Deep-Seated Landslide Research Strategy:
Landslide Mapping and Classification Project

PROJECT CHARTER

Washington State Cooperative Monitoring, Evaluation, and Research Committee (CMER)
Protocols and Standards Manual (PSM)
Chapter 7, Section 4

Project Charter 1[1]: Issue/Problem Statement, Purpose Statement, Project Objectives, Critical Questions, Program Rule Group and Program, Project Tasks and Timeline, Budget, Project Team Roles and Responsibilities, Communication Structure, Authorization, Recognition of Support, References

Oversight Committee: Upland Processes Scientific Advisory Group (UPSAG)

Project Team Members: Greg Stewart (PI), Anne Weekes, Julie Dieu, Kara Whittaker, Ben Flint (PM)

July 28, 2020

Issue/Problem Statement

In Washington State, deep-seated landslides (DSLs) occur within many lithologies and across wide breadths of climate regimes and timescales. These differences in geologic materials, climates and timescales suggest that different geographies are more or less sensitive to contemporary natural and anthropogenic landslide triggering mechanisms. Of particular interest to the Adaptive Management Program are the potential effects of hydrologic inputs from forest management on different *classes*[2] of DSLs, especially where landslides have the potential to degrade fish habitat and water quality, or threaten public safety.

As summarized by Miller (2016 and 2017), increases in groundwater recharge due to decreases in evapotranspiration from timber harvest may impact DSL processes. However, few guidelines are available to determine if an individual DSL will respond to harvest-induced changes in hydrology. Developing a DSL classification system that is based on specific factors, such as material properties, geomorphic setting and hydrology, will provide the framework for designing the subsequent, empirical research projects in the DSL Strategy. These projects will address the geologic hazards and evaluate *hydrologic sensitivities* due to timber harvest relative to other triggers.

The Washington State Forest Practices Board Manual Section 16 is provided as guidance to field practitioners (e.g., geologists, forest engineers, and foresters) and interested parties for evaluating potentially unstable slopes and landforms (WFPB 2016). Deep-seated landslides are first

[1] The purpose of the Charter is to describe the project and give the PM and the Project Team the authority to begin spending allocated project funds. In general, Project Charters should be brief and updated as needed as the project is implemented to accurately, reliably and concisely communicate projects' basic elements and objectives. (PSM Ch. 7 CMER review5 06_19_2017 final draft). When substantive changes are considered necessary, which amend the scope of the project (i.e. study design, budget, or schedule), the charter should to be updated (version #2, #3, etc.) to communicate those changes.
[2] For definitions of italicized words, please see the Deep Seated Landslide Mapping and Classification Scoping Document.

identified as occurring in either glacial materials or bedrock for which rules and FPA classification differ. Deep-seated landslides may be evaluated, per Board Manual guidance, based on other factors such as *activity levels*. This information and the location of the proposed forest practices are used to classify the forest practices application (e.g., Class III or Class IV-Special FPA) and to require varying levels of analysis and mitigation.

This first project is intended to provide a classification of DSLs inferred to represent a range of potential landslide susceptibility to natural and forest practice *triggers*. This effort will provide the framework needed to pursue the subsequent projects in the Strategy which are designed to specifically investigate landslide mechanics and hydrology based on the landslide classification.

Traditionally, geotechnical investigations and academic research on DSLs are done at the scale of individual landslides. These investigations are conducted in the context of construction projects, such as the building or repair of a segment of highway and academic research focused on specific failure mechanisms, as well as in the context of forest practices. Broad classifications of landslide type, typically based on geologic materials and movement mechanisms, are the standard. However, a classification schema that can be applied to DSLs in the context of forest practices-associated hazards and risk does not exist. An exploratory approach is appropriate for developing the methods needed to address this gap in our understanding. Considering the breadth of Washington State and the specific focus of forest practices rules on hundreds of DSLs, there is an imperative to create an effective classification system based on sound geologic principles.

Purpose Statement

The purpose of the Landslide Mapping & Classification Project is to empirically define classes of DSLs based on *critical independent variables* that control the occurrence and type of failure. These critical independent variables include, but may not be limited to, hydrology, lithology, stratigraphy, and topographic setting.

This project will aid our stratification of landslides for future projects (e.g., hydrologic modeling efforts, physical modeling efforts - see Projects 4.8, 4.9). Moving forward, these classes will be used to identify and assess a potential subset of landslide types that may be prone to increased activity due to forest practices, such as timber harvest or road construction.

Project Objectives

1) To identify distinguishing characteristics within and between DSLs.
2) To investigate why landslides with similar characteristics may exhibit differences in activity level.
3) To develop causal mechanism hypotheses for individual landslides evaluated in the field. These mechanisms might include hydrogeologic characteristics visible in active landslides.
4) To determine the best remote sensing tools, field assessment and other methods to classify DSLs in a manner that will substantially improve our understanding of the relative potential for DSL reactivation or accelerated movement.

5) To define classes of DSLs within and across clusters using a suite of physical attributes based on critical independent variables. These classes will also be used to support future phases of the research strategy (i.e., which DSLs are most representative or illustrative for future research and modeling efforts based on the results of the classification project).
6) To hypothesize if certain classes of landslides have a high or low potential for instability from forest practices and rank classes based on multiple sources of empirical evidence.

Critical Questions

1. What are the distinguishing characteristics among DSLs within similar geomorphic, topographic, stratigraphic, hydrologic, and climatic settings?
2. Can activity levels of individual DSLs within and between clusters be linked to sensitivity to hydrologic change?
3. What are the critical independent variables necessary to define DSL classes?
4. Are there particular classes of DSLs that have a greater or lesser potential for instability?
5. What data are necessary to estimate the relative sensitivity of DSLs within a class?

CMER Rule Group and Program

This project is part of the Unstable Slopes Rule Group, Mass Wasting Effectiveness Monitoring Program (CMER 2019).

Project Tasks and Timeline

The following table depicts the tasks, responsible team member for completing the task, and estimated completion dates for work associated with this project. The estimated completion dates and implementation actions will have better detail upon the completion of a study design.

Task	Responsible Team Member	Estimated Completion Date
Task 1. Develop Scoping Paper for CMER and Policy.		
Subtask 1.1. As part of the Deep-Seated Landslide Research Strategy, develop a scoping document to complete elements 4.5 & 4.6 (Landslide Mapping and Landslide Classification, respectively)	UPSAG	September 2020
Task 2. Develop study design		
Subtask 2.1. Use the completed Scoping Paper to develop a study design for this project.	Greg Stewart, CMER Staff Geologist (PI) and Project Team	June 2021
Subtask 2.2. UPSAG/CMER review and approval of Study Design.	UPSAG, CMER, PI, and Project Team	September 2021
Subtask 2.3. Completion of ISPR of study design.	CMER, PI, and Project Team	January 2022
Task 3. Implementation		

Subtask 3.1. Utilizing internal CMER Staff, complete DSL mapping and clustering.	Greg Stewart, CMER Staff Geologist (PI) and Project Team	June 2022
Subtask 3.2. Once clusters are identified, complete field reconnaissance and data collection.	Greg Stewart, CMER Staff Geologist (PI) and Project Team	June 2024
Subtask 3.3. Utilizing remote data, field data and salient 3rd party data complete the development of a classification schema for GDSLs and BDSLs.	Greg Stewart, CMER Staff Geologist (PI) and Project Team	June 2025
Task 4. Develop Final Report		
Subtask 4.1. Utilizing the findings from the study, generate a final report.	Greg Stewart, CMER Staff Geologist (PI) and Project Team	January 2026
Subtask 4.2. UPSAG/CMER Review and approval of final report.	UPSAG, CMER, PI, and Project Team	June 2026
Subtask 4.3. Completion of ISPR of the final report.	CMER, PI, and Project Team	December 2026
Subtask 4.4. Present CMER & ISPR approved final report to Policy.	PI and PM	February 2027

Budget

Although a large portion of the project will be completed by internal CMER Staff, there will be contracted support in various capacities throughout the project. The budget for the contracted support is provided below. Budget estimates will be refined upon the completion of a study design.

FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Total
$50,000	$150,000	$150,000	$85,000	$50,000	$0	$485,000

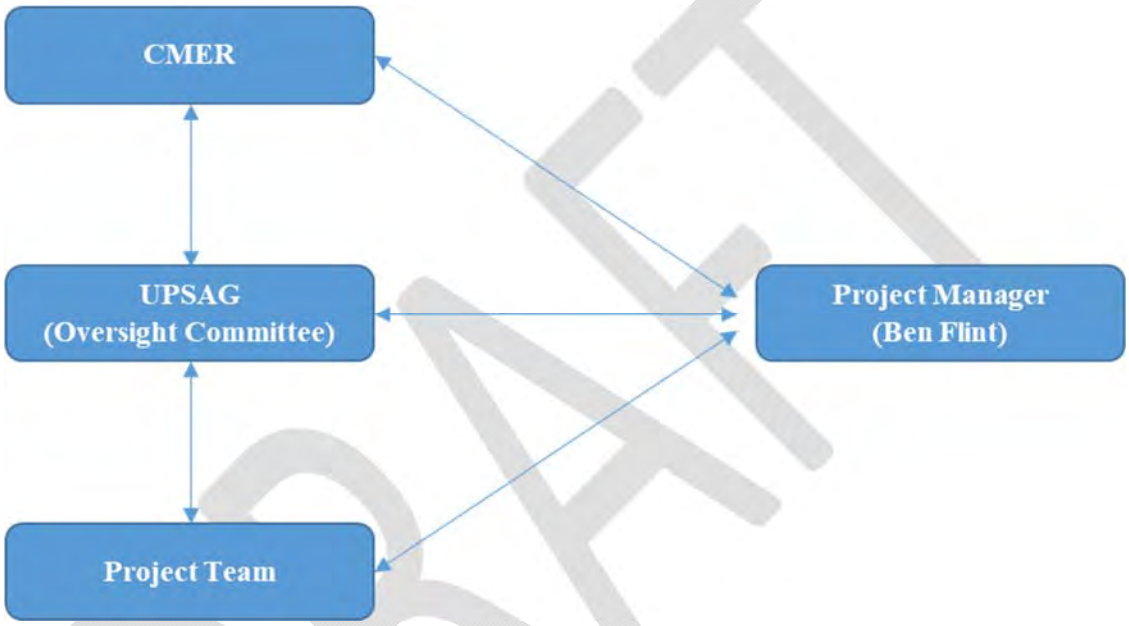
Project Team Roles and Responsibilities

Position	Roles and Responsibilities
Project Manager (PM): Ben Flint	• Monitors project activities and the performance of the Project Team. • Communicates progress, problems, and problem resolution to the Adaptive Management Program Administrator (AMPA), CMER, and UPSAG. • Works with UPSAG and Project Team to help develop Project Charter and other managing documents, and keeps them updated. • Develops proposals, RFPs or RFQQs, reviews contractor proposals, monitors contract performance, develop contract budget, schedule, scope changes, and contract amendments.

	• Develops project budget and schedule with input from the Project Team and UPSAG. • Works with UPSAG and Project Team to develop interim and final draft reports. • Ensures coordination between UPSAG, CMER, and Project Team. • Coordinates all technical reviews and responses in a timely fashion. • Facilitates archiving of all data and documents. • Ensures that contract provisions are followed. • Provides direction, support and oversight to the Project Team to achieve clear and specific scopes of work, schedules, and budgets within approved contracts. • Coordinates and/or authorizes communication with all project-related contractors. • Maintains sole responsibility for all aspects of project management even if other individuals are completing or helping complete parts of the project.
Principal Investigator (PI): Greg Stewart (CMER Staff)	• Works with the PM and UPSAG to identify additional technical expertise and time commitments needed to complete scoping, study design development and implementation. • Provides materials needed by the PM • Lead in the development and writing of the study design. • Prepares quarterly summary and progress report of project status. • Lead in the development and writing of interim and final draft reports • Presents technical findings to UPSAG, CMER, and TFW Policy as necessary • Communicates project status and issues to the PM and Project Team. • Lead author of prospective answers to 6 questions document.
Project Team members: Anne Weekes, Julie Dieu	• Assist with finding solutions to technical issues that arise during scoping, study design development and project implementation. • Provide expertise needed for successful completion of scoping, study design and implementation. • Assist with writing technical documents such as: project charter, communication plan, scoping document, study design, prospective 6 questions document, project management plan, and interim and/or final findings reports. • Provide constructive and timely feedback on project documents. • Assist as needed with communicating project information to UPSAG and CMER. • Participate in project meetings and conference calls as needed. • Assist as needed with implementation tasks at the direction of the Principle Investigator.

Technical Editor: Kara Whittaker	• Oversees the writing and revision of all documents within the study. • Responsible for ensuring consistency across all documents and within documents.

Communication Structure



Authorization

The Washington Forest Practices Board (Board) has empowered the CMER committee and the TFW Policy committee to participate in the Adaptive Management Program (AMP) (WAC 222-12-045(2)(b)). CMER is responsible for completing technical information and reports for consideration by TFW Policy and the Board. CMER has been tasked with completing a programmatic series of work tasks in support of the AMP; these tasks are outlined in CMER's biennial work plan approved by TFW Policy and the Board. This project listed under the Unstable Slopes Rule Group, Mass Wasting Effectiveness Monitoring Program.

Recognition of Support

Committee	Date of Acceptance	Reference
UPSAG	7/6/2020	meeting minutes
CMER	7/28/2020	meeting minutes
TFW Policy	8/6/2020	meeting minutes

References

Cooperative Monitoring Evaluation and Research (CMER) Committee. (January 2019), 2019-2021 Biennium Work Plan. https://www.dnr.wa.gov/publications/fp_cmer_2019_2021_workplan_20190119.pdf?o9uq19w.

Miller, D., 2016. Literature Synthesis of the Effects of Forest Practices on Glacial Deep-Seated Landslides and Groundwater Recharge. Prepared for the Upslope Processes Scientific Advisory Group Cooperative Monitoring, Evaluation, and Research Committee. 139 pp.

Miller, D., 2017. Literature Synthesis of the Effects of Forest Practices on Non-Glacial Deep-Seated Landslides and Groundwater Recharge. Prepared for the Upslope Processes Scientific Advisory Group Cooperative Monitoring, Evaluation, and Research Committee. 105 pp.

Protocols and Standards Manuel (PSM). (2017), CMER Review5 06_19_2017 Final Draft, Chapter 7.

WAC 222-12-045. April 2013. http://apps.leg.wa.gov/wac/default.aspx?cite-222-12-045.

Washington Forest Practices Board (WFPB), (May) 2016. Board Manual Section 16. Guidelines for Evaluating Potentially Unstable Slopes and Landforms. Accessible from: https://www.dnr.wa.gov/publications/bc_fpb_manualsection16.pdf?mcolf