



GENERAL GUIDELINES

Comprehensive Geotechnical Investigation and Design Report

Submitted in support of *Dike Maintenance Act* approval applications

1.0 INTRODUCTION

To ensure that the proposed works meet provincial standards, a Comprehensive Geotechnical Investigation and Design Report may be required as part of an application for *Dike Maintenance Act* approval. In general, significant changes to the configuration of a dike, upgrades made to achieve a new design flood elevation for a dike, and the construction of a new dike will require a comprehensive geotechnical investigation and design report prepared by a Professional Engineer with appropriate experience in geotechnical engineering.

This document is intended to provide guidance on the type and extent of geotechnical investigations for significant works as noted above. Minor changes to the configuration of a dike may require a less detailed geotechnical investigation.

Once the specific details of the application are known, the Deputy Inspector of Dikes office can provide further guidance on the specific requirements.

2.0 GENERAL CONTENT REQUIREMENTS

2.1 Background Information / Review of existing Data

- a) Overall description of the diking system.
- b) Description of field observations and existing conditions.
- c) Summary of previous design reports and subsurface investigations.
- d) Summary of regional surficial geology along the dike alignment and implications for dike design.
- e) Summary of applicable information from review of Operation and Maintenance Manuals and As-built drawings from previous dike upgrades.
- f) A summary of background information from interviews with local residents, diking authority, trustees, etc. regarding past performance of the dike during floods of record and specific areas where past problems have occurred (boils, seepage, slope movement, erosion, etc.).

2.2 Subsurface Investigation and Laboratory Testing

- a.** Description of the methodology used to determine subsurface soil conditions and testing to establish parameters used in the geotechnical design.
- b.** A rationale for the scope and methods of investigation used.
- c.** A summary of soil and groundwater conditions and the possible range of subsurface soil and existing dike fill conditions.
- d.** Location of test holes and/or test pits.

2.3 Evaluation and Analysis

All of the following relevant short and long term potential failure mechanisms shall be considered¹:

- a.** Landside slope stability due to steady seepage.
- b.** Waterside slope stability due to draw down.
- c.** Surface erosion of slopes.
- d.** Stream erosion of waterside slopes.
- e.** Seepage, uplift, and piping through or under the dike and structures.
- f.** Foundation shear strength and settlement.
- g.** Settlement associated impacts on any adjacent structures and future upgrades.
- h.** Structures in and through dikes.
- i.** Seismic stability of dikes and appurtenant works.

The following is required in the analysis of each applicable failure mechanisms:

- A comprehensive discussion of the design results in terms of all failure modes analyzed, all design assumptions and the value of parameters used in the analysis (internal angle of friction, coefficient of permeability, etc.).
- Discussion of the results of the analysis of each failure mode including resulting factors of safety.
- State minimum required values for the factor of safety for each failure mode analyzed. Where appropriate provide precedents or standards for minimum factors of safety (municipal standard, published technical paper, etc.).
- Discuss the possible variation of minimum factors of safety in terms of the range of anticipated variation in soil and groundwater conditions.

¹ Some failure mechanisms may not apply for certain projects

2.4 Seismic Design

- For seismic design requirements, please refer to the document “Seismic Design Requirements for Dikes” most recent edition.

2.5 Dike Construction Materials

- a. Provide specifications for dike construction materials including dike fills, filter materials, rip-rap, etc.
- b. Provide comment on local sources for Dike Construction materials.

2.6 Appendices

- Include Test pit and Soil Core logs, test hole and test pit location plan, site photos, and outputs from stability and groundwater software analysis.

3.0 REFERENCE DOCUMENTS

The following documents are useful references for existing standards and existing drill hole logs for Lower Fraser Valley dikes:

- a. Overview Report on Drilling Program - Lower Fraser Valley Dyke Studies Drilling Program
September 1962 to April 1963. E.M. Clark, P.Eng.²
- b. Ministry of Water, Land and Air Protection, Dike Design and Construction Guide. Best Management Practices for British Columbia dated July 2003.³
- c. US Army Corps of Engineers, Engineering and Design, Design and Construction of Levees, Engineer Manual, EM 1110-2-1913, dated April 30, 2000.
- d. U.S. Army Corps of Engineers, Engineering and Design, Design Guidance for Levee Underseepage Technical Letter No. 1110-2-569, dated 1 May 2005.

² Available at the following link to the Ministry of Environment Website

http://www.env.gov.bc.ca/wsd/public_safety/flood/dike_drawing_as_builds/fraser_river/Constr_Mat_Low_Fras_Dikes.pdf

³ Available at the following link to the Ministry Forests, Lands and Natural Resource Operations' Website
http://www.env.gov.bc.ca/wsd/public_safety/flood/flm-2012/safety_dma_approv.html