Dead Laundry Project:
Water Resource Effects Analysis

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Introduction

This report provides an analysis of how proposed activities would impact water resources in the Dead Laundry project area. The analysis focuses issues that have potential to significantly affect water resources. Other issues not analyzed herein are addressed with an explanation of why. Issues were identified through a combination of internal and external scoping.

This report also demonstrates how the project maintains consistency with all water resources- related management direction in the 1987 Land Management Plan for the Clearwater National Forest ("Forest Plan") (USDA, 1987) and other applicable laws, rules, and regulations.

Description of Purpose and Need for Proposed Action

The Dead Laundry project's purpose and need is to reduce hazardous fuel loading to provide protection for the wildland urban interface (WUI) areas, harvest wood products to sustain local and regional economies, and improve forest health and resiliency. These project objectives will be accomplished by: (a) focusing on a tree species mix that retains the largest, most healthy western larch, western white pine, ponderosa pine, and western red cedar, while reducing the diseased and decadent grand fir and Douglas-fir component; (b) reestablishing white pine and western larch; (c) reducing vegetative density to allow for increased tree vitality by reducing competition and even-aged management of stands impacted by root disease while restocking with disease resistant species; and (d) improving the age class distribution and spatial arrangement of young and mature stands across the landscape.

Issues Addressed

The Dead Laundry project proposed action include commercial harvest; old growth enhancement; landscape prescribed fire; landscape and activity fuels treatment; temporary and new system road construction; system road reconditioning and reconstruction; and temporary road decommissioning through obliteration. Water resource parameters that could potentially be affected by these proposed actions are water quality and quantity.

Cause-Effect Relationships

The balance of water yield and sediment yield in a watershed influences the water quality/quantity of a stream system. Water yield refers to stream flow quantity and timing, and is a function of water, soil, and vegetation interactions. Sediment yield refers to sediment delivered to stream channels and transported through the stream channel network, and is also a function of water, soil, and vegetation interactions.

Water Quantity – Peak Stream Flows & Water Yield

Removal of tree canopy and vegetation can affect how water moves through a watershed (Grant et al., 2008; Jones & Post, 2004) and the stability of stream channels downstream (Olsen et al., 1997). Vegetation removal can either occur as a result of natural events such as wildfire, insect/disease outbreaks or human-caused activities such as timber harvest, mining, and conversion of forested lands to other land uses. Prior research has so far not revealed a direct link between timber harvest and changes to stream channel form and function. Recent research suggests that any potential effects of vegetation removal from timber harvest is typically limited to low-gradient reaches, and the likelihood of stream channels being affected by small changes to the size of peak stream flows is very low (Safeeq et al.,2020). However, a measure of 20-30% Equivalent Clearcut Area (ECA) is generally recognized as a warning of deleterious effects (Gerhardt, 2000). Analysis of water yield is probably not necessary for treatments that remove

20% or less of the basal area of vegetation, as approximately 20% percent of the basal area must be removed before a statistically significant change in annual runoff can be detected (Troendle et al. 2009).

Water Quality – Sediment Delivery

Active erosion of the landscape yields sediment to streams and occurs naturally. When an excess of sediment over the natural (balanced) amount is delivered to a stream, the stream's ability to route the sediment from the system may be diminished, sediment deposition may occur, water quality may decline, and fish habitat potential may be reduced. Harvest, road construction, prescribed fire, and road-related activities have the potential to increase soil erosion and sediment delivery to streams.

Sediment delivery to streams can result from events such as landslides and wildfires. These events can deliver tremendous amounts of sediment but occur infrequently over time. Moody and Martin (2009) reviewed post-wildfire literature and found that wildfires resulted in an average of 37 tons/acre of sediment delivery from hillslopes, with even larger yields from stream channels. Aquatic ecosystems on the forest have evolved within the context of these kinds of events.

Sediment inputs to stream channels occur as a complex series of pulses that are delivered and stored within low-order, high-gradient stream channels (Benda & Dunne, 1997). Sediment accumulates for centuries within these channels before being transported or "flushed" downstream by episodic events with large increases in water yield (Kirchner et al., 2001). Transport of sediment plays a fundamental role in the natural function of forested watersheds. However, too much sediment damages aquatic and fish habitat, disrupts the connection between surface and groundwater in streams, enhances the transport of pollutants, and increases treatment costs associated with municipal water withdrawal (Rehg, Packman, & Ren, 2005).

Forests generally have very low average erosion rates unless they are disturbed (Elliot, Hall, & Scheele, 2000). Common disturbances include timber harvest operations, roads, prescribed burning, and wildfires (Elliot, Page-Dumroese, & Robichaud, 1999). Impacts to soil erosion from these activities last a few years before rapid revegetation covers the surface with protective plant litter (Elliot, 2004). However, not all impacts to soil erosion are short-lived. Numerous research studies have documented that forest roads are usually the leading human-caused contributor of sediment to stream channels (Bilby, Sullivan, & Duncan, 1989; Duncan, Bilby, Ward, & Heffner, 1987; Gucinski, Furniss, Ziemer, & Brookes, 2001).

Forest roads can be chronic sources of sediment because road construction, use, and maintenance compact soils, reduce infiltration, intercept and concentrate surface and subsurface runoff, and limit the growth of vegetation. Road ditches can alter natural drainage patterns and move sediment directly from roads into streams (Wemple et al., 1996). Also, roads can increase the frequency and magnitude of landslides by undercutting the base of unstable slopes; intercepting, diverting, and concentrating runoff to unstable hillsides; and through damage caused by plugged culverts that cause water to overtop the road.

Watershed Function – Road Density

Road density can provide a relative measure of road-stream interaction and the relative risk for increased flows and sediment input into stream systems. Road density is sometimes used as a surrogate for impacts to streams and watersheds and is related to reduced fisheries composition and persistence at higher densities. A review of research in Idaho and elsewhere concluded that non-channelized runoff from roads has a low probability of travelling further than 300 feet (Belt et al., 1992).

Methodology

Spatial Bounds of Effects Analysis

Unless otherwise stated, I analyze direct, indirect, and cumulative effects at the subwatershed scale (6th level hydrologic unit code; HUC 12). This ensures that the effects of the proposed activities are analyzed at the scale of an entire stream system and encompass not only the steep, headwater streams at the project site but also the lower-gradient stream reaches where effects are most likely to occur. Additionally, this scale matches that used by the Idaho Department of Environmental Quality when developing Total Maximum Daily Loads for impaired waterbodies.

The Dead Laundry project area encompasses 40,565 acres in total, and is located within 4 United States Geological Survey (USGS) Hydrologic Unit Code 12 (HUC12) subwatersheds: Lake Creek (HUC12 #170603070104), Elizabeth Creek-North Fork Clearwater River (HUC12 # 170603070105), Osier Creek (HUC12 #170603070301) and Deadwood Creek-Moose Creek (HUC12 #170603070303) (Figure 1). 6,024 of these acres are proposed for treatment, with 3,845 of those selected acres consisting of commercial harvest (regeneration or intermediate) and are within the Clearwater Forest Plan Management Area (MA) E1, timber producing lands.

Temporal Bounds of Effects Analysis

Direct and indirect effects are assessed from the initiation of project implementation through project completion. Cumulative effects are assessed from project initiation through project completion and include past activities that result in the current condition. Harvest and road actions would likely occur within three to four years of project implementation, and prescribed fire could occur up to 10 years from project implementation. Potential effects to water quality would be short-term (three to five years), as vegetation would rapidly re-establish to provide ground cover that minimizes surface runoff and erosion. Potential effects to water yield could be long-term (up to 30 years) as vegetation re-grows to increase canopy cover.

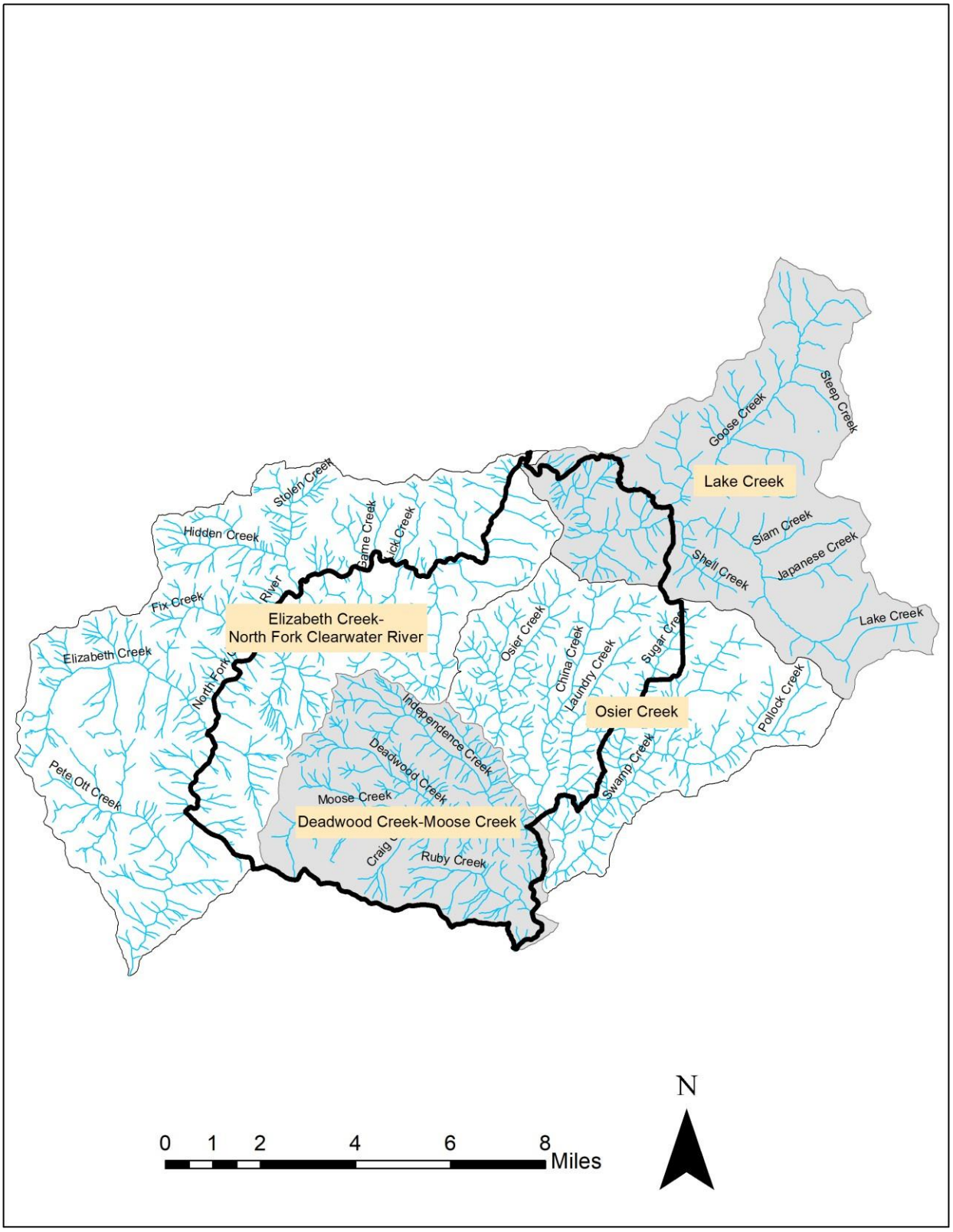

Figure 1 - USGS HUC12 subwatersheds in the Dead Laundry project area (outlined).

Required Design Features

The Design Features required to ensure compliance with the regulatory framework and reduce the risk of adverse impacts to water resources are documented in the project file.[1]

Resource Indicators and Measures

Table 1. Resource indicators and measures for assessing effects to water resources

Resource Element	Resource Indicator	Measure (Quantify if possible)
Water Quantity	Peak Stream Flows & Water Yield	Equivalent Clearcut Area (percent)
Water Quality	Sediment Delivery	Amount of sediment delivery to project streams (tons/acre/year)
Watershed Function	Road Density	Miles of road per mile^2 (miles/mile^2)

Resources Not Analyzed in Detail

Proposed activities would not affect floodplains, wetlands, or municipal watersheds because of the lack of cause-effect relationship. No municipal watersheds are located within, adjacent to, or downstream of the project area (https://data-idwr.opendata.arcgis.com/pages/gis-data). The proposed action would not alter any existing water rights claims or decrease the available water relative to these claims. No source water areas are located within the Dead Laundry project area (IDEQ, 2020).

All Dead Laundry project activities should maintain or improve water quality; therefore, the Dead Laundry project is designed to produce no measurable increase in sediment or temperature. The project would adhere to PACFISH/INFISH buffer requirements in Riparian Habitat Conservation Areas (RHCAs) per the Clearwater National Forest Plan (USDA, 1987). RHCAs maintain floodplains and most wetlands. Best Management Practices that protect water quality within the spatial and temporal bounds of the analysis (See "Spatial and Temporal Bounds of Effects Analysis" section above) would also maintain wetland resources. New road construction would cross one small, headwater streams. The limited spatial extent of the effects (limited to the road prism) and the use of Design Features and Best Management Practices would minimize effects. A small amount of non-commercial hand-felling would occur within RHCAs as part of the fuel reduction treatments, primarily in the vicinity of the designated WUI areas, following specific limitations[2]. Fuel reduction activities would not alter riparian canopy cover conditions, and there would be no effect on water temperature. Consequently, water temperature is not a water quality concern, and is not used as an indicator of water quality.

Data Sources

Table 2. Data sources for the analysis of project effects to water resources.

Data Type	Source Name	Updated[3]	Description
Aerial Imagery	National Agriculture Imagery Program (NAIP) Imagery	2019	NAIP acquires aerial imagery during the agricultural growing seasons in the continental U.S. A primary goal of the NAIP program is to make digital ortho photography available to governmental agencies and the public within a year of acquisition. NAIP imagery is acquired at a one-meter ground sample distance with a horizontal accuracy that matches within six meters of photo-identifiable ground control points, which are used during image inspection. The default spectral resolution is natural color.
Aerial Imagery	Google Earth	Ongoing	Google Earth allows users to view historical imagery for a range of dates. Aerial imagery from 1998, 2004, 2009, 2013, and 2014 was accessed. Images contain Landsat imagery from NASA Goddard Space Flight Center and U.S. Geological Survey and modified Copernicus Sentinel data.
Bare Earth Hillshade	Project Specific LiDAR (Light Detection And Ranging) – Dead_Laundry_DerivativeGDB	2015	LiDAR is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth. These light pulses – combined with other data recorded by the airborne system – generate precise, three-dimensional information about the shape of the Earth and its surface characteristics. A LiDAR instrument principally consists of a laser, a scanner, and a specialized GPS receiver. Airplanes and helicopters are the most commonly used platforms for acquiring LiDAR data over broad areas. Topographic LiDAR typically uses a near-infrared laser to map the land. This particular LiDAR-derived bare earth hillshade has a resolution (that is, cell size) of 1 meter.
Elevation Data	Project Specific LiDAR – Dead Laundry_DerivativeGDB	2015	This LiDAR-derived bare earth elevation model has a resolution of 1 meter.
Elevation Data	USFS Region 1 LiDAR Data	2009	This LiDAR-derived bare earth elevation model has a resolution of 10 meters.
Forest Service Management Activities	Forest Service Activity Tracking System (FACTS)	Ongoing	The FACTS database tracks the status of proposed forest management activities on National Forest System lands, including timber harvest, prescribed fire, and restoration activities.

Data Type	Source Name	Updated[3]	Description
HUC 12 Watershed Boundaries	Watershed Boundary Dataset	Ongoing	The intent of defining Hydrologic Units within the Watershed Boundary Dataset is to establish a base-line drainage boundary framework, accounting for all land and surface areas. Hydrologic units are intended to be used as a tool for water-resource management and planning activities particularly for site-specific and localized studies requiring a level of detail provided by large-scale map information. The Watershed Boundary Dataset is a comprehensive aggregated collection of hydrologic unit data consistent with the national criteria for delineation and resolution. It defines the areal extent of surface water drainage to a point except in coastal or lake front areas where there could be multiple outlets as stated by the "Federal Standards and Procedures for the National Watershed Boundary Dataset" "Standard" (http://pubs.usgs.gov/tm/11/a3/). Watershed boundaries are determined solely upon science-based hydrologic principles, not favoring any administrative boundaries or special projects, nor particular program or agency. This dataset represents the hydrologic unit boundaries to the 12-digit (6th level) for the entire United States. At a minimum, they are delineated at 1:24,000-scale in the conterminous United States.
Road Data	US Forest Service Infrastructure Database (Infra)	Ongoing	Infra stores road-related data such as jurisdiction, road surface type, and road maintenance level for all Forest Service system roads.
Soil Types	Web Soil Survey	2019; retrieved on 11/12/2019	Web Soil Survey provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95% of the nation's counties. The site is updated and maintained online as the single authoritative source of soil survey information.
Source Water Protection Areas	Forest Service S_R01.WaterSourceDeli neationsIdaho	Unknown	These datasets are part of the Idaho Department of Environmental Quality's Source Water Protection program. Delineations, also known as capture zones, were created as part of the State of Idaho Source Water Protection program. The delineations can be classified as one of two categories: fixed radius and modeled. Transient and surface water systems were delineated with the fixed radius method. The remaining systems were delineated utilizing groundwater modeling.

Analytical Assumptions

All Water Resources

- All analysis and modeling are based upon the best available data. I have done my best to disclose any data gaps or unknown information. If new information should become available, it would be stated and incorporated into the analysis.
- All values in this analysis are approximate. Small changes in treatment area or length may occur after this analysis is complete. Such changes do not substantially affect its results or conclusions.
- INFISH Riparian Habitat Conservation Areas (stream-side areas managed specifically to maintain and improve water quality and fish habitat) would exclude commercial timber harvest within the areas described in the Design Features[1]. Thinning may be done by sawyers on foot within non-commercial thinning and fuels reduction units that overlap Riparian Habitat Conservation Areas[2]. If additional water features or landslide-prone areas are found in the field during layout and implementation, the appropriate Riparian Habitat Conservation Area width would be applied.

Water Quantity– Peak Stream Flows & Water Yield

- ECA analysis takes a snapshot in time with the assumption that all activities within the Dead Laundry proposed action are implemented the first year following the decision.
- ECA resulting from the implementation of the proposed action was added to the existing ECA for a cumulative ECA estimate immediately following implementation of the Dead Laundry project.
- ECA predictions are used to compare alternatives and are not viewed as absolutes.
- The ECA water yield indicator serves only as a flag that suggests there may be potential for decreased channel stability due to sustained increased energy in the stream channel. ECA is used in combination with other indicators, such as channel stability and channel type, to determine hydrologic risk.
- The area of clearing associated with new temp roads, existing temp roads, and system roads is equal to the length multiplied by the travel way width of a given road segment.
- Roads can contribute to increased peak stream flows by extending the stream network and increasing drainage efficiency (Jones & Grant, 1996; Wemple et al., 1996). Using Best Management Practices on existing roads to disconnect road segments from the stream network reduces contributions to peak stream flow increases.
- Harvest levels can be at the higher end of the range before peak stream flow effects occur in watersheds with lower road density and road connectivity, slower drainage efficiency, patchier forest harvest, and greater riparian area widths (that is, higher watershed condition). Harvest levels at the lower end of the range can affect peak stream flows in watersheds in a lower watershed condition (Grant et al., 2008; Wemple et al., 1996).
- Natural disturbances (for example, landslides, wildfire, insect and disease outbreaks) prevent a watershed from ever being 100% forested. Therefore, when this analysis compares the existing or modeled future condition to the natural conditions, it provides an overestimate of peak flow change.

- The limit of detectable change to flow measurements is approximately 10% (Grant et al., 2008). Smaller changes are within the range of natural variability and measurement error and are undetectable.
- Peak stream flow increases do not affect steep channel types (for example, cascade and step-pool) (Grant et al., 2008). Gravel- and sand-bed channels are more susceptible to peak stream flow-related changes in channel form and function.
- Hydrologic recovery occurs gradually with substantial recovery occurring within 20 to 30 years after harvest (Callahan, 1996). As forest stands mature, evapotranspiration and canopy processes (snowfall interception, shade, etc.) return to pre-disturbance levels. Paired watershed studies suggest that increases in annual water yield resulting from clearcutting disappear within 30 years (Julia A. Jones & Post, 2004; Perry & Jones, 2017). As a result, stands that were harvested 30 years ago will achieve substantial hydrologic recovery over the course of project implementation.
- Intermediate and non-commercial treatments are less intensive than regeneration harvest and would affect peak stream flows less. These differences were represented in the analysis using custom ECA factors, determined in collaboration with silviculture personnel.

Water Quality - Sediment Delivery (Hillslopes)

- Treatment units were analyzed as being logged with the most impactful system probable given the slope, distance from roads, and unit shape. Some treatment units may use more than one type of logging system but would be analyzed for the most impactful. This overestimates ground disturbance and effects to water resources.
- Non-commercial hand-felling would not cause a detectable increase in erosion or runoff, and units where this is proposed will not be analyzed for sediment effects.
- The “20 Year Old Forest” treatment/vegetation type in Disturbed WEPP with 100% cover most closely matches the existing condition of forested treatment units (Dun et al., 2009; Elliot et al., 2000).
- The “5 Year Old Forest” treatment/vegetation type in Disturbed WEPP with 90% cover most closely matches the condition of forested treatment units where ground-based harvesting and grapple piling of activity fuels occurs (Dun et al., 2009; Elliot et al., 2000).
- The “Low Severity Fire” treatment/vegetation type in Disturbed WEPP with 90% cover most closely matches the condition of treatment units where cable-based harvesting and broadcast burning of activity fuels or prescribed fire occurs (Elliot, 2013; Elliot et al., 2000).
- Design Features, Best Management Practices, and Riparian Habitat Conservation Areas would minimize sediment delivery from treatment units (Litschert & MacDonald, 2009; Rashin, Clishe, Loch, & Bell, 2006; Roper, Saunders, & Ojala, 2019; Warrington et al., 2017).
- At best, any predicted runoff or erosion value is within plus or minus 50% of the true value (Elliot et al., 2000).
- Erosion rates are highly variable, and most models can predict only a single value. Replicated research shows that observed values vary widely for identical plots or the same plot from year to year (Elliot, Foltz, & Luce, 1995; Tysdal, Elliot, Luce, & Black, 1999). Spatial variability and variability of soil properties add to the complexity of erosion prediction (Robichaud & Monroe, 1997). Multiple studies demonstrate the ability of WEPP to accurately estimate runoff and

sediment delivery from management activities and fire (Dun et al., 2009; Elliot, 2004; Laflen, Flanagan, & Engel, 2004).

- WEPP predictions of sediment delivery reflect the influence of large storm events in WEPP simulations and results. These large events, while predicted to generate runoff volumes that could deliver sediment through a Riparian Habitat Conservation Area, are infrequent and have a low probability of occurring.
- Sediment delivery less than 0.5 ton/acre/year is undetectable and negligible (Elliot and Miller, 2004).

Water Quality – Sediment Delivery (Roads)

- Non-channelized runoff from roads is unlikely to travel more than 300 feet with most sediment settling out within 200 feet of where the road drains to the forest floor (Belt et al., 1992).
- GRAIP_Lite (Nelson et al., 2019) is an adequate tool to efficiently identify road segments that pose the greatest risk of chronic sediment delivery to streams and to estimate the degree of "before-after" change to sediment delivery from road-related activities at a subwatershed scale. The accuracy of the GRAIP_Lite modeling results is not adequate for use in quantifying the absolute amounts of sediment production for road segments in this analysis. However, GRAIP_Lite model results can be effectively be used to compare pre-treatment (current conditions) and post-treatment (recovered condition) sediment delivery rates.
- When using the GRAIP_Lite sediment prediction model, the disturbed conditions model assumes all haul routes and temporary routes experience high traffic. Operational Maintenance Level 1 routes and temporary routes were modeled as Maintenance level 2 in the disturbed condition.
- When using the GRAIP_Lite sediment prediction model, all routes listed as ATV trails in the travel Plan, all new construction routes, and all Maintenance Level 1 routes are assumed to be placed into storage after project implementation. All temporary routes are assumed to be decommissioned following project implementation. Additional route-specific assumptions[4] were also parameterized in the GRAIP_Lite sediment prediction model.
- No Best Management Practices, such as graveling or engineered drainage structures, were included when modeling the current, disturbed, or recovered conditions in GRAIP_Lite. The Forest Service effectively uses Best Management Practices (Stone & Hess, 2016), and site-specific Best Management Practices minimize road-related sediment delivery to streams and subsequent effects to water quality and the aquatic environment (Cristan et al., 2016; Edwards et al., 2016; Ice et al., 2004; Seyedbagheri, 1996; Sugden, 2018; Warrington et al., 2017). Therefore, modeled sediment delivery results from the GRAIP_Lite are likely an overestimation and represent a worst-case scenario.
- Recontouring/obliterating temporary roads, decommissioning system roads, and placing roads into storage minimizes their contribution to long-term runoff, erosion, and, sediment delivery (Foltz, Rhee, & Yanosek, 2007; Sugden, 2018; Switalski, Bissonette, DeLuca, Luce, & Madej, 2004).
- When sediment leaves a road, the greatest impact to water quality is immediately below where it enters a stream. Effects decrease quickly within several hundred feet and return to near-background levels within ½ mile even without mitigation (Foltz, Yanosek & Brown, 2009). I assume that using Best Management Practices reduces how far downstream sediment effects

travel and that effects decrease to near-background levels within approximately 1,000 feet based on inferences from this research and professional judgment.

Watershed Function – Road Density

- Road density is a measurement of length of roads divided by their respective area. Road density is commonly used as an indicator of disturbance rather than a specific measure of sediment input from roads (Al-Chokhachy et al. 2016).
- Decommissioned roads have either had a combination of activities performed to render them hydrologically stable (for example, recontouring, decompaction, removal of stream crossing culverts, waterbarring, etc.) or were previously abandoned and have well-vegetated road prisms. My field experience indicates that these roads typically have very low erosion rates, minimal sediment delivery to waterbodies, and flow patterns similar to undisturbed forest hillslopes. Research also suggests that this is the case (Daigle, 2010; Foltz et al., 2007; Switalski et al., 2004). Similarly, stored roads are intensively treated to minimize effects to streams and other waterbodies and have effects similar to decommissioned roads.

Analysis Methods

Water Quantity – Peak Stream Flows & Water Yield

Predicted changes in water yield within the Dead Laundry project area HUC12 subwatersheds are assessed using the indicator of ECA, which represents the amount of forest canopy openings in a watershed, and is often used as surrogate for water yield. While there are no Federal, State of Idaho, or Forest Plan standards governing increases in water yield, there is general guidance on thresholds (NOAA 1998, Gerhardt 2000). ECA analysis is a tool used to correlate the relationship between water yield and the extent of forest canopy openings from fire, harvest, and roads. The water yield indicator serves as a red flag that suggests there may be potential for decreased channel stability due to sustained increased energy in the stream channel.

The Matrix of Pathways and Indicators of Watershed Condition (NOAA, 1998) categorizes ECA at the HUC12 subwatershed scale (10,000-40,000 acres) to rate the quality of watershed condition, where the lower the percent ECA, the higher (better) the watershed condition. ECAs of less than 15% indicate high (good) watershed condition; 15-30% indicates moderate (fair) watershed condition; and greater than 30% indicates low (poor) watershed condition (NOAA 1998). The *Matrix of Pathways and Indicators of Watershed Condition* was developed to evaluate the effects of human actions on habitat components important to salmonids (NOAA 1998). ‘High’ designations refer to watersheds considered to be properly functioning with high habitat conditions, ‘Moderate’ are watersheds functioning at moderate habitat conditions and potentially at risk, and ‘Low’ are watersheds functioning at low habitat conditions or not functioning properly. The regulatory agencies that developed the Matrix did not intend for it to establish minimum management thresholds; rather, to highlight habitat indicators that collectively defined properly functioning conditions. The Matrix is also intended to determine if actions would impair attainment of PACFISH objectives, particularly those that speak to “maintenance or enhancement” of stream conditions. The value of one indicator is not representative of overall watershed condition.

Water Quality – Sediment Delivery

Forest Plan Appendix K specifies water quality standards and maximum allowable percent sediment yield increase over natural conditions criteria for project area streams (USDA, 1987). Sediment delivery from hillslopes and roads were modeled separately using the methods described below.

Water Quality – Sediment Delivery (Hillslopes)

Water Erosion Prediction Project (WEPP) runoff and erosion prediction model (Flanagan and Livingston 1995) was used to estimate average annual soil erosion and sediment delivery for proposed harvest, activity fuels, fuels thinning and prescribed fire treatments. WEPP is a process-based, spatially distributed hydrology and erosion prediction model that predicts runoff, soil erosion, and sediment delivery by considering specific soil, climate, ground cover, and topographic conditions. It was developed by an interagency group of scientists including the U.S. Department of Agriculture's Agricultural Research Service, Forest Service, and Natural Resources Conservation Survey; and the U.S Department of the Interior's Bureau of Land Management and Geological Survey.

Custom online interfaces to the WEPP model have been developed by the U.S. Forest Service Rocky Mountain Research Station specifically to assist forest land managers in the selection and assessment of site-specific management options. The hillslope portion of the sediment analysis was performed using the Disturbed WEPP on-line interface[5]. At best, any predicted runoff or erosion value would be within plus or minus 50% of the true value. Erosion rates are highly variable, and most models can predict only a single value. Replicated research has shown that observed values vary widely for identical plots, or the same plot from year to year (Elliot et al. 1995; Tysdal et al. 1999). Additionally, spatial variability and variability of soil properties add to the complexity of erosion prediction (Robichaud 1996).

The Rocky Mountain Research Station Climate Generator (Rock:Clime)[5] to generate climate parameters. Rock:Clime uses PRISM, a precipitation model within the U.S. Forest Service WEPP models, to adjust precipitation and temperature based on elevation and topography from established weather station data. The model allows users to input latitude and longitude and then adjusts the climate for that particular location. A location near the center of the project area was selected for input into Rock:Clime. The silt loam soil type was selected for all units because it has the highest erodibility, thus providing a "worst-case scenario" parameterization for all units. The Distributed WEPP Batch online interface[6] was used to estimate average sediment delivery from treatment units for a 30-year simulation period under existing conditions and after the proposed treatment.

Water Quality – Sediment Delivery (Roads)

GRAIP_Lite is a system of tools developed for ArcGIS that is used to model road-related sediment impacts to stream habitats (Nelson et al., 2019). GRAIP_Lite uses a topographic model, along with other inputs, to create road segments, applies average vegetation parameters and calculates sediment production from individual road segments, uses a local polynomial fit to describe stream connection probabilities and fractional sediment delivery based on flow distance to streams, and accumulates routed sediment throughout the modeled stream network. The output (specific sediment; Megagrams/year/kilometer^2) can easily be used to determine areas where roads are more likely to contribute excess sediment to stream habitats.

Field work was conducted in 2019. Existing system roads were traveled, the location and condition of sediment delivery points to streams were documented, delivery points were photographed, and conditions-based, site-specific Best Management Practices to minimize road-stream interactions prescribed.

When using the alternatives analysis function, GRAIP _Lite allows the user to specify various treatment options for individual road segments then models the road-related sediment conditions at the initial condition (before work begins), disturbed condition (during and immediately following project activities),

and recovered condition (once vegetation has recovered to normal values). As with the WEPP models, absolute values of sediment delivery and accumulation in streams often deviate from the true value, due to the high spatiotemporal variability of erosions rates and sediment delivery. However, GRAIP_Lite alternatives function is a useful tool for comparing pre- and post-activity sediment delivery for a range of proposed treatment options.

The model output, Gl_SedDel (Accumulated sediment, kilograms/year) was converted to tons/acres/year. This was accomplished by estimating the area occupied by modeled roads using assumed travel way widths and road segment lengths. Accumulated (delivered) sediment from individual road segments were divided by corresponding road area, then summarized at the subwatershed scale (HUC12).

Watershed Function – Road Density

Road density was calculated by dividing the total road miles by the area of the subwatershed (HUC12 areas, in mi^2). Roads that were previously decommissioned or rendered hydrologically stable and placed into storage are not included in road density calculations. No temporary roads were included in the existing road density calculations, nor were they included in the Proposed Action (Alternative 2) road density calculations.

Existing Condition

Conditions in the project area watersheds are a result of both natural processes and human activities. Past human related activities include mining, timber harvest, prescribed fire, recreation, road building, and road maintenance.

Beneficial Uses and TMDLs

Beneficial uses of analysis area streams are identified by Idaho Department of Environmental Quality (IDEQ) in the 305(b) Integrated Report and are summarized in Table 3 below (IDEQ, 2020). Seven streams within the analysis area are on the IDEQ 303(d) list and have a Total Maximum Daily Load (TMDL) in place for sediment or temperature (IDEQ, 2003; IDEQ, 2018). Table 4, below, contains a summary of TMDLs on analysis area streams.

Table 3. Beneficial uses of project area streams listed on the IDEQ 305(b) Integrated Report (IDEQ 2020).

HUC12 Subwatershed	Stream Name	Beneficial Uses			
		Assessed	**Supporting**	**Not Supporting**	**Cause (If Not Supporting)**
Elizabeth Cr – North Fork Clearwater R	Comet Cr	CWAL, PCR, SS	CWAL, PCR, SS		
	Deception Gulch	CWAL, PCR, SS	PCR	CWAL, SS	Sed/Silt, WT
	Lake Cr (Goose Cr to mouth)	CWAL, SS, SCR	SCR	CWAL, SS	WT
	Lake Cr (above Goose Cr)	CWAL, SS	CWAL, SS		
Osier Cr	Osier Cr	CWAL, SS, SCR	SCR	CWAL, SS	WT
	China Cr	CWAL, SS, SCR	SCR	CWAL, SS	WT
	Laundry Cr	CWAL, SS, SCR	SCR	CWAL, SS	WT
	Sugar Cr	CWAL, SS, SCR	SCR	CWAL, SS	WT

Deadwood Cr - Moose Cr	Deadwood Cr	CWAL, SS, SCR	CWAL, SS, SCR		
	Independence Cr	CWAL, SS, SCR	CWAL, SS, SCR		
	Moose Cr (source to Osier Cr)	CWAL, SS, SCR	CWAL, SS, SCR		
	Moose Cr (Osier Cr to mouth)	SCR	SCR		
	Ruby Cr	CWAL, SS	CWAL, SS		
Key					
CWAL =	Cold Water Aquatic Life	SCR =	Secondary Contact Recreation		
SS =	Salmonid Spawning	WT =	Water Temperature		
PCR =	Primary Contact Recreation	Sed/Silt =	Sedimentation/Siltation		

Table 4. TMDL summary of Dead Laundry project area streams.

HUC12 Subwatershed	Stream	TMDLs Completed	TMDL Boundary	Forest Service Observed*** Temperature (Cold Water Aquatic Life and Salmonid Spawning)
Elizabeth Cr- North Fork Clearwater R	Deception Gulch*	Temperature, Sediment	HW to North Fork Clearwater R	15.2°C (Mean Daily Maximum) 12.6°C (Mean Daily Average)
Lake Cr	Lake Cr**	Temperature	Goose Cr to North Fork Clearwater R	17.0°C (Mean Daily Maximum) 14.1°C (Mean Daily Average)
Osier Cr	Osier Cr*	Temperature	HW to Moose Cr	18.6°C (Mean Daily Maximum) 13.9°C (Mean Daily Average)
	China Cr*	Temperature	HW to Osier Cr	15.8°C (Mean Daily Maximum) 12.9°C (Mean Daily Average)
	Laundry Cr*	Temperature	HW to Osier Cr	13.0°C (Mean Daily Maximum) 11.7°C (Mean Daily Average)
	Sugar Cr*	Temperature	HW to Swamp Cr	Data not available
*IDEQ (2003)				
**IDEQ (2018)				
*** Values displayed are means over period of record (1994-2013) measured at or near stream mouth				

Water Quantity – Peak Stream Flows and Water Yield

Existing ECA was predicted using treatment and recovery coefficients from Ager and Clifton (2005). Forest silviculture staff provided appropriate treatments coefficients for silvicultural prescriptions not included in Ager and Clifton (2005). The Forest Service acquired roughly 16,000 acres of land in 1996 within the project area HUC12 subwatersheds. Management of this land prior to acquisition is largely unknown. Therefore, the ECA calculations assumed a clearcut without retention (the treatment which would cause the largest potential ECA value) was carried out on the 1996 exchanged lands. Considering ECA, NOAA (1988) indicates the existing condition is high for all project area HUC12 subwatersheds as existing

ECA values are less than 15%. Table 3, below, contains the existing ECA and associated watershed condition.

Table 5. Existing equivalent clearcut area (ECA) of project area HUC12 subwatersheds and associated watershed condition (NOAA 1998).

HUC12 Subwatershed	HUC12 Area (ac)	Existing ECA* (%)	Watershed Condition (NOAA 1998)
Deadwood Cr - Moose Cr	14307.2	0.6%	High
Elizabeth Cr -North Fork Clearwater R	38555.5	13.3%	High
Lake Cr	22061.0	7.1%	High
Osier Cr	19829.9	8.8%	High

*The existing condition ECA assumes roughly 16,000 ac acquired by the Forest Service in 1996 was clearcut without retention in 1996. This is a conservative estimate as prior management of the ~16,000 ac parcel was not recorded.

Water Quality – Sediment Delivery

The results of Disturbed WEPP Batch (Eliot and David, 2010) was to used to model average annual sediment delivery rates within the analysis area under natural conditions. Disturbed WEPP predicts an annual average natural sediment delivery rate of 3.24 tons/mi^2 (0.005 tons/ac) within the project area[6]. This rate assumes a mature forest landscape and does not consider road-related sediment, sediment produced from land management, or sediment produced from landslides.

The results of the GRAIP_Lite modeling estimate that system roads, described in the "Analysis Methods" section, deliver an average of 0.72 tons of sediment per acre, per year to streams[7] (Table 9). This rate does not consider sediment produced from land management, or sediment produced from landslides.

Existing condition percent sediment yields over natural for project area streams, where available, are produced from the Clearwater National Forest Watershed Condition Report (Jones and Murphy 1997) and presented in Table 6. These sediment yields are based on watershed modeling, and indicate that project area streams, within modeled drainages, were meeting Forest Plan percent sediment yield over natural conditions criteria in 1997.

Harvest last occurred in project area stream drainages under Forest Service management in 2015. The total harvest area in all project subwatersheds from 1997 to 2015 was 185 acres. From 1997 to 2012, 45 acres of Forest Service harvest occurred in Deadwood Creek – Moose Creek subwatershed. From 1997 to 2015, 40 acres of Forest Service harvest occurred in Elizabeth Creek – North Fork Clearwater River subwatershed. From 1997 to 2011, no Forest Service harvest occurred in Lake Creek subwatershed, and 100 acres of Forest Service harvest occurred in Osier Creek subwatershed. Wildfire has not occurred in project area subwatersheds since 2012. Prescribed broadcast burning records from 1986 to 2019 show prescribed fire has not occurred in project area subwatersheds since 2011. Satellite imagery of these prescribed burn and wildfire areas show minimal tree mortality, suggesting low burn severity fire, which would have negligible effects on erosion and sediment delivery. Watershed condition ratings for individual project area stream drainage areas are listed below in Table 6. Given the low acreage of Forest Service harvest occurring since 1997, and limited extent of high burn severity fire, it is reasonable to assume that project area streams are currently meeting Forest Plan water quality standards and percent sediment yield over natural conditions criteria, and have not declined from watershed conditions in 1997.

Table 6. Clearwater Forest Plan water quality standards and criteria, and watershed condition.

Stream	Channel Type	Water Quality Objective	Maximum Sediment Yield (Percent Over Natural)			Watershed Condition[1]
			Forest Plan Standard	Existing Condition[1]	Allowable Years in 30 Exceeding Threshold	
NF Clearwater Rver (above Aquarius)	B	No Effect	45%	No Data	0	No Data
Comet Creek	A	High Fishable	110%	6%	10	Moderate
Deception Gulch	B	Low Fishable	225%	28%	20	Low
Lake Creek	B	High Fishable	55%	10%	10	Moderate
Lake Creek (above Shell Cr)	B	High Fishable	55%	No Data	10	High
Lake Creek (above Goose Cr)	B	High Fishable	55%	0%	10	Moderate
Moose Creek	C	High Fishable	50%	5%	10	Moderate
Osier Creek	B	High Fishable	55%	2%	10	Moderate
Osier Creek (above China Cr)	A	High Fishable	110%	5%	10	Moderate
West Fork Osier Creek	B	High Fishable	55%	0%	10	Moderate
Osier Creek (above WF Osier Cr)	B	Moderate Fishable	150%	0%	10	Low
China Creek	A	High Fishable	110%	8%	10	Moderate
Laundry Creek	A	High Fishable	110%	12%	10	Moderate
Sugar Creek	B	High Fishable	55%	15%	10	Moderate
Moose Creek (above Independence Cr)	B	High Fishable	55%	0%	10	Low
Deadwood Creek	B	High Fishable	55%	5%	10	Moderate
Moose Creek (above Deadwood Cr)	B	High Fishable	55%	0%	10	High

[1] Clearwater National Forest Watershed Condition Report (Jones and Murphy 1997).

Watershed Function – Road Density

Existing road density was calculated as described in “Analysis Methods” for each of the project area HUC12 subwatersheds. Existing road density results are included in Table 7 below. NOAA (1998) watershed condition, exclusively considering road density, are reported for respective project area subwatersheds in Table 7, as well.

Table 7. Existing road densities by HUC12 subwatershed and associated watershed condition

HUC12 Subwatershed	HUC12 Area (mi^2)	Existing Road Density (mi/mi2)	Watershed Condition (NOAA 1998)
Deadwood Cr-Moose Cr	22.4	1.7	Moderate
Elizabeth Cr-North Fork Clearwater R	60.2	1.9	Moderate
Lake Cr	34.5	1.5	Moderate
Osier Cr	31	2.9	Moderate

Direct and Indirect Environmental Effects

Alternative 1 – No Action

Under the No Action Alternative, there are considerable potential indirect effects to water resources from transportation resources. With no action, there would be no additional road maintenance. Ageing drainage structures will continue to degrade, and deferred maintenance will increase. The lack of activity could result in an increase in probability of road prism failure that would result in increases in sediment delivery in the watershed. In some instances, the lack of activity could result in a stabilizing affect to soils and reduce erosion due to revegetation.

Alternative 2 – Proposed Action

Alternative 2 proposed actions that could affect water resources include commercial harvest; noncommercial fuels thinning; landscape prescribed burning; prescribed burning of activity fuels; new temporary road construction; temporary road reconstruction on existing road templates; new system road construction; and existing system road, maintenance and reconstruction.

Erosion control contract provisions would be employed as necessary to attain stabilization of roadbed and fill slopes of temporary roads, including such measures as out-sloping, drainage dips, and water-spreading ditches. Reconstructed road segments at stream crossings would implement erosion control to minimize erosion and sediment delivery. Culvert replacement would implement standard BMPs to minimize erosion and sediment delivery.

Water Quantity – Peak Stream Flows and Water Yield

Increases in ECA resulting from Alternative 2, the proposed action, are reported in Table 8, below. Table 8 also includes existing ECA and cumulative ECA (the sum of existing and proposed action ECA values), and NOAA (1998) watershed condition considering cumulative ECA values.

Table 8. Equivalent clearcut area (ECA) of project area HUC12 subwatersheds. ECA of the proposed action, and cumulative condition (the addition of existing condition and proposed action) are reported.

HUC12 Subwatershed	HUC12 Area (ac)	Proposed Action ECA (%)	Cumulative ECA (%)*	Watershed Condition - considering cumulative effects (NOAA 1998)
Deadwood Cr - Moose Cr	14307.2	8.9%	9.5%	High
Elizabeth Cr - North Fork Clearwater R	38555.5	2.5%	15.8%	Moderate
Lake Cr	22061.0	0.7%	7.8%	High

Osier Cr	19829.9	8.5%	17.3%	Moderate

*The cumulative ECA assumes roughly 16,000 ac acquired by the Forest Service in 1996 was clearcut without retention in 1996. This is a conservative estimate as prior management of the ~16,000 ac parcel was not recorded.

Cumulative ECA within the Elizabeth Cr – North Fork Clearwater R and Osier Cr HUC12 subwatersheds are estimated to be over 15% - indicating these subwatersheds would be changed to moderate condition post implementation (NOAA 1998). Cumulative ECA estimates for Deadwood Cr – Moose Cr and Lake Cr HUC12 subwatersheds indicate these subwatersheds would remain in high condition after implementation of the Dead Laundry project (NOAA 1998).

Water Quality - Sediment Delivery (Hillslopes)

Modeled sediment delivery and probability assumes treatment units are in a disturbed state – the first year post-activity. WEPP predictions of average annual sediment delivery for proposed harvest (including broadcast burning of activity fuels), fuels thinning (including associated hand-pile burning), and landscape prescribed fire range from 0 to 0.392 tons/acre/year, with the probability of predicted sediment delivery occurring the first year post-activity ranging from 10 to 80%. The average sediment delivery of all units was 0.014 tons/ac/yr, well below the 0.5 tons/ac/yr detection threshold (Elliot and Miller 2004).

WEPP predictions of sediment delivery reflect the influence of large storm events in WEPP simulations and results. These large events, while predicted to generate runoff volumes that could deliver sediment through an RHCA, are infrequent and have a low probability of occurring; however, they are included in WEPP's calculation of average annual sediment delivery.

Water Quality - Sediment Delivery (Roads)

GRAIP Lite predictions of average annual sediment delivery from roads (system roads, all temporary roads) during project implementation (disturbed condition) range from 3.72 to 11.34 tons/acre/year (Table 9). Given the accuracy of the GRAIP Lite model (see "Analysis Methods"), at best these results indicate sediment delivery will increase by approximately an order of magnitude during project implementation. However, GRAIP Lite predictions of average annual sediment delivery from roads (system roads, all temporary roads) after project implementation (recovered condition) range from 0.65 to 0.77 tons/acre/year (Table 9). Comparison of the estimated pre- (current condition) and post-project (recovered condition) sediment delivery indicates no predicted net change in sediment delivery from roads as a result of the proposed action (Alternative 2).

No Best Management Practices, such as engineered drainage structures or graveling 100' on either side of a road-stream crossings, were parameterized in the disturbed condition or in the recovered condition GRAIP Lite models (See "Analysis Assumptions" above). However, numerous studies document that site-specific Best Management Practices minimize road-related sediment delivery to streams from road construction, maintenance activities, and log haul (Arismendi et al., 2017; Cristan et al., 2016; Edwards et al., 2016; Ice et al., 2004; Seyedbagheri, 1996; Sugden, 2018; Warrington et al., 2017). Minimizing sediment delivery reduces the effects of management activities on water quality and the aquatic environment. Monitoring shows that the Forest Service effectively uses Best Management Practices (Stone & Hess, 2016) and that implementation rates in Idaho are high (Cristan et al., 2018; Ice et al., 2010). Therefore, we can reasonably assume by not including any Best Management Practices in the disturbed condition or recovered condition GRAIP Lite Models, sediment delivery results from these models are overestimates. Yet, even with sediment delivery likely overestimated in the disturbed and recovered condition, comparison of recovered conditions to the current condition sediment delivery rate demonstrates no net increase in sediment delivery, and hence, compliance with the 1993 "no new sediment" settlement agreement (USDA, 1987).

Table 9. GRAIP_Lite sediment delivery results summarized by subwatershed.

	Sediment Delivery (tons/ac/year)			
HUC12 Subwatershed	**Current Condition**	**Disturbed Condition**	**Recovered Condition**	**Difference (Recovered - Current)**
Deadwood Cr-Moose Cr	0.73	11.34	0.65	-0.08
Elizabeth Cr-North Fork Clw R	0.79	4.31	0.77	-0.03
Lake Cr	0.71	3.72	0.69	-0.02
Osier Cr	0.64	8.08	0.65	0.00
Analysis Area Average	**0.72**	**6.86**	**0.69**	**-0.03**

The effects of temporary road construction to water quality would be minimal because of the limited hydrologic connection of temporary roads to streams and the short time that they would exist on the landscape (. Design Features would require that these crossings be designed and constructed to minimize sediment delivery to streams in the same way as new permanent roads. Sediment from temporary road construction would be controlled using Best Management Practices such as maintaining the road surface to provide proper drainage and prevent excessive erosion and suspending construction and haul during wet conditions. Within 3 years of project completion (including site preparation and planting), temporary roads would be rendered hydrologically stable through recontouring/obliteration. Obliterating temporary road built on existing road prisms would benefit water quality and watershed function slightly and would not occur under the No Action alternative.

System roads would be maintained, reconditioned, or reconstructed to facilitate access to treatment units and would include Best Management Practices to improve road drainage and reduce sediment delivery to streams. Road activities would include a combination of brushing; blading and shaping; the addition of gravel to driving surfaces; improving drainage by replacing, upgrading, or installing new culverts; and cleaning and armoring ditches where necessary. Activities on reconstructed road segments could also include minor road realignment, road widening, and the addition of turnouts. At stream crossings, activities could include work such as installing a combination of ditch relief culverts or drivable dips before perennial stream crossings and graveling the driving surface over crossings. Failing and severely undersized stream crossing culverts would be replaced with culverts meeting the criteria described in the Design Features, reducing long-term chronic sediment delivery and the risk of road fill failures. Although maintenance, reconditioning, and reconstruction activities could increase sediment production in the short term (that is, days to weeks), Design Features and Best Management Practices would be used to achieve the Riparian Management Objectives and meet the requirements of the Idaho Forest Practices Act (IDAPA, 2015) and the Soil and Water Conservation Handbook.[8] The long-term benefits of improving drainage and armoring road surfaces would outweigh any short-term increases in sediment delivery as a result of maintenance, reconditioning, or reconstruction activities.

Watershed Function – Road Density

Table 10 includes road densities following implementation of the Dead Laundry Project (Alternative 2). The road densities in Table 10 account for construction of new system roads needed to implement the Dead Laundry project. Road density values in Table 10 do not consider any new or existing temporary roads implemented as part of the proposed action.

Results indicate that road densities in each subwatershed will increase by 0.0 to 0.1 mile/mile^2 (Table 10). Thus, the proposed action results in no changes in watershed condition classifications (NOAA, 1998), and all subwatersheds in the project area will remain in a "Moderate" condition, considering road density only.

Table 10. Road density by HUC12 subwatershed following Alternative 2 (Proposed Action) implementation.

HUC12 Subwatershed	HUC12 Area (mi^2)	Road Density (mi/mi^2)	Watershed Condition (NOAA, 1998)
Deadwood Cr-Moose Cr	22.4	1.8	Moderate
Elizabeth Cr-North Fork Clearwater R	60.2	1.9	Moderate
Lake Cr	34.5	1.5	Moderate
Osier Cr	31	3.0	Moderate

Cumulative Effects

Cumulative effects arise when the incremental impact of an action is added to impacts from past, present, and reasonably foreseeable actions.

Alternative 1 – No Action

No proposed management actions and associated vegetation removal, ground disturbance, or road maintenance activities would occur. As stated in the forested vegetation and hazardous fuels resources reports, the cumulative effects would be continued type conversion, insect and disease prevalence, and accumulation of surface and ladder fuels. This will increase the likelihood of high severity wildfire events. High severity wildfire events can have severe impacts to water quality through sediment deliver and water yield. Given that less that 25 percent of the project area has any recorded fire history and wildfire is the greatest agent of change in this fire adapted ecosystem, there can be a reasonable anticipation of these types of effects within the temporal bounds of this analysis.

Alternative 2 – Proposed Action

The Proposed Action is designed to protect water quality and the beneficial uses of water and to maintain the integrity of streams using Riparian Habitat Conservation Areas, Design Features, and Best Management Practices. Sediment delivery from timber harvest and site preparation activities would, on average, increase by 0.014 tons/acre/year for 2-3 years following project activities, but would be undetectable at the subwatershed (HUC 12) scale and have a negligible effect on water quality. The impacts of temp road construction would be minimized by avoiding locations near streams, using Best Management Practices to limit erosion and sediment delivery, and recontouring them after use. The impacts of new permanent roads would be minimized by using Best Management Practices and Design Features to limit erosion and sediment delivery. Sediment delivery from haul on newly constructed and existing roads would be concentrated around stream crossings and short-term in its effects. In the long term, the Proposed Action would result in no change or a slight reduction in sediment delivery to streams. Road maintenance, reconditioning, and reconstruction activities would reduce sediment delivery to streams in the long term by improving driving surfaces and road drainage and disconnecting roads from streams.

The Proposed Action would increase road density during project implementation. However, in the long term, the addition 1.5 miles, in total, of new permanent road would increase road densities by a negligible amount in project area subwatersheds and would not change the watershed condition rating of project area subwatersheds (Table 10). Therefore, the proposed action will have no cumulative impact(s) to watershed

function and road densities in project area subwatersheds.

The Proposed Action would increase cumulative equivalent clearcut area (ECA) in all project area subwatersheds, with the largest increases in Deadwood Creek-Moose Creek and Osier Creek subwatersheds. However, cumulative ECA does not exceed 20% in any project subwatershed, which is

the threshold of the basal area that must be removed before a statistically significant change in annual streamflow can be detected. The Proposed Action may result in minor peak flow increases in low-gradient reaches, but recent research cited above suggest that these small increases in peak stream flow would not change channel stability or sediment dynamics in project area streams, and hence, the likelihood of stream channels being affected by small changes to the size of peak stream flows is very low.

The Proposed Action would implement INFISH buffers in Riparian Habitat Conservation Areas (RHCAs); therefore, harvest activities would not alter riparian vegetation, and there would be no decrease in streamside shading that could affect stream temperature. Hence, there be no cumulative effects of the Proposed Action on water temperature in any project area stream drainage. The Deception Gulch drainage currently is not meeting beneficial uses (Salmonid Spawning and Cold Water Aquatic Life) due to sedimentation/siltation. However, sediment modeling results indicate the Proposed Action will slightly improve sediment delivery conditions in the Deception Gulch drainage. Since the Dead Laundry project will not alter beneficial uses of project area streams and will increase system road mileage negligibly, and there will be no cumulative effects to beneficial uses for project area streams at the subwatershed scale.

Consistency with Relevant Laws, Regulations, and Policy

The proposed action has been reviewed and is determined to be in compliance with the management framework applicable to water resources. The laws, regulations, policies, and Forest Plan direction applicable to this project and this resource are as follows:

All activities would be consistent with the criteria for water resources found in the Clearwater Forest Plan, Appendix K (USDA, 1987), and all federal and state laws and regulations applicable to watershed resources would be applied to the Dead Laundry project including the Clean Water Act, Idaho State Water Quality Standards, Idaho Forest Practices Act, Idaho Stream Protection Act, Executive Orders 11988 (1977) and 11990 (1977), and Soil and Water Conservation Practices (SWCP) Handbook, FSH 2509.22[8].

Executive Orders 11988 and 11990 regarding Floodplain and Wetland Management direct the Forest Service to “restore and preserve the natural and beneficial values served by floodplains” and to “minimize the destruction, loss or degradation of wetlands.” The Dead Laundry project does not propose to occupy floodplains, nor does it propose to modify or impact wetlands. Direct and indirect effects could occur on wetland areas and within stream floodplains during culvert replacement; however, culvert replacement would implement standard BMPs to minimize erosion and sediment delivery, and effects would not be significant. As such, there would be no effects to floodplains or wetlands, thereby complying with EO 11988 and EO 11990.

Section 303 of the Clean Water Act requires federal agencies to comply with all federal, state, interstate, and local requirements; administrative authorities; and process and sanctions with respect to control and abatement of water pollution. Executive Order (EO) 12088 requires the Forest Service to meet the requirements of this Act. Therefore, all state and federal laws and regulations applicable to water quality would be applied, including 36 CFR 219.27; the Clean Water Act; the Clearwater Forest Plan, including INFISH Riparian Management Objectives (RMOs) and RHCAs; and Idaho State Best Management Practices (BMPs). To comply with Section 404 of the Clean Water Act, it may be necessary to obtain a permit from the Army Corps of Engineers to conduct culvert replacement during road improvement work, through application of either nationwide or site-specific permits. The Dead Laundry project is consistent with Idaho Nonpoint Source Management Plan (IDEQ 2015).

The Idaho Forest Practices Act regulates forest practices on all land ownership in Idaho. Forest practices on NFS lands must adhere to the rules pertaining to water quality (IDAPA 20.02.01). The rules are also

incorporated as BMPs in the Idaho Water Quality Standards. The project activities have been designed to be consistent with the Idaho Forest Practices Act.

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[1] Project File: Dead_Laundry_DesignFeatures_&_MitigationMeasures
[2] Project File: Dead_Laundry_RHCA_Fuels_Limitations
[3] The data sources used in this analysis contained the most accurate and current information available at the time of analysis. Any changes occurring after the last update/date of retrieval will be small and inconsequential to the results of the analysis.
[4] Project File: Dead_Laundry_GRAIP_Lite -Route_Specific_Assumptions
[5] Project File: DL_Climate_WEPP_Modeling
[6] Project File: DL_Disturbed_WEPP_natural_background
[7] Project File: GRAIP_Lite_HUC12_SummaryTbls
[8] Project File: Forest Service Handbook 2509.22 – Soil and Water Conservation Practices Handbook