Twelvemile Creek Basin Assessment and Restoration Prioritization

A Tributary of the Middle Fork Coquille River

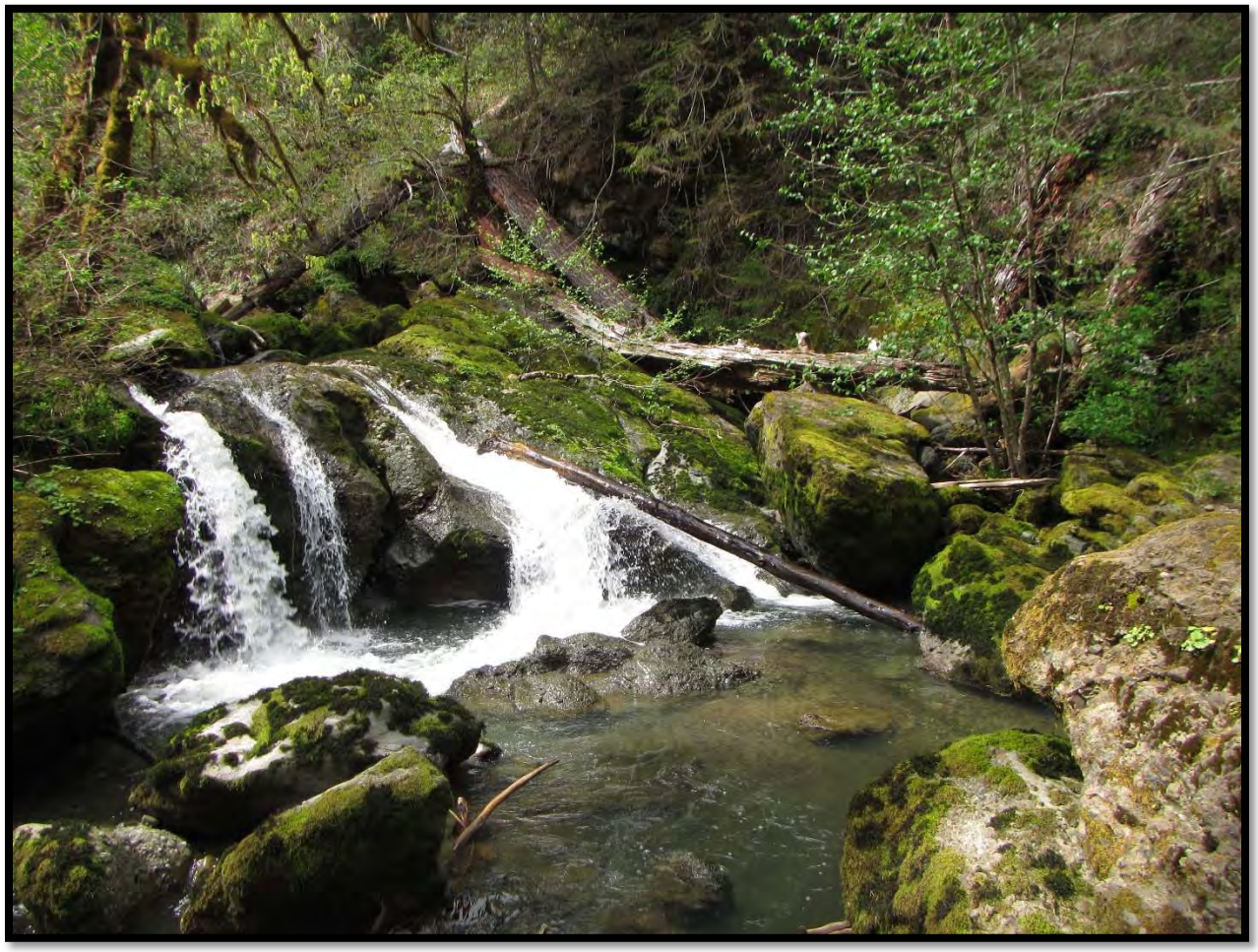

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Table of Contents

Table of Contents 2
Introduction 3
Physical Setting 5
Resources used in developing this report 6
General questions that guide the assessment 6
Stream Survey Analysis 6
  Reach Summary for Stream Survey 6
  Unit Summary by Reach 7
  Pool Summary 9
  Riparian Zone Vegetation Summary 10
  Large Woody Debris Summary 11
Road Sediment Delivery Surveys and Analysis 14
  Top Sediment Producing Drain Points 15
  Top Sediment Producing Road Segments 18
  Stream Crossings in Poor Condition 20
  Gully Formation and Drain Points in Poor Condition 22
Twelvemile Basin Restoration Prioritization 25
  Instream Restoration Prioritization 26
  Road Improvement Prioritization 27
  Permitting 28
References 29
Appendices 30
Appendix A – GRAIP Glossary 30
Appendix B – GRAIP Photos 32

Introduction

This assessment provides a prioritization of watershed restoration actions proposed to enhance native fish populations and working forested landscapes within the Twelvemile Creek Basin in Douglas County, Oregon. Twelvemile Creek is a 24,000-acre tributary drainage to the Middle Fork Coquille River (MFCR) located about 6 miles west of Camas Valley, OR. Twelvemile Creek has been prioritized for restoration by the Coquille Watershed Association (CoqWA) because it has 35 miles of available spawning and rearing habitat, 5.3 miles of which are classified as high intrinsic potential for coho salmon (Figure 1). Specifically, Twelvemile Creek provides spawning and rearing habitat for native fish including coho, Chinook, Pacific lamprey, steelhead, and coastal cutthroat.

Historically, Twelvemile Creek was splash dammed for logging, subjected to stream cleaning, and logged in the riparian areas resulting in a current lack of sufficient large woody debris (LWD). The sub-watershed has riparian corridors impacted by road construction, timber harvest, and previous mining. Primary limiting factors for anadromous fish in the sub-watershed are lack of stream habitat complexity and water quality. Twelvemile Creek is currently 303d listed by the Oregon Department of Environmental Quality (DEQ) for sedimentation and temperatures that exceed federal and state cold water standards.

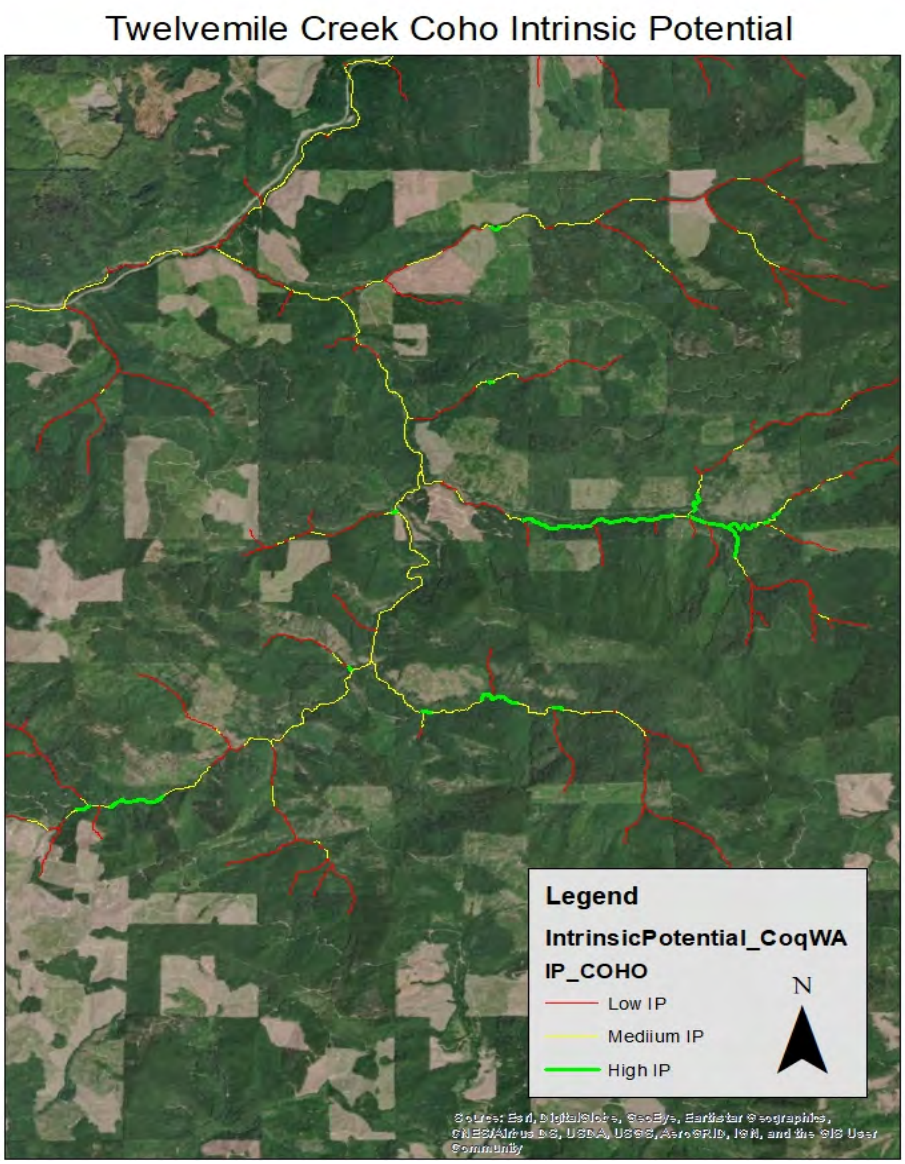


Figure 1: Map showing low, medium, and high intrinsic potential for coho salmon within the Twelvemile Creek Basin.

Physical Setting

During the summer of 2000, 10 reaches within Twelvemile Creek were identified and surveyed by ODFW using the AQHI methods (Figure 2), which equals to about 7.2 river miles (RM). However, access was not granted to the second reach, therefore nine were surveyed for in-stream and riparian habitat features. The road system within this basin was also surveyed during 2019 using the Geomorphic Road Analysis and Inventory Package (GRAIP) where we learned more about the impacts of this road system on erosion and sediment delivery to streams.

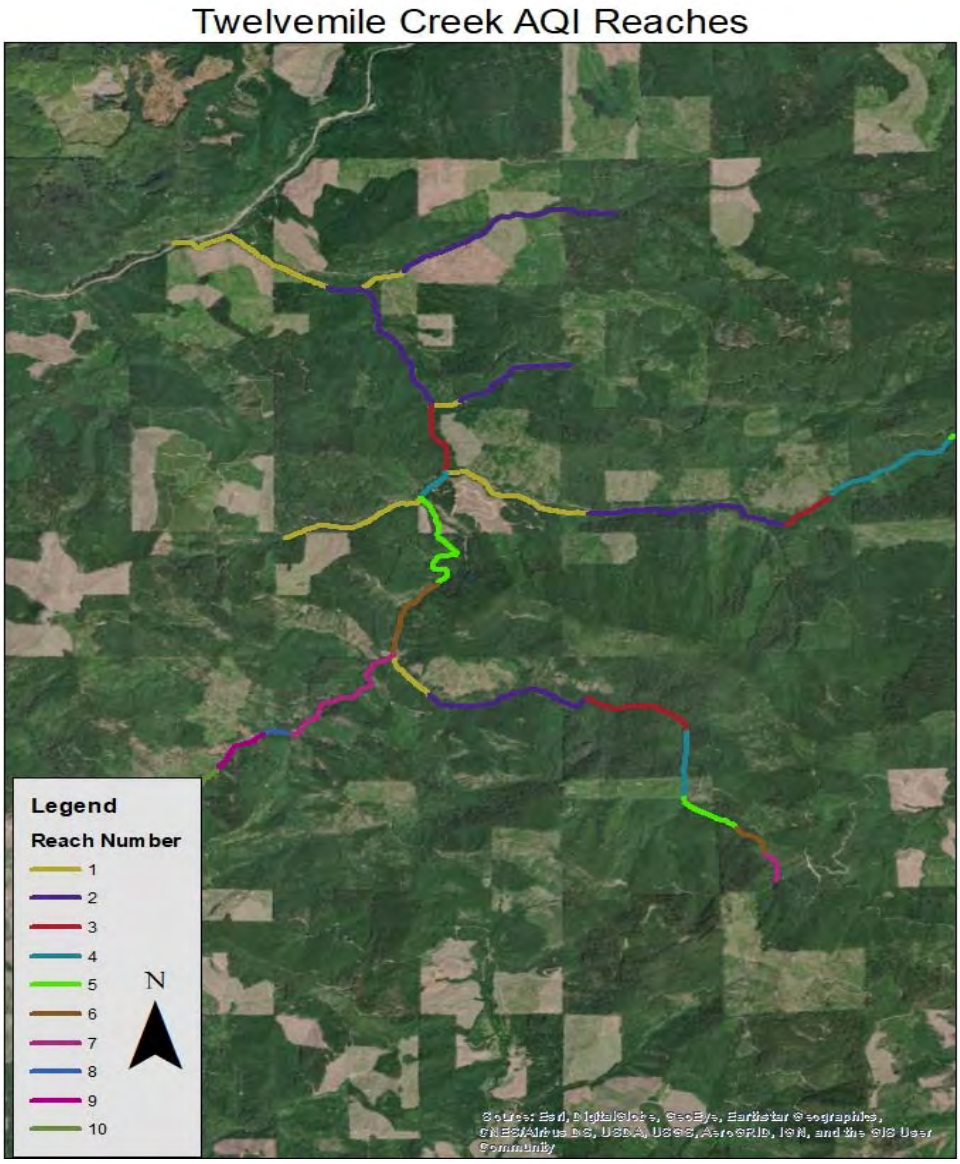


Figure 2. Map of AQI surveyed reaches within Twelvemile Creek

Resources used in developing this report

Technical assistance funds from the Oregon Watershed Enhancement Board (OWEB) facilitated the review of watershed habitat conditions in order to develop, prioritize, and design habitat enhancement projects in the sub-watershed. Assessments included surveying fish passage impediments on federal, county and private road crossings, conducting road network surveys using GRAIP methods, assessing in-stream habitat features using the Aquatic Inventories Project (AQI) methods, evaluating riparian conditions, and monitoring water quality metrics (sediment and temperature). Please go to this website to learn more about the Oregon Department of Fish & Wildlife (ODFW) AQI survey methods: https://odfw.forestry.oregonstate.edu/freshwater/inventory/methods.html and here to learn more about U.S. Forest Service GRAIP survey methods: https://www.fs.fed.us/GRAIP/.

General questions that guide the assessment

1. What are the existing habitat limiting factors?
2. What areas of the Twelvemile Creek Mainstem and its tributaries should be prioritized for restoration?
3. Where are fish passage barriers located?
4. What restoration actions need to be completed to enhance the habitat function for all life stages of salmon and other fish and wildlife?
5. What sediment abatement and riparian restoration actions should be completed to support the instream work?

Stream Survey Analysis

Reach Summary for Stream Survey

The **active channel width (ACW)** is the distance across the channel at "bank full" flow and is used to evaluate channel and valley characteristics. The **valley width index (VWI)** is the number of active channels that fit between hillslopes across the valley floor and reflects the potential for the stream to meander back and forth or create new channels within the valley. Valley characteristics and channel morphology are especially significant during high flow events, where streams may form secondary channels on broad valley floors. Secondary channels provide important resting and over-wintering habitat for fish because they help them escape from high velocity winter flows (Foster et al. 2001).

Channel characteristics and dimensions describe the stream with respect to the adjacent landforms. These measurements indicate the degree of channel constraint and the ability of the stream to interact with its floodplain. Interactions with floodplains enhance bank stability, secondary channel formation, and riparian vegetation. These variables contribute to habitat complexity. The **height of the active channel** is measured from the bottom of the channel to the height at bankfull flow. The average **wetted width** and **depth** indicate the size of the stream. In general, stream channels with significant depth compared to width have a higher potential for

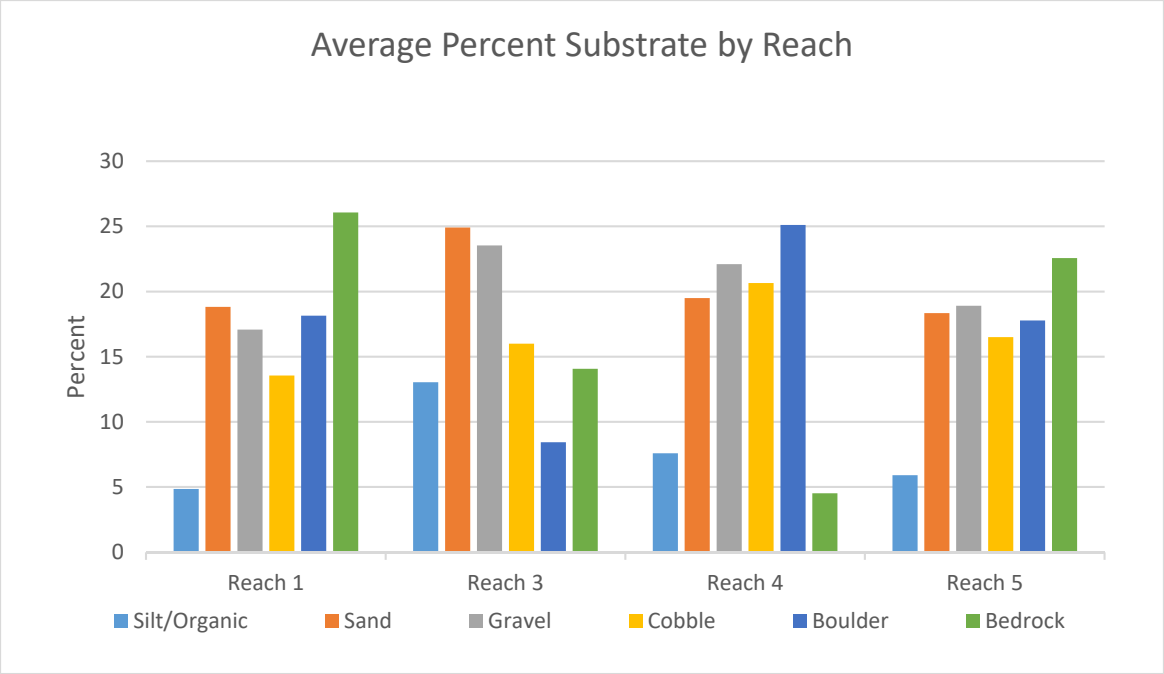
productive fish habitat. A high **width to depth ratio** increases the water's exposure to solar radiation, resulting in potentially higher temperatures Undercut banks are often reduced, affecting critical cover preferred by many salmonids. (Foster et al. 2001).

Within the Twelvemile Creek Basin, land uses beyond the riparian zone are almost exclusively second growth timber with a riparian zone dominated by a mix of conifer and hardwood species. However, past and present activities are degrading the riparian areas of Twelvemile Creek. The riparian vegetation in lower reaches is limited in providing bank stability, shade over the channel, and recruitment of large woody debris. Higher reaches of Twelvemile Creek do provide a healthier riparian canopy that shades the stream channel, which helps to reduce high summer water temperatures.

Unit Summary by Reach

The Habitat Unit summary describes the mix of habitat types, average dimensions of the habitat units, and the amounts of substrate types and large boulders, Figure 3 andFigure 4. Units are categorized as either pools (lateral scour, straight scour, trench, plunge, beaver pools, dammed pools, alcoves, backwaters, and isolated pools), riffles, rapids (rapids over boulder or bedrock), cascades, or steps and waterfalls. Habitat types are described according to the slope of the water's surface, flow characteristics, and substrate. Large boulders are those which have a diameter of 0.5 m or greater, and protrude from the water surface. Substrate types are visually estimated for each unit and large boulders are counted. The number of different habitat units indicates the complexity of the reach. For example, backwater pools, alcoves, and dammed and beaver pools provide refuge habitat for fish during high flows. Depth of the units indicates the flow at the time of the survey and the potential for high quality fish habitat. Depth in both pool and fast water habitat is important for juvenile and adult fish. Each unit's substrate composition provides information about stream roughness and hydrologic complexity. Substrate also influences survival of salmonids at different life stages. High percentages of silt and sand in riffle areas may indicate poor quality spawning habitat, while cobbles and boulders in pools are important winter rearing habitat (Foster et al. 2001).

During the summer of 2000, nine reaches of Twelvemile Creek were surveyed. Twelvemile is predominantly constrained by hillslopes. Rapids and riffles are the most common instream habitat types and cobble, gravel and sand are the dominant substrate types in the surveyed stream. Wood volume is low according to ODFW Aquatic Inventories benchmarks.



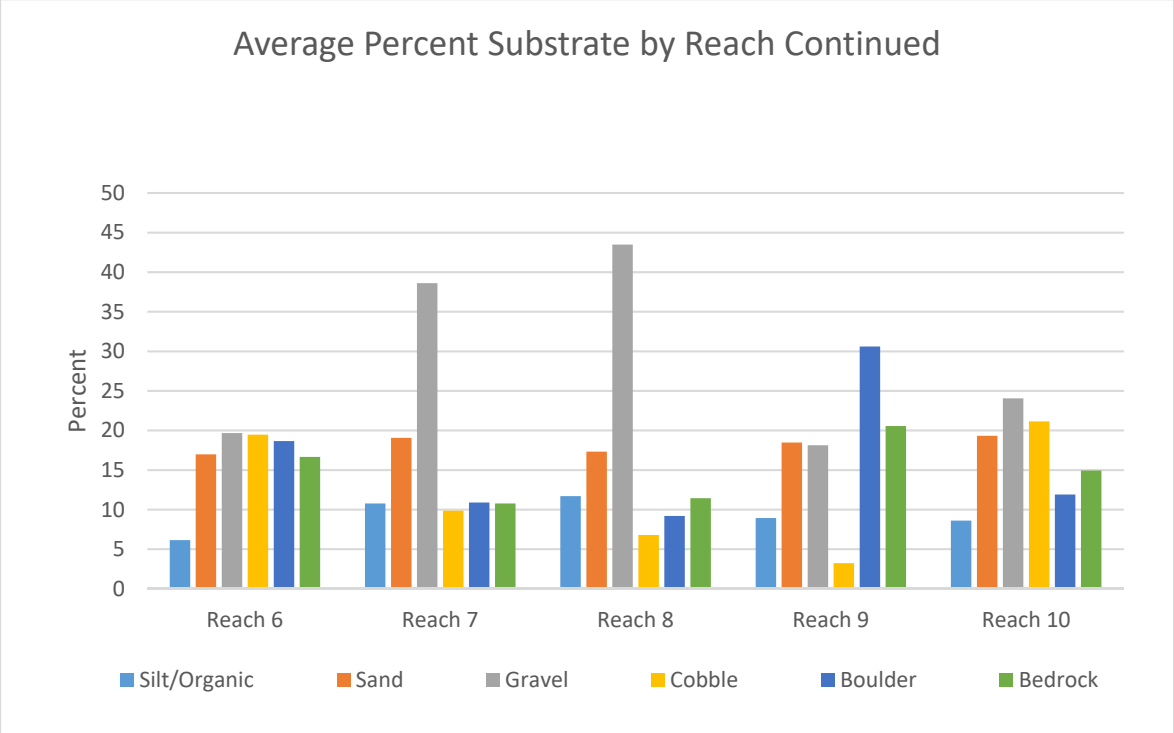


Figure 3. Average percent substrate within the surveyed reaches of Twelvemile Creek. Note: Reach 2 was unable to be surveyed.

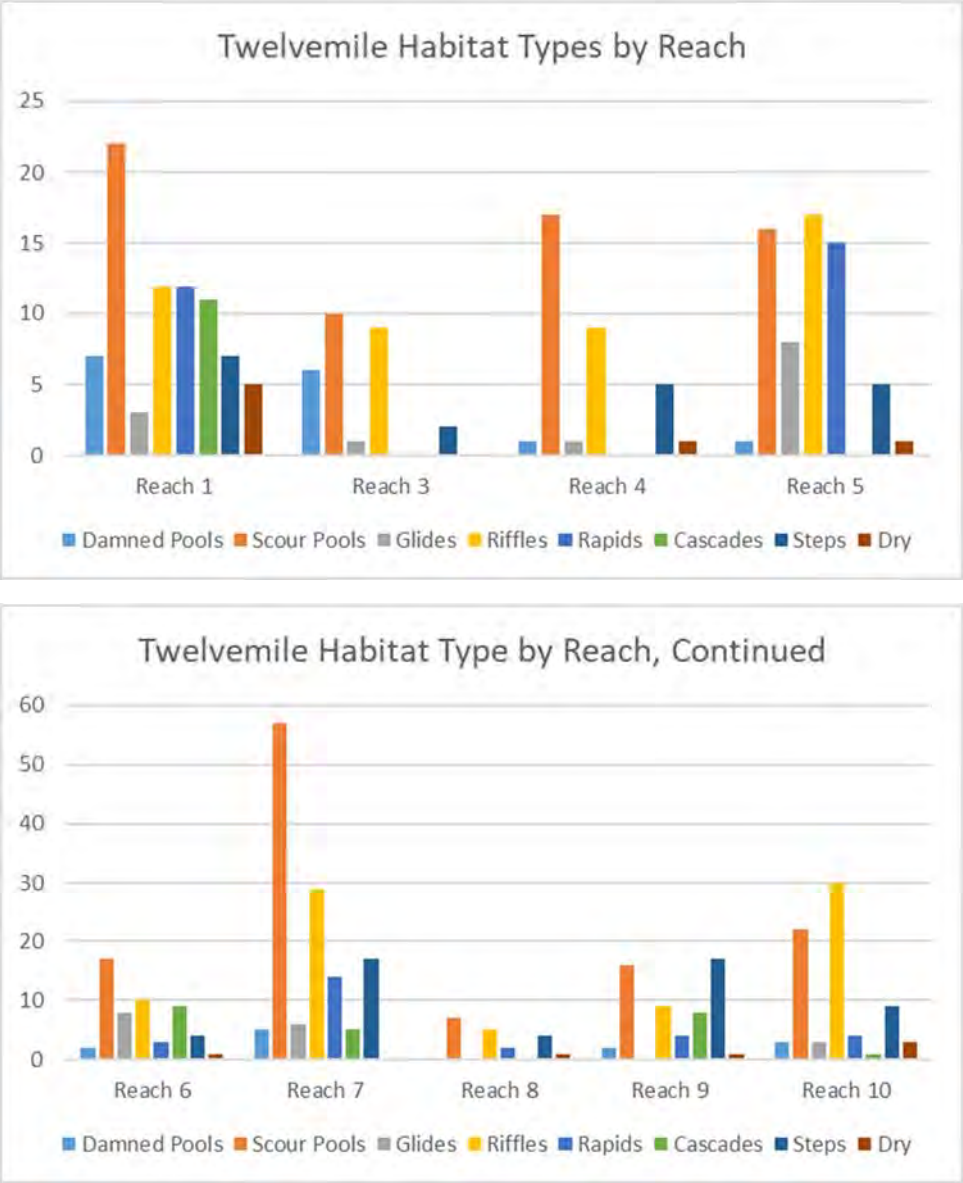


Figure 4. Habitat types by reach for Twelvemile Creek. Note: Reach 2 was unable to be accessed.

Pool Summary

Pools, particularly deep pools, are important habitat for juvenile and adult fish. Pools provide slow water habitat, critical over-wintering habitat for some species and sometimes, the only habitat available for fish during the summer low flow period. Pools with depth and/or large wood are particularly desirable for increased space and complexity (Foster et al. 2001). Twelvemile is lacking in complex pools, such as deep pools, pools with LWD, and other diverse and dynamic habitat types, such as alcoves and backwater pools, Figure 5.

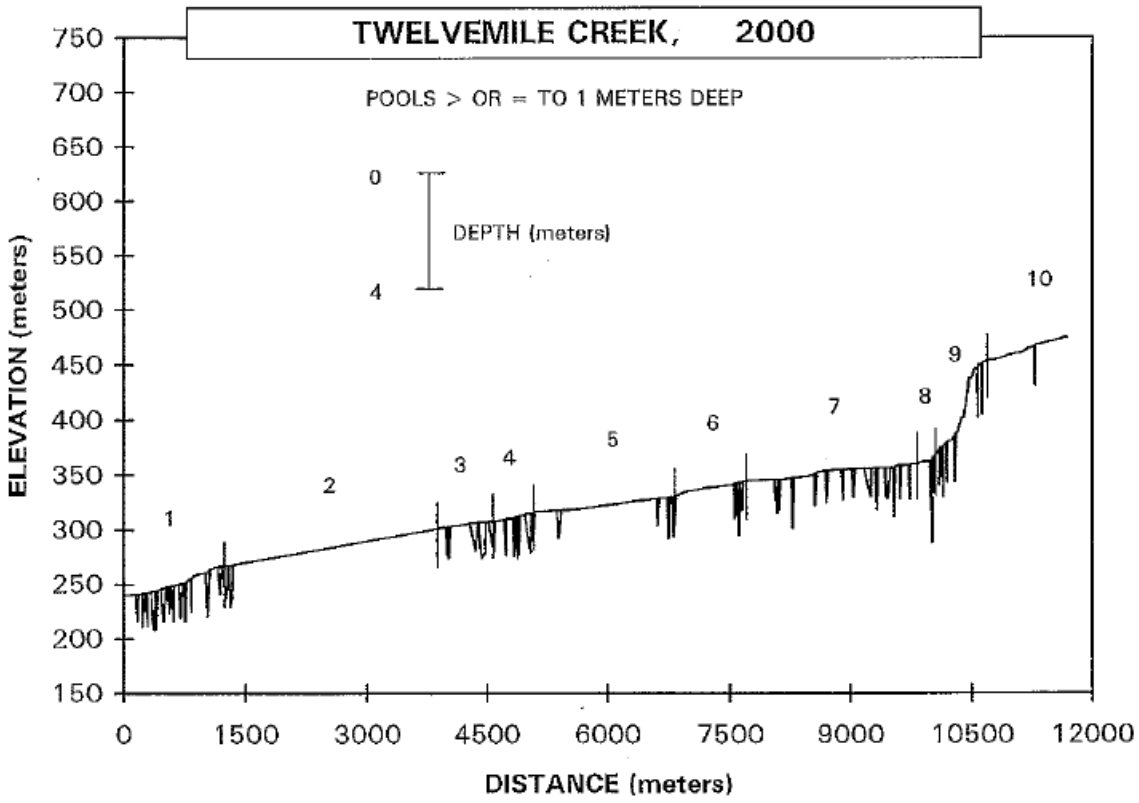


Figure 5. Total pools per mile by surveyed reach in Twelvemile Creek.

Riparian Zone Vegetation Summary

Riparian vegetation is a key component of fish habitat. A healthy riparian canopy shades the stream channel, which can help reduce high summer water temperatures. Healthy riparian vegetation stabilizes stream banks with the reinforcing action of interconnecting root systems and the stream is more likely to develop bank **undercut**, which provides important cover for fish. Stabilized stream banks are less likely to provide fine sediments, which can embed spawning gravels and, in extreme cases, fill in pools. Riparian trees also provide the majority of large woody debris (LWD) recruitment into the stream (Foster et al. 2001).

All reaches within Twelvemile Creek are dominated by large or second growth conifers and deciduous trees. Figure 6 shows the percent shade for all surveyed riparian areas of the nine reaches. Note: There are 10 reaches but due to access issues, only nine were included in the 2000 surveys.

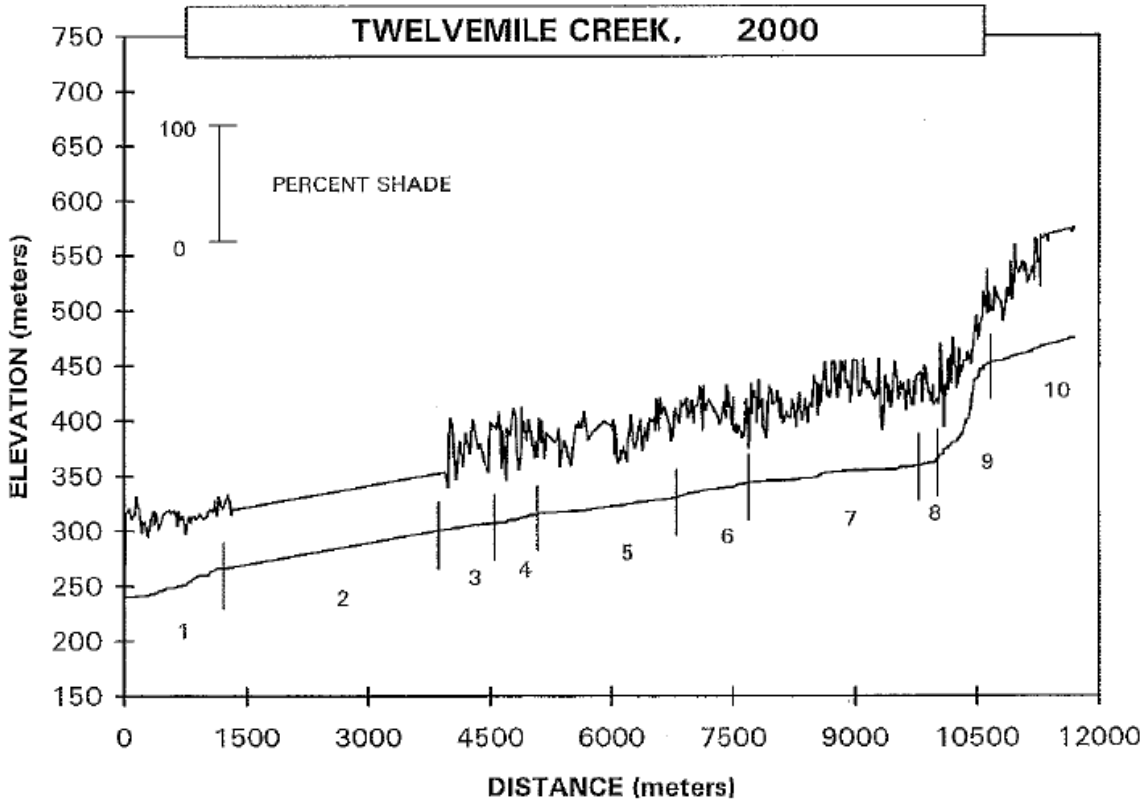


Figure 6. Percent shade for all surveyed reaches within Twelvemile Creek.

Large Woody Debris Summary

Large woody debris is displayed in total pieces and as the number of pieces per 100 meters of stream channel per reach. Figures below show pieces of large wood per reach, volume of large wood per reach and key pieces of large wood per reach. Overall, the data indicates that all reaches are low in large woody debris, largely due to past practices such as stream cleaning and riparian logging, Figure 7 -Figure 9.

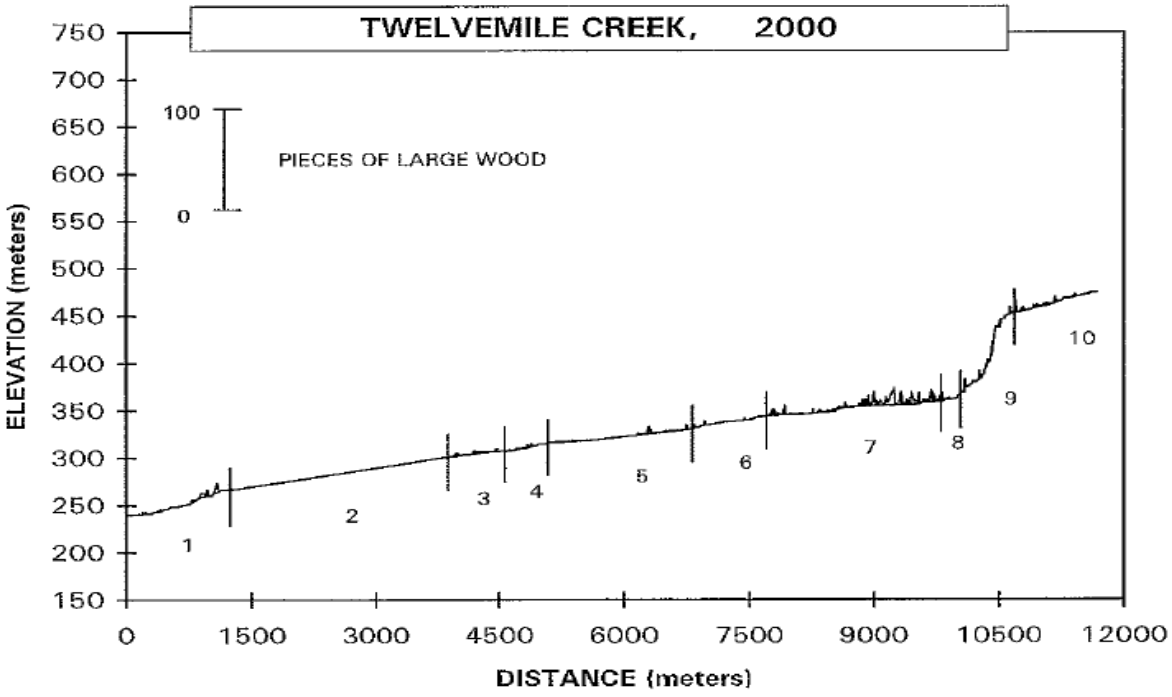


Figure 7. LWD per 100m within the surveyed reaches of Twelvemile Creek.

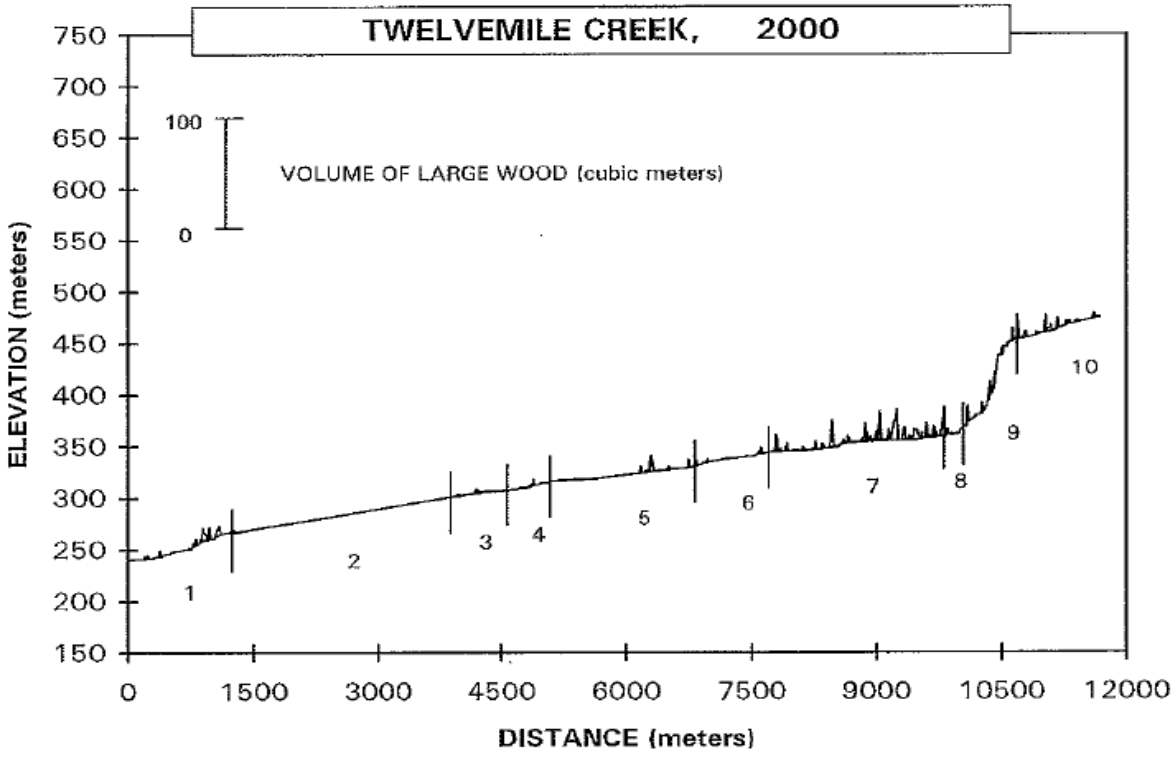


Figure 8. Volume of LWD within the surveyed reaches of Twelvemile Creek

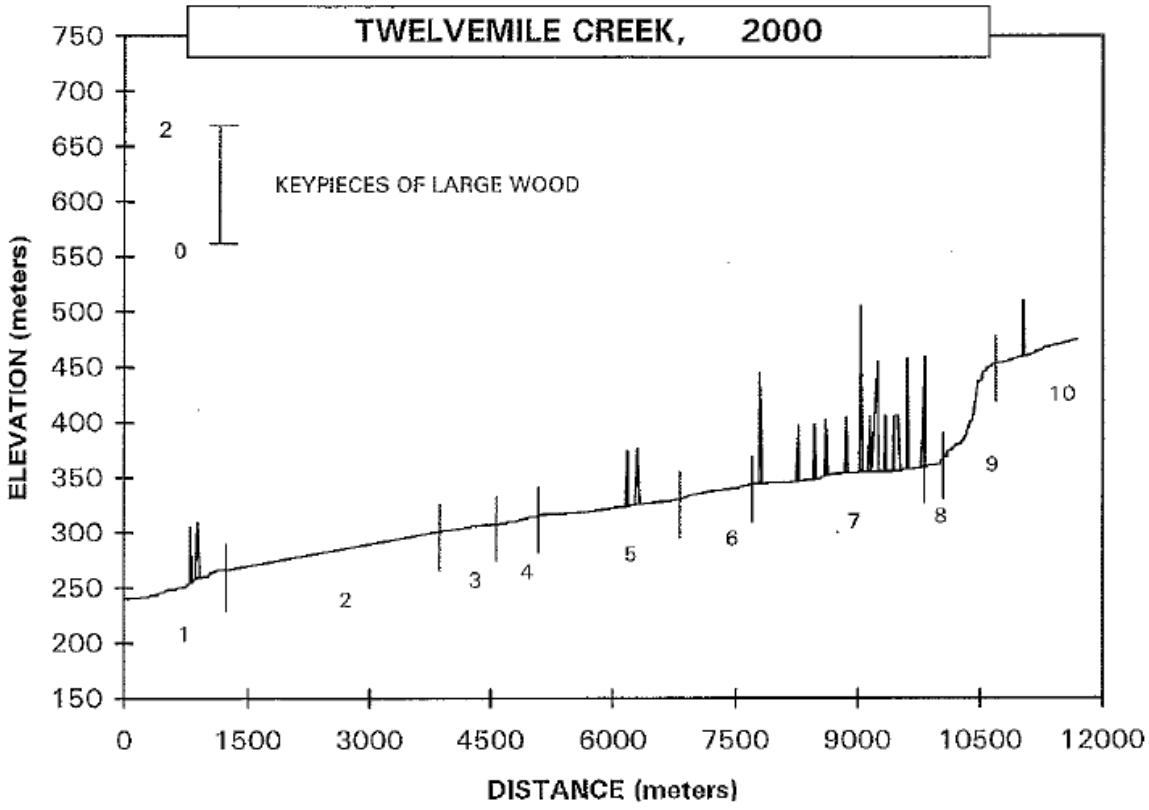


Figure 9. Key pieces of LWD within the surveyed reaches of Twelvemile Creek.

Road Sediment Delivery Surveys and Analysis

Although sediment entering streams and rivers is a necessary and natural process, there has been an increase in the amount of fine sediments entering these aquatic ecosystems due to anthropogenic activities, primarily from road networks. Fine sediments can smother fish eggs laid in spawning gravels and high sedimentation levels cause damage to respiratory systems in fish and negatively affect macroinvertebrate species. Naturally added sediment typically comes from mass-wasting events (e.g. landslides, debris torrents, etc.) that occur infrequently and effect only a portion of a watershed, fish and other aquatic species are adapted to these events by migrating to other areas in the watershed or a different watershed altogether. The sediment delivered to stream systems from road networks tend to be a finer sediment and at a lower level than mass-wasting events but because it occurs throughout the entire watershed there is a constant low-level pressure on the aquatic ecosystem. Overtime, this low-level pressure can affect population numbers of sensitive species (e.g., salmonids, trout, etc.) watershed wide. Therefore, it is important to monitor, manage and improve road networks to ensure they are not delivering large quantities of sediment to streams and rivers.

One protocol to assess road networks is the USFS Geomorphic Road Analysis and Inventory Package[1] (GRAIP). GRAIP uses an on-the-ground survey and assessment to define and characterize the road segments and drain points[2] (e.g. water bars, ditch relief culverts, etc.) of the road network. The surveys are then used in a sedimentation model to identify which roads and drain points produce and deliver the largest quantities of sediment to the stream. The most significant inputs to the sedimentation model are slope of road, base erosion rate, road surface cover and whether there is vegetation growing in the flow path of the draining water. All of the inputs are determined by the survey except base erosion rate which was estimated to be the same as the Siuslaw National Forest base rate.

GRAIP surveys were completed on over 42 miles of roads in the Twelvemile Creek Basin, these roads are managed by Roseburg Resources and BLM, Figure 10. Within these roads there were 150 seasonal and perennial stream crossings, 323 ditch relief culverts, 34 lead off ditches, 610 other miscellaneous drain points, 41 gullies and 5 active and inactive landslides.

[1] https://www.fs.fed.us/GRAIP/
[2] A list of GRAIP terminology can be found in Appendix A

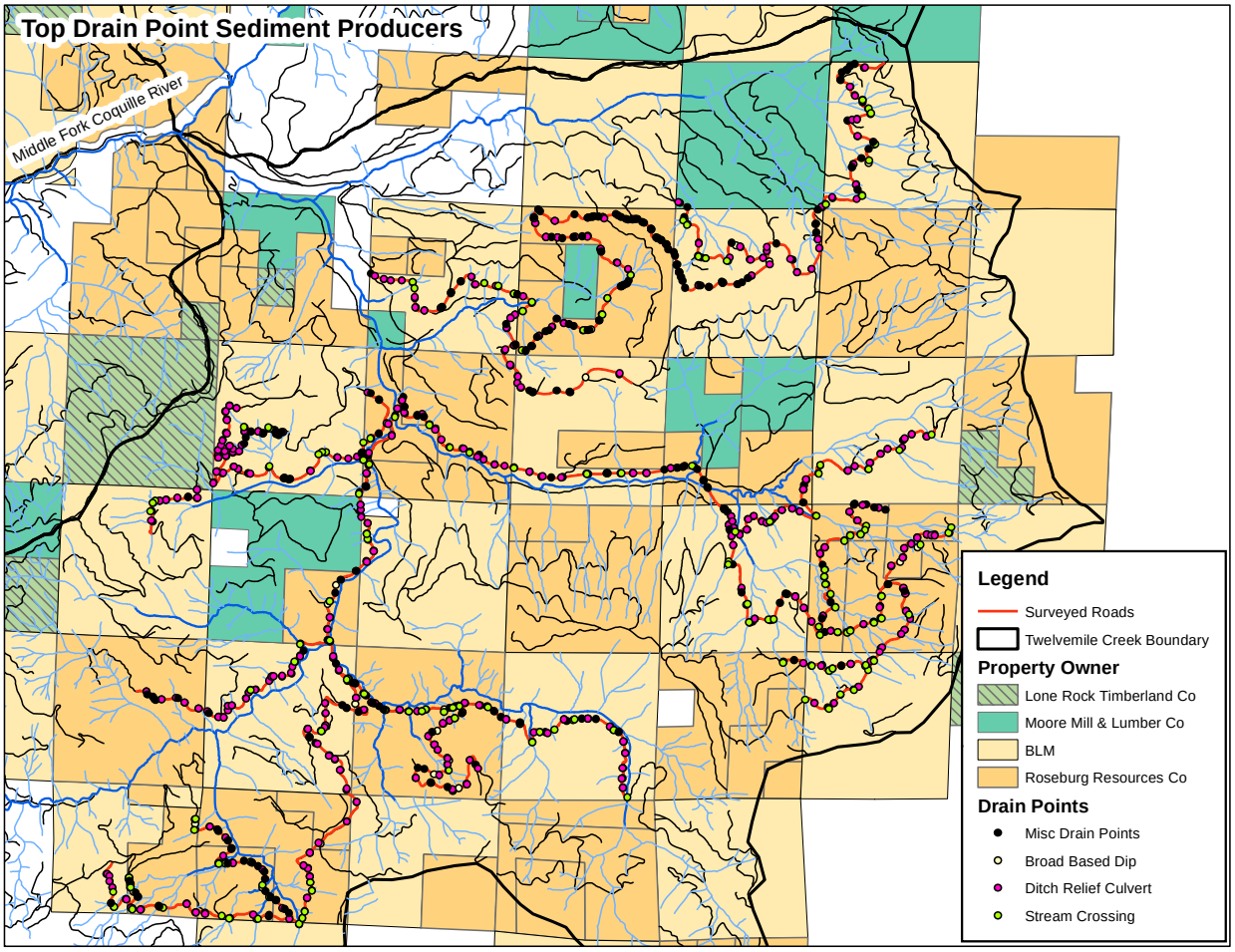


Figure 10. GRAIP Road survey completed by CoqWA in summer of 2019 covered 42 miles of road in the Twelvemile Creek Basin.

Top Sediment Producing Drain Points

The GRAIP model identified 271 drain points that produced and delivered sediment to Twelvemile Creek and 13 gullies that produced and delivered sediment to Twelvemile Creek. The top seven delivering drain points and the top six delivering gullies are identified as high priority candidates for road improvements, Table 1 and Figure 11.

Table 1. Top 13 drain points and gullies that deliver sediment to Twelvemile Creek.

Drain Point ID	Drain Point Type	Sediment Produced (kg/yr)
1207	Gully	2,300
1204	Gully	2,040
1201	Gully	1,785
1205	Gully	1,403
952	Stream Crossing	1,175
81	Broad Based Dip	1,103
82	Broad Based Dip	1,023
993	Stream Crossing	1,015
949	Stream Crossing	916
31	Broad Based Dip	912
1202	Gully	872
1206	Gully	850
1007	Stream Crossing	764

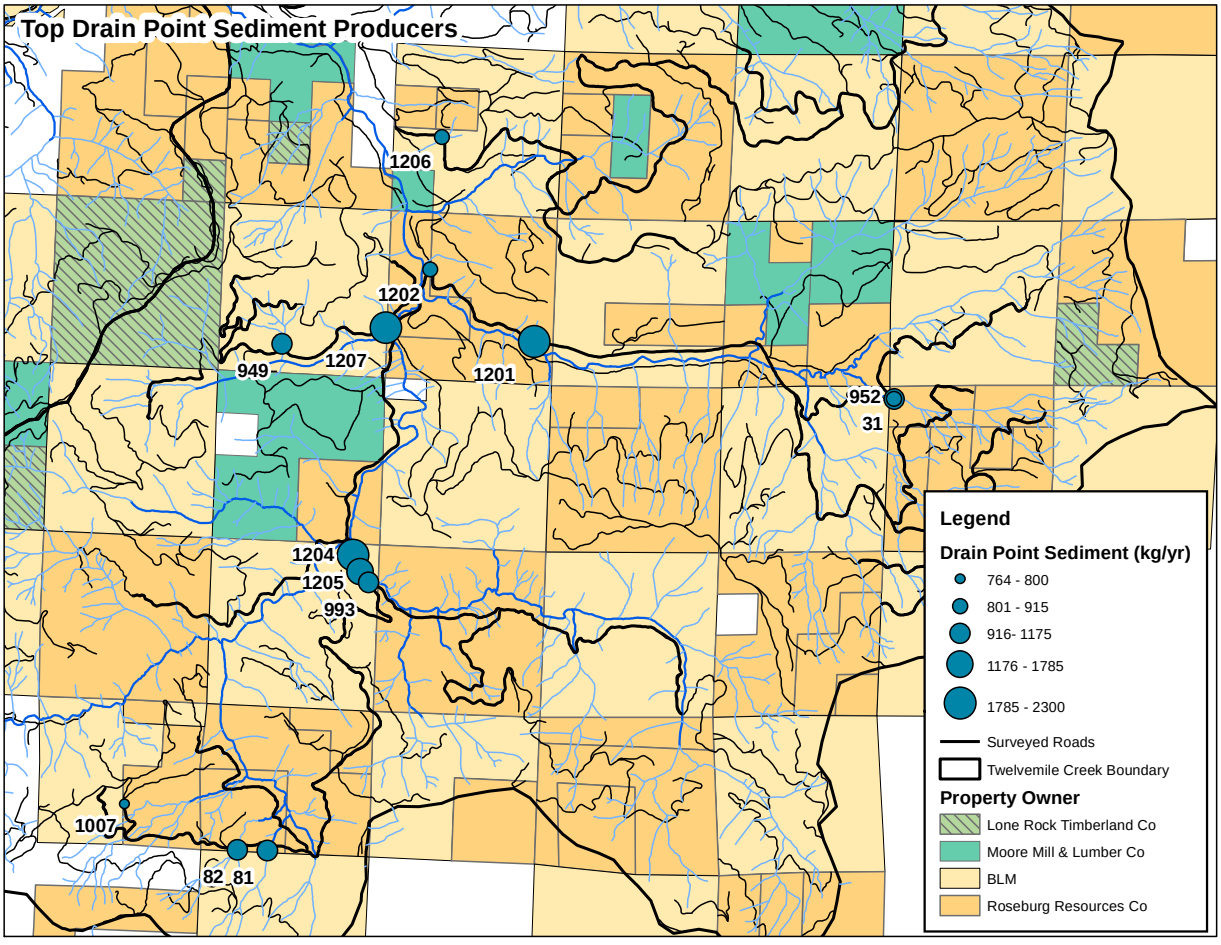


Figure 11. Locations of top sediment delivering drain points and gullies of the Twelvemile Creek GRAIP survey.

The top four sediment producing points are gullies. Currently Gully 1207 is inactive as the road is in poor shape and impassable further up the road. The road acts like a sump for all of the water and sediment draining off the steep road and if the road were to be re-opened the gully would become active and contribute high quantities of sediment to the creek if it was not addressed, Figure 16. Gully 1204 is on the outlet of a ditch relief culvert (DRC) that drains a long steep section of road (road 54, below). The ditch of road 54 is eroded and flows through a DRC, creates a gully on the outlet of the DRC and discharges directly into Dice Creek, Figure 17. The third largest sediment deliverer, Gully 1201, is another gully on the outlet of the DRC draining a road segment. There is an increased amount of water in the ditch being drained by the DRC due to a wet swale that has been diverted into the ditch. The gully drains down the hillslope while gullying on and off until it discharges directly into Boulder Creek. Gully 1205 is just uphill of road segment 54 and Gully 1204. A wet swale is diverted into the ditch and drains through a DRC into a sump like area. The outlet of the sump area is highly gullied, due to the steep hillside, and discharges straight into Dice Creek.

Stream crossing 952 and broad based dip 31 are located on the same section of road. The broad based dip is at the intersection of the road with the stream crossing. The western section of road diverts some of the water from a ditch onto the road and then into the stream. In addition, the ditch intercepts a wet swale sending some of the water and sediment laden ditch water into the upstream side of the stream crossing. Compounding these issues is the long steep eastern section of road (RD 244, below) that drains to both the stream crossing and the broad based dip, this section of road lacks any cross drains. Broad based dips 81 and 82 are near each other and share similar features. Both of these broad based dips occur at stream crossings and drain long steep sections of road that concentrate water on the road bed and drain directly into streams. Stream crossing 993 serves as a ditch relief culvert that drains a very steep section of road that intercepts multiple small seasonal streams or wet swales along the length of the ditch. This drain point produces lots of sediment due to the increased water flowing in the steep ditch and the erosion on the outlet of the culvert caused by excess water flowing over the steep hillside. Stream crossing 949 is washing out the road significantly and contributing lots of sediment directly to the stream, Figure 18.

Gully 1202 is on the outlet of a ditch relief culvert whose ditch drains a steep eroded section of road. Additionally, this ditch drains water from the road above it in a cascading fashion, this has increased the amount of water in this drain point causing gullying that drains directly into Twelvemile Creek. Gully 1206 occurs on the inside corner of a tight bend in the road that is also a stream crossing. The water drains in a concentrated fashion down a steep eroded section of road. A gully occurs in the road crossing fill where the concentrated flow path leaves the road and drains directly into a small seasonal stream, Figure 19. Stream crossing 1007 is on a section of hillside that has slumped many times. The current road is impassable and flow sometimes overtops the slumped road washing sediment into the stream crossing. This location would be an ideal road segment to decommission as it services a young timber stand and the far side of the stream crossing can be accessed from a different route.

Top Sediment Producing Road Segments

The GRAIP survey and analysis identified 338 segments of road whose drain flow paths connect to the stream network and deliver sediment. Of those the top eight have been identified as candidates for road improvements, Table 2 and Figure 12.

Table 2. Top 8 road segments that deliver sediment to Twelvemile Creek.

Road ID	Road Length (m)	Sediment Produced (kg/yr)
244	296	1,824
294	40	1,453
329	124	1,158
536	65	918
488	181	864
54	79	794
676	162	752
473	19	752

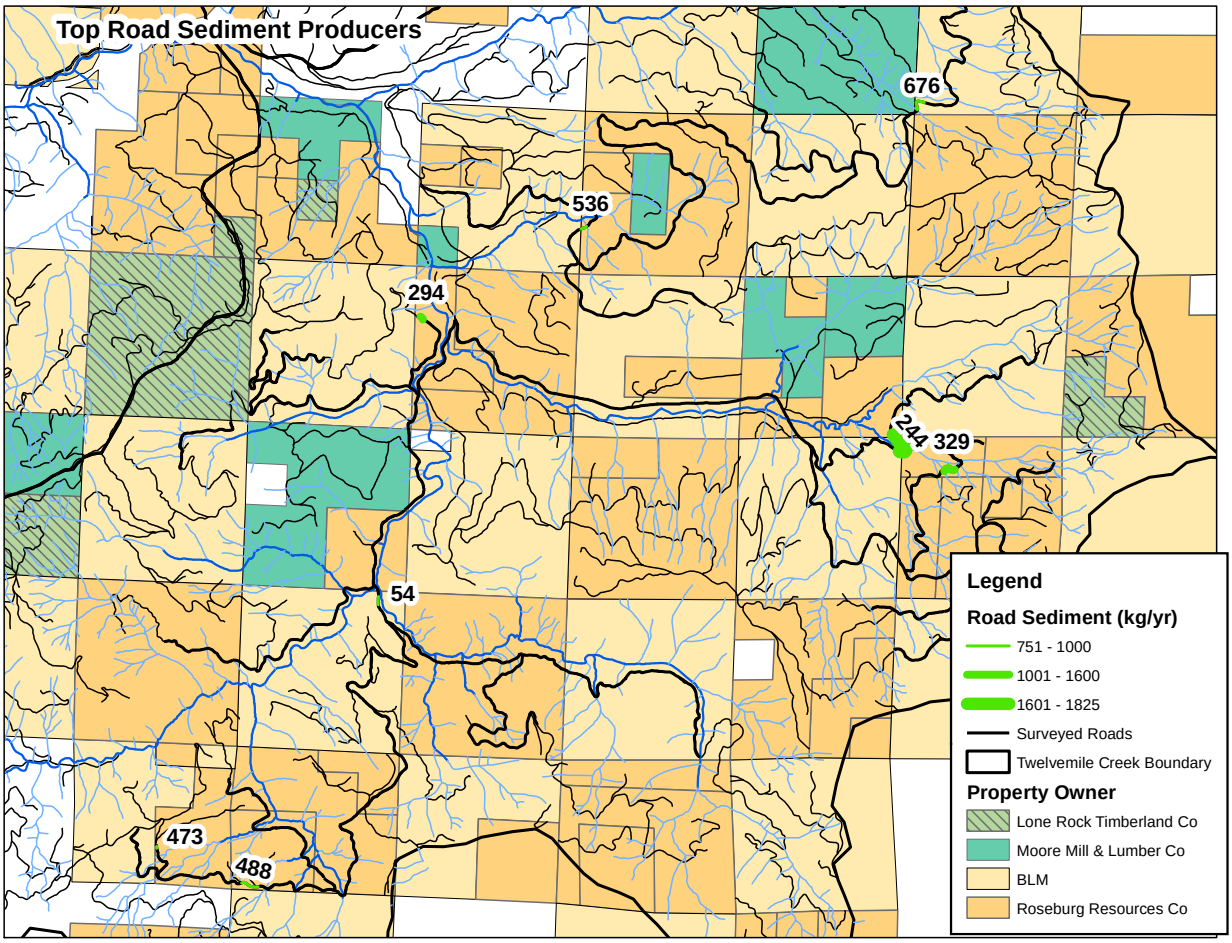


Figure 12. Top sediment delivering road segments of the Twelvemile Creek GRAIP survey.

The top sediment producing road, Road 244, drains to the stream crossing 952 and broad based dip 31 discussed above. This road is long and steep and the water flows down the road in a concentrated path eroding the road bed and depositing the water and sediment into the creek. The road segment 294 is a short steep section of road that is highly gullied and almost impassable, Figure 20. Another long steep road with few cross drains is road segment 329, this road section is delivering sediment from road surface run off and delivering it directly to the stream via the ditch. Road 536 contributes sediment to the stream network in two major ways. A good portion of the road drains in a concentrated flow path on the road surface eroding the road, this flow path then enters the ditch and erodes the ditch adding further sediment to the ditch water. The ditch then flows directly into a small stream. The road segment 488 is associated with the broad based dip 82, discussed above, and is a long steep section of road that has erosion in both the road bed and the ditch. All road sediment from road 488 drains directly into the stream crossing at its base. Road 54 is associated with gully 1204, discussed above, this segment of road is steep and the ditch is eroded and delivering the sediment laden water directly into the stream. Another long, steep road segment, Road 676, with few DRCs delivers all of the road sediment directly into the stream via a broad based dip and ditch. Lastly, the ditch flow path of

road 473 drains directly into the stream system and further erodes the road bed where the road has slumped at stream crossing 1007.

Stream Crossings in Poor Condition

The GRAIP surveys have also identified 81 stream crossings in poor condition. These stream crossings are a combination of fish-bearing, perennial and seasonal streams. The condition of the stream crossing ranges from rusted significantly to partially blocked to flows around pipe with flows around pipe being the most severe condition. There is the greatest chance of mass wasting and stream crossing failure when the stream flows around the pipe; therefore, all identified stream crossings where the stream flows around the pipe are listed below, Table 3 and Figure 13.

Table 3. A list of the stream crossings in poorest condition identified during the Twelvemile Creek GRAIP survey.

Stream Crossing ID	Stream Type	Condition	Pipe Size and Length (ft)
913	Seasonal	Rusted significantly	18" x 30'
918	Seasonal	Diverted flow path	18" x 60'
945	Fish Bearing	Flows around pipe	>72" x 40'
949	Perrenial, non-fish bearing	Flows around pipe	36" x 50'
979	Perrenial, non-fish bearing	Flows around pipe	36" x 50'
990	Seasonal	Flows around pipe	18" x 60'
1029	Perrenial, non-fish bearing	Flows around pipe	18" x 50'
1030	Perrenial, non-fish bearing	Flows around pipe	18" x 50'

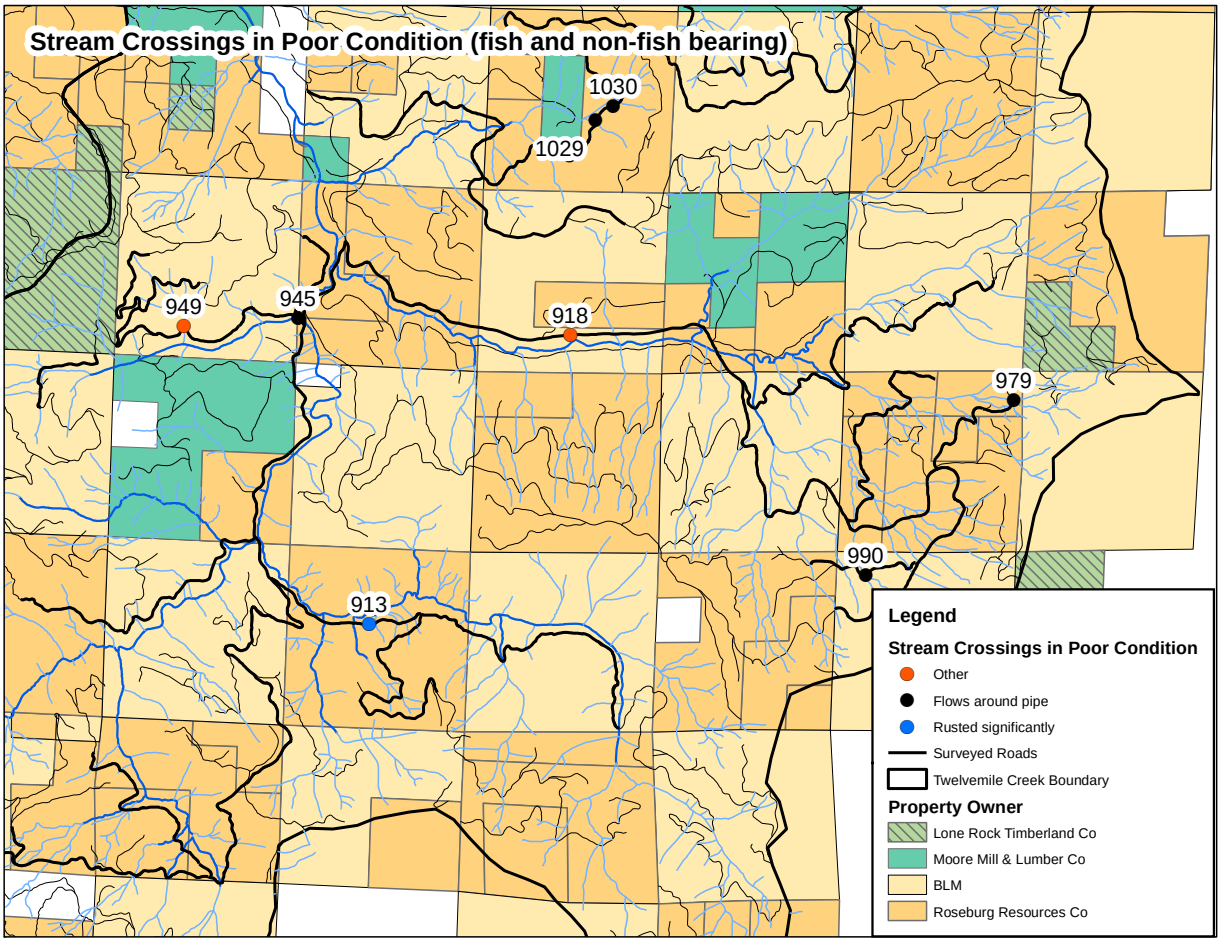


Figure 13. Locations of the 7 stream crossings in poorest condition as identified in the Twelvemile Creek GRAIP survey.

Stream crossing 913 is a small seasonal stream whose culvert is extremely rusted and has the potential of failing therefore is listed as requiring repair. Although the actual stream crossing at location 918 is in good condition, the small seasonal stream has been diverted from its channel

into the road ditch for 75m before it crosses the road at location 918. Additionally, more sediment is added to the stream network because the channel is incised downstream of the crossing due to the added ditch water draining to this point and the stream diversion has caused erosion in the flow path of the ditch. Stream crossing 945 is the only fish bearing culvert listed in Table 3. This culvert was first identified during an ODFW AQI survey in 2018 (ODFW, 2018) and further identified during the GRAIP surveys. The culvert is rusted significantly and water is flowing underneath the culvert creating a fish barrier. Stream crossing 949 is on a section of road that has been washed out, therefore every storm event the stream is contributing more road sediment (from the washed out road) to the stream network. Stream crossing 979 is at a known mass-wasting site where a large slide upstream occurred and a debris torrent traveled down the stream bed and washed out the stream crossing at this location. Since this site is already known and with the hazardous nature of this site the mass-wasting event was not surveyed.

Stream crossing 990 is a seasonal stream whose culvert is rusted and causing water to flow around the culvert. The road over this stream crossing is still in good condition and does not appear to be failing, but there is the possibility of failure at a future date due to water flowing around the culvert through road material. Stream crossing 1029 is rusted significantly and the stream water is flowing below the pipe. In addition to the potential of failure at this stream crossing a lot of fine road sediment is draining straight into the stream crossing. At stream crossing 1030 there are 2 road sections that are slumping, it is uncertain if it was the stream flowing around the pipe that caused the road to become saturated and slump or if the slump occurred and caused the stream to flow around the pipe, Figure 21. At this point there is not a lot of sediment added to the stream network from the slumping but it has the potential to completely fail and send a large pulse of sediment into the network.

Gully Formation and Drain Points in Poor Condition

An indication of a drain point or road segment that is draining too much water is the formation of a gully. When the hillslope or road beds are steeper gullies will form more easily from smaller quantities of water than when the grade is gentler. A map of gully locations occurring on the outlet of drain points and where flow paths (e.g., ditches) have been gullied or eroded identifies stretches of road that would benefit from more cross drains, Figure 14. Even though some of these gullies don't connect to streams they are still moving road material from the road prism onto the hillslope requiring costly maintenance more frequently. Some of these road segments have been identified in the above analysis as benefiting from more cross drains, such as Roads 54, 294, 488 and 536.

In addition, many of the drain points that were surveyed were in poor condition, Figure 15. There is a range of how poor the drain point is from being 20-80% blocked all the way to being totally crushed. A list of drain points in poor condition will be provided to all land managers to aid in maintenance.

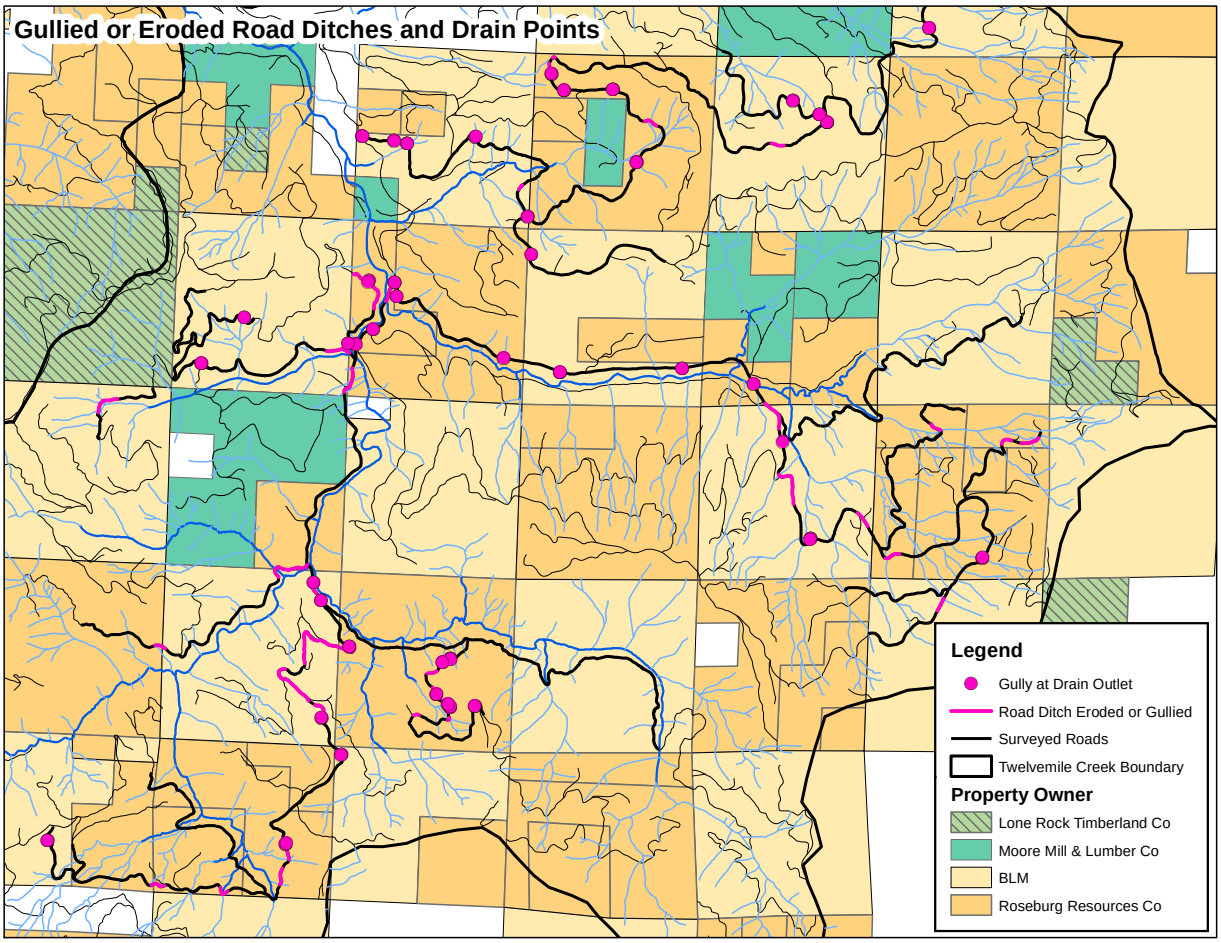


Figure 14. Gullied or eroded drain points and road ditches or flow paths identified in the GRAIP surveys of Twelvemile Creek.

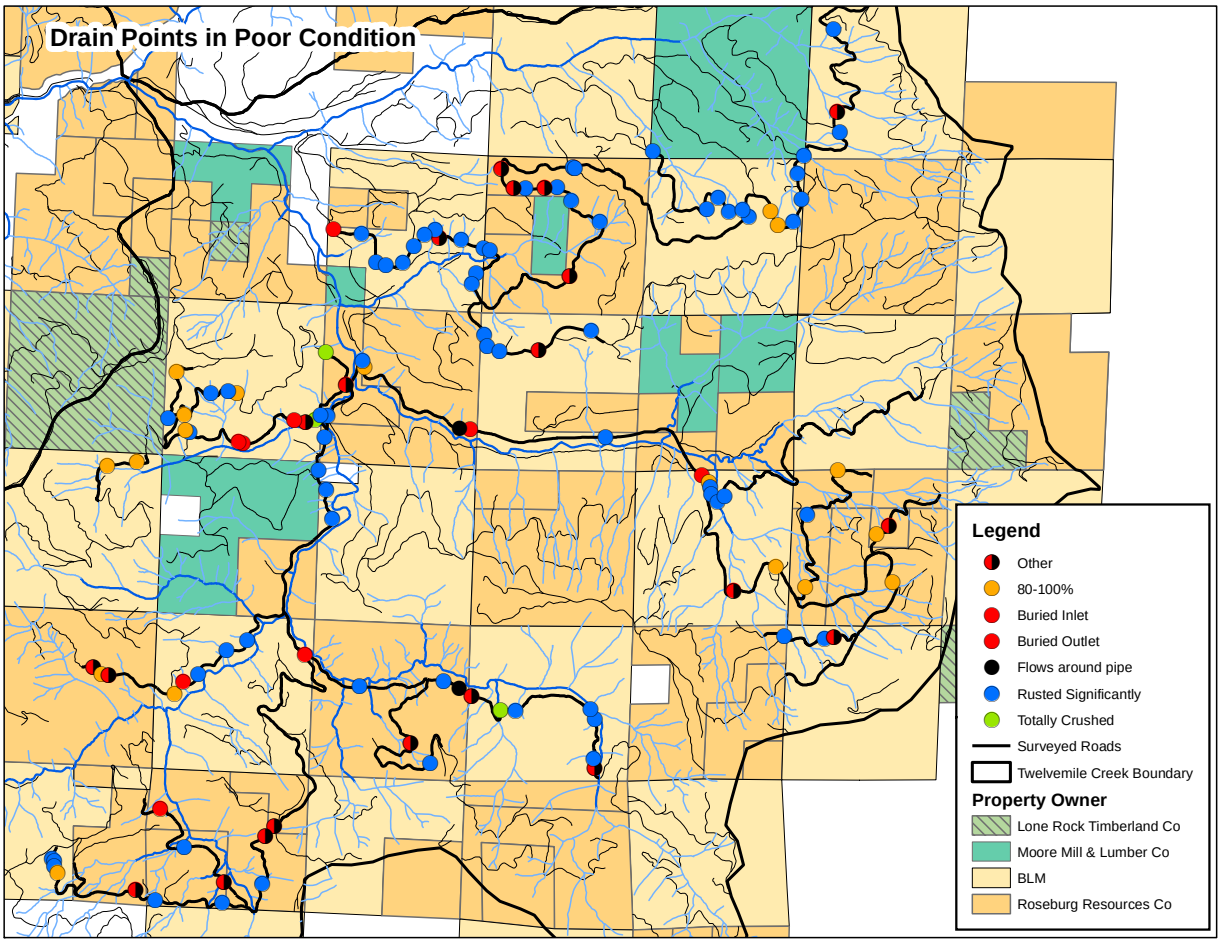


Figure 15. All drain points identified in the Twelvemile Creek GRAIP survey that are in poor condition.

Twelvemile Basin Restoration Prioritization

Twelvemile Creek, like most in the Coquille watershed, is currently suffering from the legacy of historic land use practices that adversely affected watershed health. These problems are limiting native fish viability and impairing water quality in the MFCR watershed. These limiting factors and their causes are:

1) Lack of long-term instream large woody debris (LWD) and a low riffle pool ratio caused by historical logging practices, road construction, and stream cleaning from 1880s to early 1990s. Log jams were historically removed when nearby areas were logged and few large trees were left for natural recruitment.

2) Sediment input above natural conditions caused by historic logging practices, road building and stream cleaning activities and erosion from current unpaved roads.

3) Degraded riparian quality, fish habitat and production caused by intensive management of stream-side forests, current dominance of hardwoods in riparian areas and sediment loading from road networks and erosion.

4) Down-cut channels disassociated from their historic channels caused by erosion from road and logging activities and channel confinement.

Many of the current limiting factors identified in Twelvemile Creek are a result of past logging practices, stream cleaning, and road construction. Historic land use on the project site is consistent with the land use practices in the Coquille watershed and the Coast Range in general. Since the 1850s, accessible areas along the coast and larger rivers have been heavily logged. The increase in the size and number of mills and the advance of technology and road infrastructure in the mid-1900s allowed logging operations to harvest into more remote, headwater areas. These areas were extensively clear-cut with no regard for stream corridors, riparian buffers or fish habitat. Log drives utilizing splash dams and road infrastructure allowed for year-round transport of timber to mills and drastically affected stream ecology and anadromous fish habitat. Timber harvesting up to the stream edge and extensive road construction have left a legacy of down-cut rivers, disconnected floodplains, increased sediment loading, streambank erosion, and reduced density and diversity of riparian vegetation.

The AQI GRAIP analyses reflect these historic drivers. AQI surveys in the Twelvemile Basin show a dramatic lack of large wood debris, stream complexity and riparian shade. In fact, much of Twelvemile has been cut town to bedrock even when there is a clear gravel input from the headwaters. Sections of gravel that do exist are often deeply imbedded in fine material from the road network; making them more difficult for fish to spawn and less hospitable for egg development and survival. The passage of the Oregon Forest Practices Act in 1972 began the process for improving logging practices and road construction, but both the ecology of previously disturbed systems and the logging infrastructure inside these systems are still catching up.

Instream Restoration Prioritization

Instream restoration prioritization was informed by AQI surveys described above, field-based recommendations from the BLM and ODFW, accessibility, and permission from landowners. A restoration grant was developed from this prioritization and submitted to OWEB in Fall of 2019 to capitalize on a large quantity of match in the form of free trees, cost shares and work efficiencies.

For Objectives 1-3, instream restoration designs were crafted after surveying the rare segments of intact high quality habitat in Twelvemile Creek—including the previously unsurveyed Reach 2. At sites, our intent is to mimic naturally formed wood and boulder structures observed elsewhere in the basin as closely as possible given logistical/operational considerations. Our project team has had the opportunity to observe natural recruitment of some trees into Twelvemile Creek over the past two years, which has allowed us to determine which conditions (log angle, quantity, species, size, etc) are most effective at increasing fish habitat quality and quantity. We have also conducted steelhead and Pacific lamprey spawning surveys in Twelvemile Creek, which has allowed us to determine how fish are or are not using habitat features. This basin specific knowledge was considered when designing instream restoration sites and makes us confident that this restoration project will significantly improve the quality and quantity of useable fish habitat in Twelvemile Creek.

Instream restoration actions developed are as follows:

<u>Objective 1: Construct 19 log and boulder structures in the main-stem of Twelvemile Creek during the 2020 IWWP.</u>

Actions:

a) Four log and boulder structures will be placed in Reach 2 on BLM property by Roseburg BLM. Boulders will be sourced from a local stockpile donated by ODOT. Logs and trees with rootwads will be donated from BLM property impacted by the Horse Prairie fire and from the onsite riparian reserve.

b) Ten log and boulder structures will be placed in Reach 4 on Roseburg Forest Products property. Boulders will be sourced from Kincheloe & Sons. Logs and trees with rootwads will be donated from BLM property impacted by the Horse Prairie fire and from the onsite riparian reserve.

c) Five boulder structures will be placed on Roseburg Forest Products property. Boulders will be sourced from Kincheloe & Sons. Boulders.

d) Trees and logs will be delivered and staged by a self-loader and boulders will be delivered and staged by a dump truck. Instream structures will be installed with an excavator or by using a truck mounted cable system to pull material into the channel.

Objective 2: Construct 14 log structures on Dice Creek and 9 log structures on Boulder Creek, tributaries to Twelvemile Creek, during the 2020 IWWP.

Actions:

a) Nine log and boulder structures will be placed on BLM property along Boulder Creek. Boulders will be sourced from a local stockpile donated by ODOT. Logs and trees with rootwads will be donated from BLM property impacted by the Horse Prairie fire and from the onsite riparian reserve.

b) Four log jam sites will be placed on BLM property along Dice Creek. Logs and trees with rootwads will be donated from BLM property impacted by the Horse Prairie fire and from the onsite riparian reserve.

c) Ten log jam sites will be placed on Roseburg Forest Products property. Logs and trees with rootwads will be donated from BLM property impacted by the Horse Prairie fire and purchased from the BLM and Roseburg Forest Products.

d) Trees and logs will be delivered and staged by a self loader and boulders will be delivered and staged by a dump truck. Instream structures will be installed with an excavator or by using a truck mounted cable system to pull material into the channel.

Objective 3: Create habitat improvement by directionally felling 120 trees at 25 sites on two unnamed tributaries to Twelvemile Creek during the 2020 IWWP.

Actions:

a) Trees will be donated on-site from BLM property.

Road Improvement Prioritization

The USFS Geomorphic Road Analysis and Inventory Package (GRAIP) was used to perform on-the-ground surveys and assessment to determine the most significant inputs of the sedimentation in the Twelvemile Creek Basin road network. GRAIP surveys were completed on over 42 miles of roads in the Twelvemile Creek Basin managed by Roseburg Resources and BLM. Within these roads there were 150 seasonal and perennial stream crossings, 323 ditch relief culverts, 34 lead off ditches, 610 other miscellaneous drain points, 41 gullies and 5 active and inactive landslides. Restoration prioritization includes top sediment producing drain points (i.e. gullies, stream crossings, broad based dips), the top sediment producing road segments, and stream crossings that have been determined to be in poor condition.

All of the top sediment producing locations within the Twelvemile Creek Basin are on roads managed by Roseburg Resources and the BLM. We will choose from the top drainage points (Table 1), road segments (Table 2), and stream crossings in poor condition (Table 3) as funding and maintenance schedules from our partners allows.

Our restoration goals for Twelvemile Creek road improvements are as follows:

- Improve road conditions to fix five of the top sediment producing drain points

- Upgrade at least two of the stream crossings listed as being in poor condition
- Improve conditions on five of the road segments that produce the most sediment
- Work with public and private timber partners on other sediment producing road issues for roads slated to receive improvements due to upcoming timber sales.

Permitting

Due to our partnership with the Roseburg BLM, all restoration including instream and road improvements can be covered under the Aquatic Restoration Biological Opinion (ARBO II) with BLM coordination. Some road improvements may also be permitted through an ODF notification. Any additional land use approval will be coordinated with the Douglas County Planning Department.

Acknowledgements

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