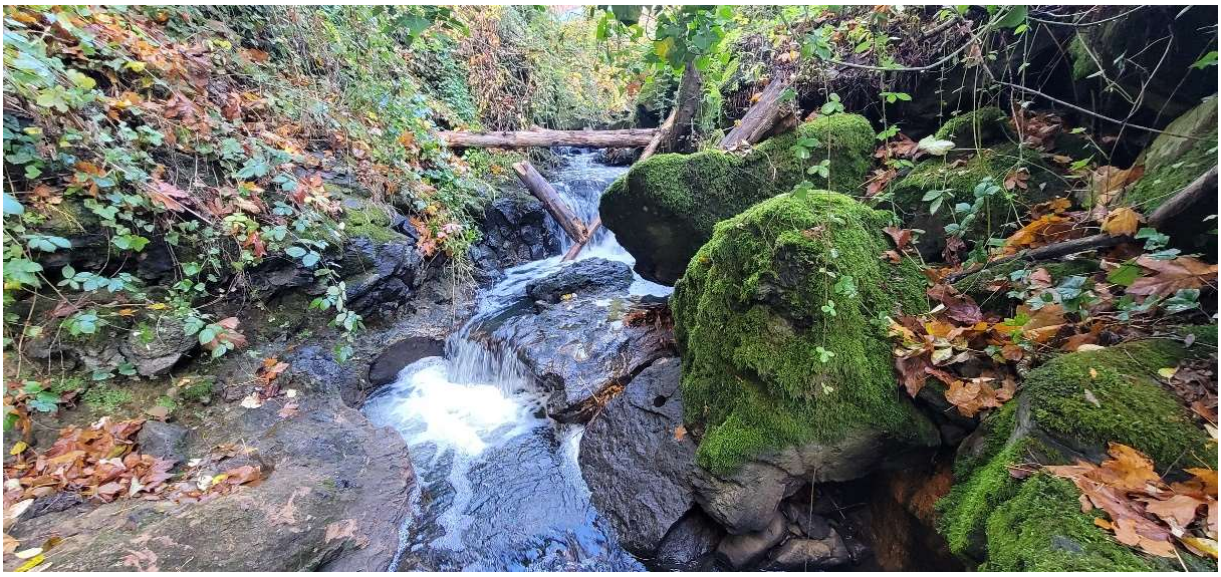
Mt. Scott Creek @ Boulder Cascade/Bedrock Drop Upstream of I-205

[Location: 45.42811263, -122.5655638; Not documented in ODFW barrier database]
Owner: Oregon Department of Transportation

A boulder cascade and bedrock drop directly upstream of the I-205 culvert and beneath the Sunnybrook Blvd connector fly-over bridge creates a partial barrier to upstream passage due to multiple elevation drops over angular rock. The boulder cascade combined with bedrock drop directly upstream create a partial barrier to upstream passage. It is likely a flow dependent barrier that restricts upstream passage at high and low stream flows.

Photo 15. *Upstream view of boulder cascade directly upstream of I-205 culvert.*

Photo 16. *Upstream view of bedrock drop directly upstream of I-205 culvert.*



Mt. Scott Creek @ SE 129th Ave.

[Location: 45.442683, -122.531824; Not documented in ODFW barrier database]
Owner: Clackamas County

The 129th Avenue crossing of Mt. Scott Creek is an arched culvert that spans the active channel of the stream in this area. The culvert takes a 30° turn in the middle in an apparent effort to maintain sinuosity through the structure. A large diameter tree is situated in the upstream end of the culvert which restricts flow and forces stream energy to the left bank through the structure. There does not appear to be any restriction to upstream or downstream passage through this crossing.

Photo 17. *Upstream view of the SE 129th Ave. culvert on Mt. Scott Creek*

Mt. Scott Creek Upstream of SE 129th Ave.

[Location: 45.442601, -122.531457; Documented in ODFW barrier database]
Owner: Clackamas County

The crossing of Mt. Scott Creek directly upstream of SE 129th Ave. is a small, single lane bridge that provides emergency access to the neighborhood off SE Snowfire Ct. The bridge abutments are near the active channel, but they do not impede flows or create unnatural erosion near the crossing. Bedrock is evident in the stream under and upstream of the crossing, but it does not appear to be associated with the bridge or abutments. The crossing is near the upstream end of anadromous fish use in Mt. Scott Creek and does not impede passage.

Photo 18. *Upstream view of bridge crossing directly upstream of SE 129th Ave. on Mt. Scott Creek.*

Phillips Creek @ SE 82nd Ave.

[Location: 45.427847, -122.578532; Not documented in ODFW barrier database]
Owner: Clackamas County

The Phillips Creek crossing under SE 82nd Ave. consists of two 4-sided concrete box culverts. The culvert to the right in the photo is constricted due to sediment build-up that reduces cross sectional area ~50%. This causes most of the flow in Phillips Creek to be conveyed through the culvert to the left. Fish passage may be restricted at higher stream flows due to most flows being conveyed through one culvert, leading to higher velocity flow that may restrict certain life stages or species of fish (i.e., juvenile salmonids, adult chum salmon).

Photo 19. *Upstream view of the SE 82nd Ave. crossing of Phillips Creek. Abandoned railcar bridge that was a trail over Phillips and Mt. Scott creeks is seen in foreground.*

Phillips Creek @ SE 84th Ave.

[Location: 45.428148, -122.57693; Not documented in ODFW barrier database]
Owner: Clackamas County

The SE 84th Ave. crossing of Phillips Creek consists of three corrugated metal pipes (CMP's). Two of the three culverts are partially filled with sediment leading to the culvert to the right in the photo below conveying most of the stream flow in Phillips Creek. High stream flows typical of winter months may restrict upstream access due to the high velocity water being conveyed through one of three pipes.

Photo 20. *Upstream view of the SE 82ND Ave. culverts*

Phillips Creek @ Costco Rear Access Road

[Location: 45.428952, -122.576779; Not documented in ODFW barrier database]
Owner: Private property

A two lane bridge crossing of Phillips Creek is a secondary access to Costco Wholesale off SE 84th. The bridge abutments are located outside the active stream channel and they do not restrict flows or create any unnatural erosion or sedimentation in the stream channel. The Phillips Creek stream channel is very constricted upstream of this site due to being bound by SE 84th and buildings that are protected by rock gabions. The rock gabions constrict the stream channel to a point that increase water velocity at most stream flows. There is no passage limitation at this crossing but the reach upstream of the crossing is very constricted due to stream bank revetments being present on boh sides of the channel that narrow the channel to approximately ½ of the active channel width.

Photo 21. Costco access road bridge over Phillips Creek. Notice high quality of gravel substrate.

Phillips Creek @ SE Sunnybrook Blvd.

[Location: 45.429951, -122.576742; Not documented in ODFW barrier database]
Owner: Clackamas County

Phillips Creek is conveyed by two CMP's underneath SE Sunnybrook Boulevard. The pipes are set at approximately the same slope as the stream channel which is ~4% in this reach of Phillips Creek. The lack of streambed substrate combined with relatively high slope creates a nearly complete barrier to upstream passage of adult and juvenile fish. It is very unlikely that adult migrating salmonids could effectively pass through the relatively long culvert with high water velocity, lack of water depth and substrate to reduce stream energy and create resting spots for fish.

Photo 22. *Two CMP's at relatively high slope and no substrate through entire length. Fill at upstream end of culvert to left forces most flows through the culvert on the right.*

Phillips Creek @ SE Sunnyside Blvd.

[Location: 45.43304, -122.577611; Documented in ODFW barrier database]
Owner: Clackamas County

Phillips Creek at SE Sunnyside Boulevard is conveyed through two concrete box culverts. The culvert to the right on the photo below carries water from a stormwater detention pond and is activated during storm events. The concrete box culverts have smooth bottoms and no substrate leading to very low water depth and high water velocity during higher stream flows. There is a 1-foot elevation drop at the downstream end of the culvert creating a challenging jump for smaller resident migratory fish. The smooth concrete bottom that leads to higher velocity flows, overall length of the crossing, and outlet jump create a near complete barrier to upstream passage migratory fish in this reach of Phillips Creek.

Photo 23. *Upstream view of the Sunnyside Blvd. crossing of Phillips Creek*

River Forest Creek @ SE River Forest Drive

[Location: 45.41574773, -122.6543307; Not documented in ODFW barrier database]
Owner: Clackamas County

River Forest Creek is conveyed by two CMP's beneath SE River Forest Drive. The culverts impound River Forest Lake and create a complete barrier to upstream passage of migratory fish into River Forest Creek watershed upstream of the lake. Water temperature monitoring indicates the potential for cold water refugia upstream of River Forest Lake. A combination of barrier removal and potential isolation of the River Forest Creek stream channel from the lake could combine to create unrestricted access into the watershed where cold water refugia exists. Other potential barriers upstream of the lake including SE Fairoaks and SE Laurie should be assessed to determine the extent to which they may restrict passage.

Photo 24. *Upstream view of two CMP's near the confluence of River Forest Creek and the Willamette River. Small diameter of culvert and elevation drop >2-feet combine to create complete barrier to upstream passage of migratory fish, including juvenile fish seeking refuge from high temperatures in the Willamette River.*

Boardman Creek @ Confluence w/Willamette River

[Location: 45.395123, -122.628151; Not documented in ODFW barrier database]
Owner: Private Property

Large boulders located at the confluence of Boardman Creek and the Willamette River create a partial barrier to upstream passage into the Boardman Creek watershed. Juvenile fish are likely restricted during summer months due to a relatively high elevation drop over the boulders. Higher flows in the Willamette River during late fall and winter months reduces the overall drop and on occasion (flood flows) will completely backwater over the top of the boulders leading to no elevation drop or jump for migratory fish. Unfortunately, two partial passage barriers upstream of the boulders restrict access to the upper reaches of Boardman Creek. One partial barrier is a bedrock chute that creates high water velocity and low water depth and another elevation drop approximately 200-feet upstream where a sewage conveyance structure situated in the middle of the Boardman Creek channel. The structure combined with large angular boulders create a substantial challenge for fish migrating upstream as there are several drops between the large boulders.

Additionally, crossings upstream of those found near the mouth (SE Walta Vista, SE River Road, SE Naef Road, and SE Roethe Road) were not included in the assessment.

Photo 25. *Large boulders create an elevation drop of >3-feet in lower Boardman Creek. Bedrock chute and instream sewer line infrastructure create additional passage challenges for fish migrating upstream into the Boardman Creek watershed.*

Rinearson Creek @ Rinearson Ave (upstream of beaver pond/wetland complex)

Cobble Dam
[Location: 45.37943335, -122.6112707; Not documented in ODFW barrier database]
Owner: Private ownership

A small dam constructed of small cobble and concrete is present at the upstream end of the beaver pond/wetland complex near the mouth of Rinearson Creek. The dam creates a 3-foot vertical drop in the stream channel and likely restricts access for migratory fish to approximately 200-feet of moderate quality stream habitat before a bedrock cascade completely restricts access to the remainder of the Rinearson Creek watershed.

Photo 26. *Cobble dam in lower Rinearson Creek creates a barrier that restricts access to ~200-feet of stream.*

Bedrock Cascade
[Location: 45.395123, -122.628151; Not documented in ODFW barrier database]
Owner: Private ownership

A bedrock cascade in lower Rinearson Creek completely restricts upstream passage of migratory fish in the watershed. The cascade is approximately 300 feet upstream of an existing wetland complex that reaches to the Willamette confluence. A juvenile coho salmon was documented in this reach during survey of the cascade. The slope of the cascade exceeds 30% for over 30-feet of stream length restricting access to all life stages of migratory fish.

Photo 27. *Bedrock cascade in lower Boardman Creek that is a complete barrier to upstream passage.*

Results

The assessment of potential barriers to fish passage in the North Clackamas Watershed Council area streams documented all stream crossings within the migratory range of anadromous fish in Mt. Scott, Phillips, and Dean creeks. We were unable to complete assessments in Minthorn Creek or Kellogg Creek due to access limitations and challenges effectively documenting stream crossings, particularly in Minthorn Creek where extensive industrial development leads to long sections of culverted stream and few chances for upstream fish access. Kellogg Creek, upstream of its confluence with Mt. Scott, will require outreach to landowners along the creek who may develop temporary instream structures that can create substantial impediments to upstream passage, particularly for juvenile fish that may benefit from cold water refugia present in Kellogg. The dam and fish ladder at the mouth of Kellogg Creek is not included in the assessment as it is being investigated through other ongoing processes.

The assessment included barriers at the confluence of River Forest Creek, Boardman Creek, and Rinearson Creek but did not assess barriers upstream. There is a substantial number of crossings upstream of the confluence barriers and their priority for replacement is likely to be low due to substantial modifications and degradation of instream and riparian habitat upstream.

Mt. Scott Creek

Many of the stream crossings documented across Mt. Scott Creek are full spanning bridges or culverts that are wide enough to span the active stream channel. The exceptions are:

- Lake Road bridge crossing (no restriction to upstream passage)
- Concrete weir in lower 3-Creeks Natural Area (partial passage)

- Concrete culvert and associated control gates at Three Creeks (partial passage; needs further assessment)
- Three CMP's (corrugated metal pipes) at SE 84th (partial passage; needs further assessment)
- Small bridge upstream of SE 129th near the end of anadromy (no passage restriction).

The failing concrete weir in lower section of 3-Creeks and the water control structure at 3-Creeks are both need further assessment to determine the extent to which they may be impacting upstream passage or stream habitat (in the case of the failing weir). An assessment of instream and riparian habitat completed by ODFW (ODFW 2008) and the council (NCWC, 2020) documented some of the highest quality habitat for both spawning and rearing juvenile fish in the entire watershed in 3-Creeks. It is important to ensure that passage is not restricted at any time of year so fish can reach spawning areas (identified in lower Phillips Creek and Mt. Scott reach downstream of Phillips) and juveniles can reach potential cold-water refuges in the summer in tributary streams feeding into the 3-Creeks Natural Area (i.e., Phillips and Dean creeks) (NCWC, 2023).

Passage into the upper reaches of the Mt. Scott Creek watershed is likely restricted during higher stream flows at the SE 84th Avenue crossing of the creek. Fish that pass SE 84th Avenue will then need to migrate through the I-205 culvert which was retrofit in 2004 to increase passage by installing weirs throughout the length of the culvert as well as downstream to mitigate a drop that formed at the outlet. The retrofit significantly increased the opportunity for fish to pass upstream. A flow dependent natural barrier to passage is present directly upstream of the I-205 culvert that can restrict passage at low and very high flows.

Phillips Creek

Phillips Creek has been identified as a potential source of cold water, and access to this creek during summer months may provide some cold-water refuge for rearing fish (NCWC, 2023). The Phillips Creek watershed contains several multi-lane road crossings resulting from extensive development in the area.

- Sunnyside and Sunnybrook Boulevards are both multi-lane crossings that have long culverts >100-feet long beneath them. The culverts at Sunnyside and Sunnybrook are nearly complete barriers to upstream passage.
- Bridge crossing that provides access to Costco is not a passage barrier, but it marks the beginning of a change in instream habitat where gravel and cobble is present and suitable for spawning.
- SE 82nd Ave. and SE 84th Ave. where culverts create constrictions in the channel and reduce upstream passage at higher stream flows. Neither crossing is a complete barrier to upstream passage but combined they may restrict access to the reach of Phillips Creek upstream of SE 84th.

Dean Creek

Dean Creek has been identified as a source of significant cold water, and access to this creek during the summer months will provide a critical cold water refuge for rearing fish (NCWC, 2023).

- Dean Creek watershed has few road crossings within the range of migratory fish but one that is present is right at the confluence with Mt. Scott Creek. The two CMP's at the mouth of the stream are very small diameter with one being partially filled with substrate. They also appear to be crushed or potentially failing near the middle of the structures. The small diameter of the culverts combined with partial filling and potential failure create a passage limitation for both adult and juvenile fish. Dean Creek is documented to contain cold water refugia so access for juvenile fish may be critical for long term survival in the Kellogg/ Mt. Scott Creek watershed.
- The Dean Creek watershed upstream of I-205 will need further investigation to determine if all cold-water refuge habitat is completely accessible to fish. The stream channel splits upstream of I-205 with one channel crossing under Lawnfield Road. The stream channel could not be found at time of field survey in October. The other channel flows to the northeast toward Mt. Talbert where anecdotal evidence indicates presence of springs that may provide the cold water found in Dean Creek.

River Forest Creek

Upstream access to River Forest Creek watershed is completely restricted at the crossing of SE River Forest Drive. One CMP conveys the stream at most flows with higher flows using a culvert set at a higher elevation.

- SE River Forest Drive essentially impounds River Forest Lake, a lake that significantly impacts water temperatures in River Forest Creek (NCWC, 2023). A combination of barrier removal and potential hydraulic isolation of the River Forest Creek stream channel from the lake could combine to create unrestricted access into the watershed where cold water refugia exists.
- Potential barriers upstream of the lake including SE Fairoaks and SE Laurie should be assessed to determine the extent to which they may restrict passage. A preliminary investigation during water temperature monitoring documented small diameter culvert crossings.

Boardman Creek

The Boardman Creek watershed contains multiple stream crossings and instream habitat features that restrict fish passage into the watershed.

- Boulders in the channel approximately 200-feet upstream of the confluence with the Willamette River create a barrier to fish passage where only higher flows in the Willamette River provide access over the boulders.
- A bedrock chute within 20-feet of the boulder drop creates another passage restriction where higher velocity flows and low water depth combine to create conditions challenging to upstream migration.
- A third potential barrier to passage is present another 150-feet upstream where sewer infrastructure is in the channel creating multiple drops over angular rock placed to protect the infrastructure.
- Additional barriers are present upstream that were not included in this assessment, including SE Walta Vista Road, SE River Road (complete barrier to upstream passage), SE Naef Road, and SE Roethe Road.

Rinearson Creek

- Fish access into the Rinearson Creek watershed is completely restricted at a bedrock chute located approximately 200-feet upstream of the wetland complex at the mouth of Rinearson Creek. The slope of the bedrock chute is >30% for a length of ~30-feet. There are no pools or resting spots in the bedrock chute that might allow for upstream passage of adult migratory fish.
- A small rock dam is located between the wetland complex and bedrock chute. It creates a 3-foot elevation drop and small pool upstream that may have been used for recreation in the past. The dam does partially restrict access to the 100-foot reach between the dam and the bedrock chute.

Discussion

The assessment of potential barriers to fish passage in North Clackamas Watershed Council area streams documented several crossings in streams that are complete or partial barriers to upstream passage. The quantity and quality of habitat upstream of these crossings varies leading to differences in benefit to replacing the structure with something that provides unrestricted upstream passage to all life stages and species of migratory fish.

Water quality upstream of a particular crossing also directly relates to the benefit provided by providing unrestricted passage to both adult and juvenile migratory fish. Cold water refuge provides adult migratory fish the opportunity to spawn throughout the entire range of time that is typical for the species. Cold water provides juvenile migratory fish refuge at times when typical rearing areas warm to the extent they are no longer suitable for rearing. Streams in the NCWC area including Kellogg, Dean, Phillips can provide critical cold-water refuge for fish as stream temperatures rise from the effects of climate change.

Kellogg Creek upstream of its confluence with Mt. Scott Creek, was not included in the assessment due to the large number of private crossings in the watershed. An outreach effort to landowners along Kellogg Creek should be performed in order to identify private dams or instream structures that could not be identified through aerial photo and map review. It is likely that juvenile fish are restricted to the lower reaches of Kellogg Creek due to private dams and instream structures that limit upstream access critical cold-water refugia.

Barriers to upstream passage in Phillips and Dean Creeks prevent fish from accessing critical cold water refugia that juvenile fish require to survive through warming summer months. Dean Creek has only one barrier known within the range of migratory fish, but it is nearly a complete barrier to both adult and juvenile fish located at the mouth of the stream. The barrier in River Forest Creek near its confluence with the Willamette River also blocks access to potential cold-water refuge that juvenile salmonids from the Willamette might benefit from.

Mt. Scott Creek has multiple stream crossings that may be partial barriers to upstream passage and are candidates for additional assessment (i.e., culvert/bridge hydraulics) to determine the extent to which they may be restricting access to important habitat in the watershed. The culvert and water control gates at 3-Creeks should be assessed to determine if current conditions may be preventing fish from moving upstream during critical migration periods. The culvert crossing of SE 84th Ave. should also be assessed to determine if the three culverts and their current condition (partial fill in culverts) is preventing access to the portion of the watershed upstream of I-205 (Mt. Talbert, Happy Valley).

Determining priorities for restoration requires an understanding of the quality and quantity of habitat upstream of a particular barrier. We utilized habitat reports and analysis developed by ODFW (ODFW, 2010), Montgomery Watson HARZA (2001), Waterways Consulting (2018), and NCWC's recent temperature study, as well as the local knowledge of this reports author to consider the barriers assessed and qualitatively determine priorities for replacement or potential retrofit.

<u>The following stream crossings should be considered for replacement or retrofit:</u>

1) Dean Creek at confluence w/Mt. Scott Creek
    - A two-barrel culvert at the mouth of Dean Creek is a partial barrier to upstream passage that restricts access to the entire Dean Creek watershed. Dean Creek provides cold-water refuge for juvenile salmonids and lampreys that may look to access Dean Creek and gain protection from high summer water temperatures in Mt. Scott Creek.
2) River Forest Creek at SE River Forest Drive
    - The culvert near the mouth of River Forest Creek completely restricts access to the entire River Forest watershed. Habitat upstream of the crossing would provide benefits to juvenile salmonids migrating out of the Willamette River during summer months as temperature monitoring indicates the potential for cold-water refugia once the temperature impacts from the lake can be hydraulically disconnected.
3) Mt. Scott Creek at SE 84th Ave.
    - The crossing of Mt. Scott Creek at SE 84th Ave. is likely a partial barrier to upstream passage at higher stream flows. Two of the three culverts are partially filled with sediment which forces most of the stream flow down one culvert. This condition may lead to a temporal (flow dependent) barrier to upstream migration. The crossing is downstream of the I-205 culvert which was retrofit to provide passage up to moderately high-quality habitat upstream along Mt. Talbert.
4) Phillips Creek at SE 82nd Ave.
    - The twin concrete box culverts in the lower reach of Phillips Creek may restrict access to higher quality habitat upstream when stream flow is higher than normal in fall and winter months. High road fill and culvert length would lead to a very expensive project to replace the culverts. Consideration should be given to a potential retrofit if an analysis of culvert hydraulics indicates that passage is restricted. The crossing immediately upstream (SE 84th) is also a partial barrier.
5) Phillips Creek at SE 84th Ave.
    - The SE 84th Ave. culverts (3) are undersized and two of them are partially filled with substrate. Moderately high-quality habitat (suitable spawning gravel) is present upstream of this crossing although it is limited to a 400-foot reach that extends up to the bridge accessing Costco off SE 84th Ave.

Additional analysis should be conducted on the following crossings to determine the extent to which they may be restricting fish passage:

1) Mt Scott at SE 84th Ave.

- Culvert hydraulics – velocity at higher stream flows

2) Mt. Scott at 3-Creeks Concrete Weir
   - Failing concrete weir creates erosion and sedimentation problem. Adult passage concern with potential jump over weir and velocity through open section of weir.
3) Mt. Scott Creek at 3-Creeks Water Control Structure (culvert and control gates)
   - Concrete box culvert hydraulics – velocity at higher stream flows
4) Phillips Creek at SE 82nd Ave.
   - Concrete box culvert hydraulics – velocity at higher stream flows
   - Assess for potential retrofit
5) Phillips Creek at SE 84th Ave.
   - Three CMP's with two that are partially filled with substrate.
   - Culvert hydraulics with current condition of partial fill.

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