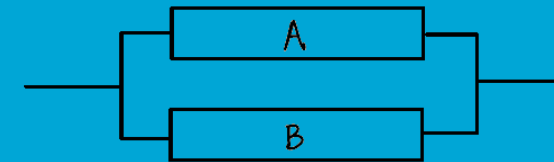
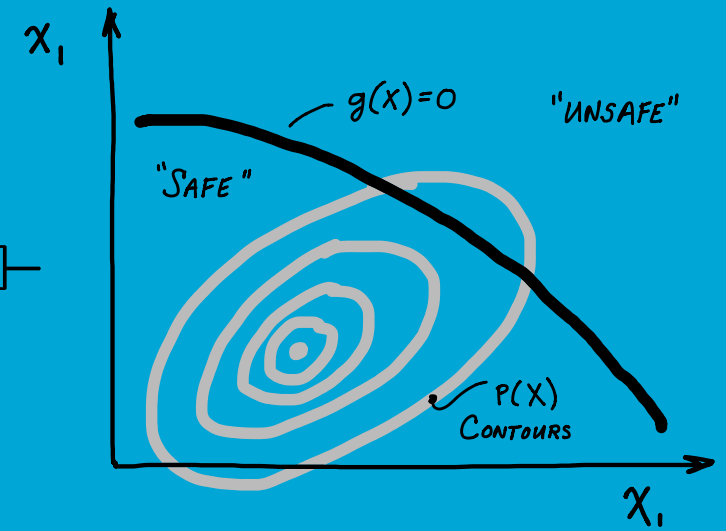
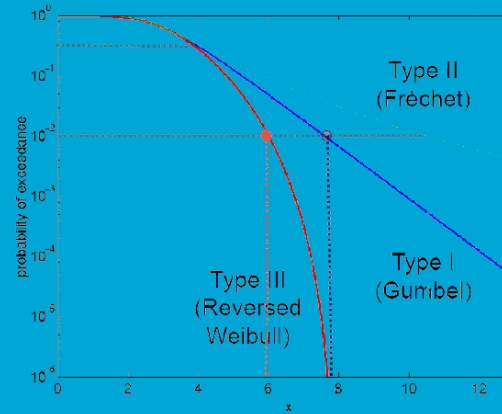


# CIEM42X0 Probabilistic Design

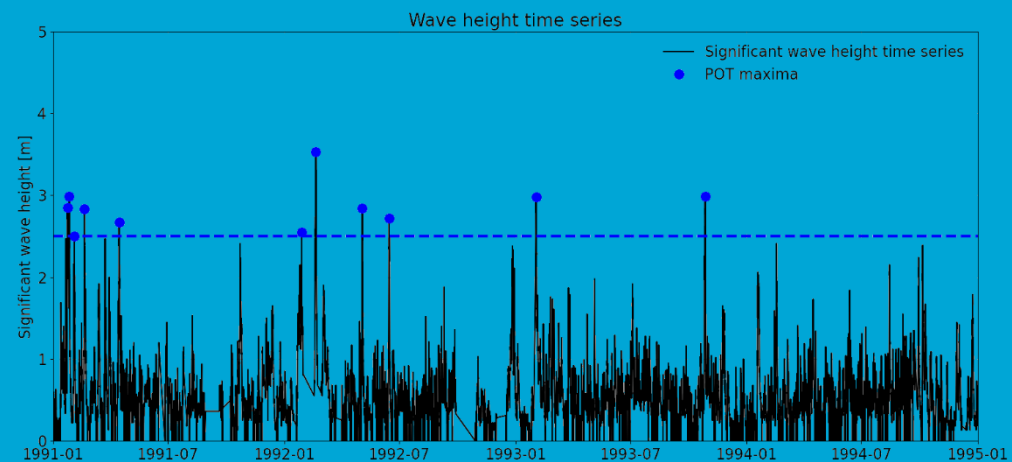
Hydraulic and Offshore Structures (HOS) Track

Civil Engineering MSc Program



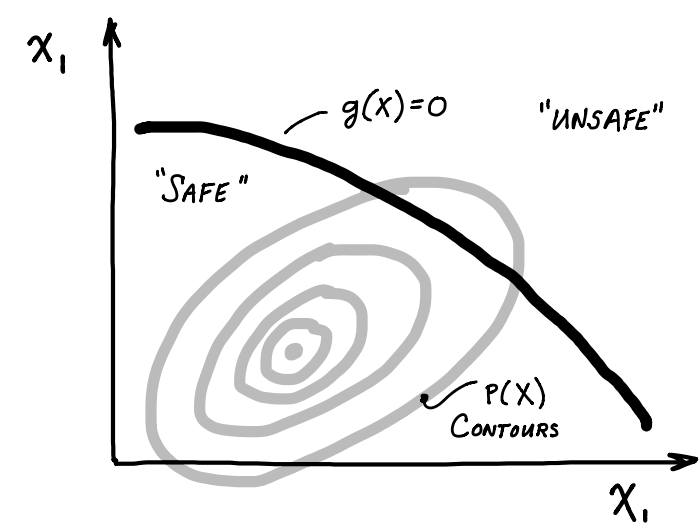
## Introduction

Robert Lanzafame



# CIEM42X0 Probabilistic Design

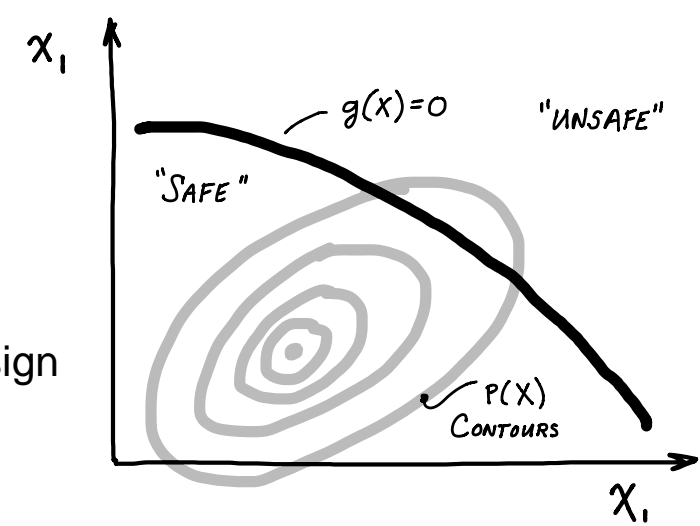
3 main topics: extreme value analysis, component reliability, system reliability



# CIEM42X0 Probabilistic Design

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Objective: learn how the methods can be used to gain insight and improve your design



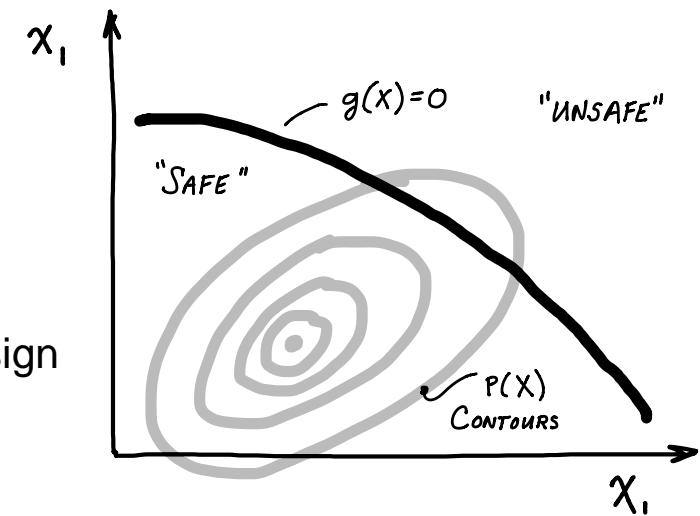
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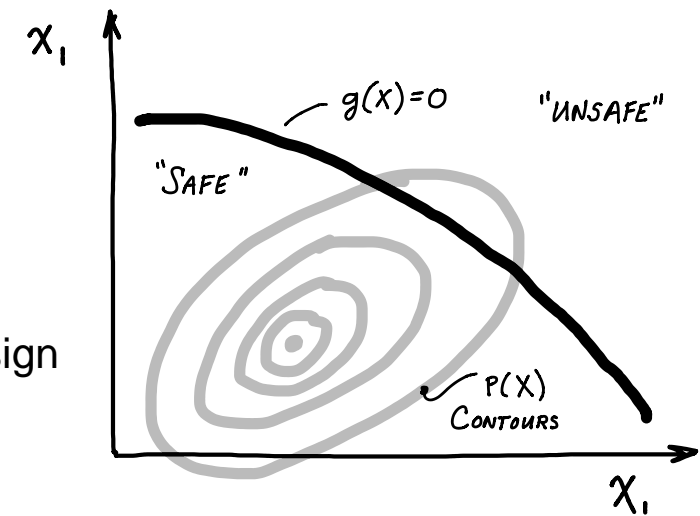
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Unit Website: textbook access, calendar, announcements, logistics, etc [bookmark the website!](#)

Assessment: incorporated in projects and exams for each unit (use code from homework & workshops)



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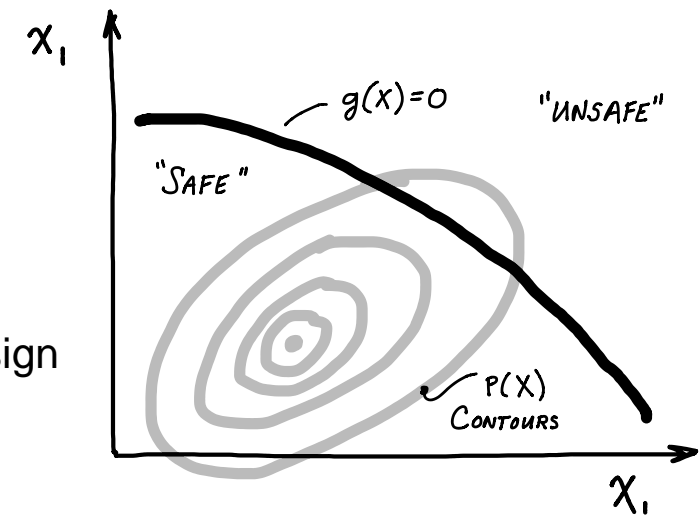
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Contact Robert Lanzafame with questions.



# Unit Website

CIEM42X0

Search CIEM42X0

[CIEM4210](#) [CIEM4220](#) [CIEM4230](#) [HOS book](#) [ADK book](#)

## Welcome to CIEM42X0 Probabilistic Design

CIEM42X0 is a unit that is part of three B modules ([CIEM4210](#), [CIEM4220](#), [CIEM4230](#)) offered in Q4 of the Hydraulic and Offshore Structures (HOS) track in the Civil Engineering MSc program at TU Delft.

*This page shows the most recent announcement and the calendar. For more information check the appropriate pages on the left. Links to Brightspace and the course textbooks are at the top.*

### Getting Started

Apr 21 · 2 min read

We decided to start this unit off with good news: **the in-class session on Friday during Week 1 is cancelled!** With the holiday on Thursday, we thought many of you might enjoy the chance to sleep in. It should disappear from your course calendar within a day or two.

However, there is still plenty of fun for you to have with this unit during Week 1: we have prepared a few short videos to introduce the material and a quick refresher of our first main topic, Extreme

# Unit Website – Calendar

## Calendar

This page gives an overview of the in-class sessions, homework assignments and reading material. Unless otherwise noted, our “typical” in-class sessions will always be on Friday at Bouwcampus Hall 1 (26.B0.030). The sessions are scheduled from 9:45-12:30, but we will try to wrap up by 12:00 most days.

See the [About](#) page for more information about the unit. Required reading is noted in the third column below, where “HOS” and “ADK” refer to the online HOS textbook and [textbook](#) by Armen der Kiureghian, respectively. For the HOS book, “HOS-PD” and “HOS-EVA” refer to the parts with chapters on Probabilistic Design and Extreme Value Analysis topics.

### Week 1

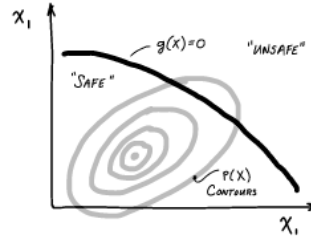
|           |   |
|-----------|---|
| April 24: | <b>Introduction:</b> Probabilistic Design Unit<br><i>Module and unit introduced on Monday in other units</i><br><b>START HW 1</b> <b>Reliability Analysis Introduction</b> <a href="#">HOS-PD-1, ADK-4</a><br><i>Start HW 1 anytime during week 1; TA Fri by request.</i> |
| April 26: | Students in: CIEM4220 Dams, Dikes and Breakwaters<br>Wed 13:45, Hall C (Antonini)<br><b>Recommended reading prior to lecture:</b> <a href="#">HOS-EVA-1, 2.4</a><br><i>At minimum, read <a href="#">HOS-EVA-1.2</a>.</i>  |
| April 28: | <b>In-Class Session Cancelled</b><br><b>START HW 2</b> <b>Extreme Value Analysis</b> <a href="#">HOS-EVA-all</a>  |
| Holidays: | Thursday (King’s Day)   |

### Week 2

|        |   |
|--------|---|
| May 4: | <b>Optional lecture:</b> Floods & Droughts: Hydrological Forcing (Ragno).<br><i>Lecture in Rivers unit of HF track (Thu 10:45-12:30 Hall C)</i> |
|--------|---|



# HOS Book



## Probabilistic Design

- 1. Unit Introduction ∨
- 2. EVA Overview ∨

## Extreme Value Analysis

- 1. Extremes ∨
- 2. Block Maxima & GEV ∨
- 3. Peak Over Threshold & GPD ∨
- 4. Threshold & Declustering ∨
- 5. MUDE Materials ∨

## Homework

- 1. Assignment
- 2. Assignment

## Workshops

- 1. Assignment



## Welcome to the Online Textbook for CIE42X0 Probabilistic Design!

CIE42X0 Probabilistic Design is a unit that is part of three B modules (CIEM4210, CIEM4220 and CIEM4230) offered in Q4 of the Hydraulic and Offshore Structures (HOS) track in the Civil Engineering MSc program at TU Delft. Detailed information and updates can be found at [unit website](#).

This book has three main parts:

- **Probabilistic Design:** chapters in this part contain an introduction to the course and various topics related to component and structural reliability that are not covered in the ADK book.
- **Extreme Value Analysis:** chapters in this part provide underlying theory to help understand the EVA procedure that is key for assessing hydraulic loads in HOS projects.
- **Homework and Workshop** assignments and solutions will be added throughout Q4. Note that if you follow a link before the file is released, it will take you to [this page](#).

The EVA material from MUDE is also included [here](#) for you to be able to refer to it easily.

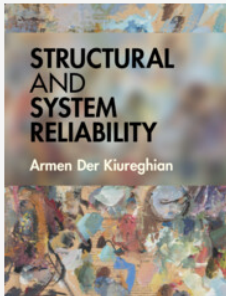
This book will be actively updated throughout the quarter; primarily with assignments and solutions, but also new technical content may be added, depending on questions and needs from students. A list of updates is provided below.

## List of updates

Major updates to the book made during Q4 will be listed here. Depending on the importance or urgency, some (but not all) of these updates may also be communicated via [announcements](#) on the unit website or the Brightspace page for your B module (links at top of the [unit website](#)).

# ADK Book

## Structural and System Reliability



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Textbook

eCollection

Armen Der Kiureghian, *University of California, Berkeley*

Published 2022

### Description

Based on material taught at the University of California, B comprehensive treatment of the methods of structural an order reliability methods for components and systems, sir Bayesian parameter estimation and reliability updating. It finite-element reliability methods, stochastic structural dy networks. A wealth of well-designed examples connect...

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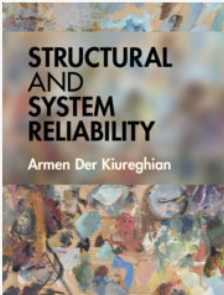
Authors

Reviews

Metrics

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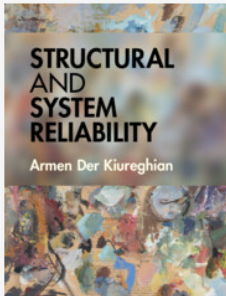
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The screenshot shows a digital book interface. At the top, there is a dark blue header with a search icon, a page number '93 / 594', and navigation icons. Below the header is a 'Table of Contents' panel with a search icon and a close button. The table of contents lists chapters 2 through 8, with chapter 4 'Formulation of Structural Reliability' highlighted. Below the table of contents is a 'Log in' button, a 'Register' button, and a 'Continue with read-only access' button. The main content area shows the title '4 Formulation of Structural Reliability' in a large blue box, followed by the sub-section '4.1 Introduction' in a light blue box. The text of the introduction is displayed below, with left and right navigation arrows. The text describes the concept of structural or system reliability, mentioning capacity and demand, and the failure of a structure or system.

## 4 Formulation of Structural Reliability

### 4.1 Introduction

Many structural or system reliability problems involve two opposing quantities: a capacity (or resistance, supply, strength, etc.) and a demand (or load, stress, load effect, etc.). The structure or system is said to have failed when the demand exceeds the capacity. The word "fail" is used here in a general sense. It does not necessarily imply fracture or collapse of the structure or system. Rather, it is the failure of the structure or system to perform according to a specified criterion – here, the criterion that the structure or system must meet the demand placed on it. This chapter closely examines this important

# Summary

- Keep an eye on the Unit Website  
(major announcements will go through Brightspace)
- Start with reading and HW1 and HW2
- Let us know if you have questions!

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See you on Friday, May 12 in Week 3!

# Video 2 – Reliability-based design philosophy

- Risk analysis overview
- Determine reliability (component and system)
- How does it fit in the design cycle?
  - Make assumptions, set up model
  - Evaluate limit states (component reliability)
  - Check if it meets the safety standard
  - Sensitivity study

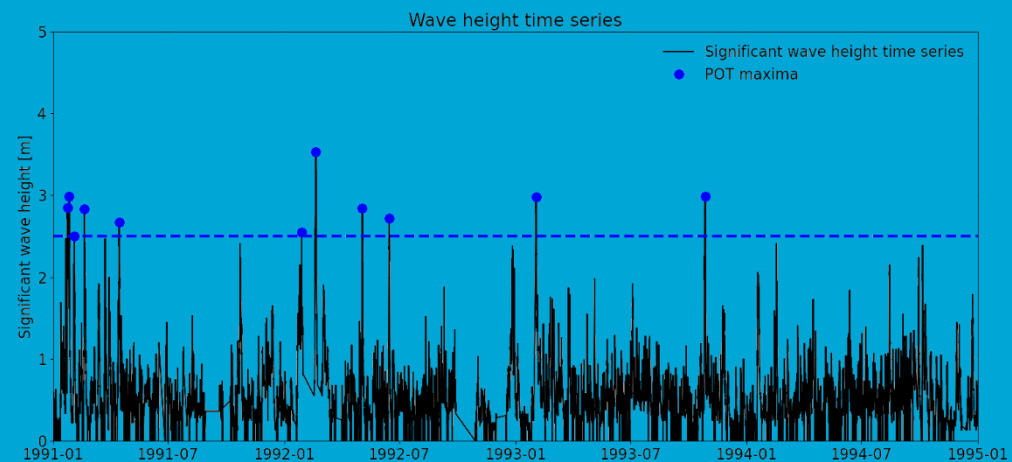
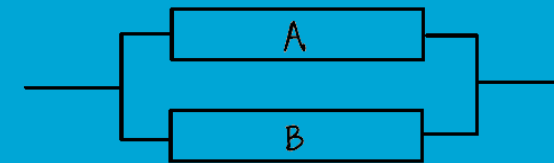
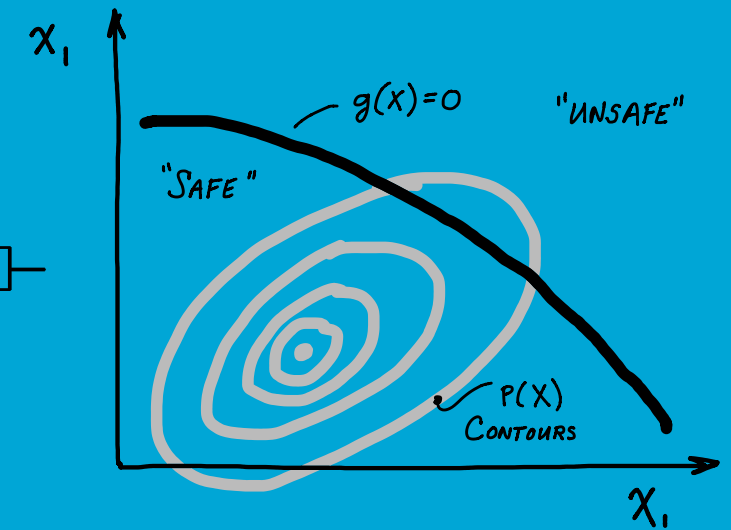
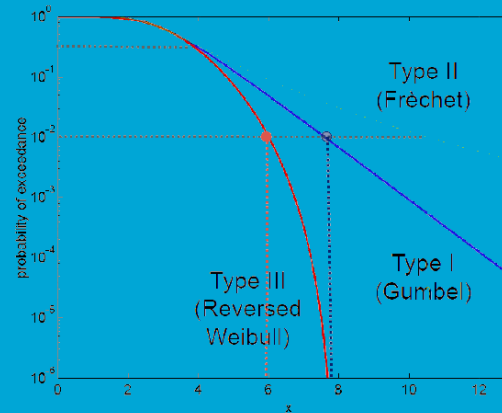
# CIEM42X0 Probabilistic Design

Hydraulic and Offshore Structures (HOS) Track

Civil Engineering MSc Program

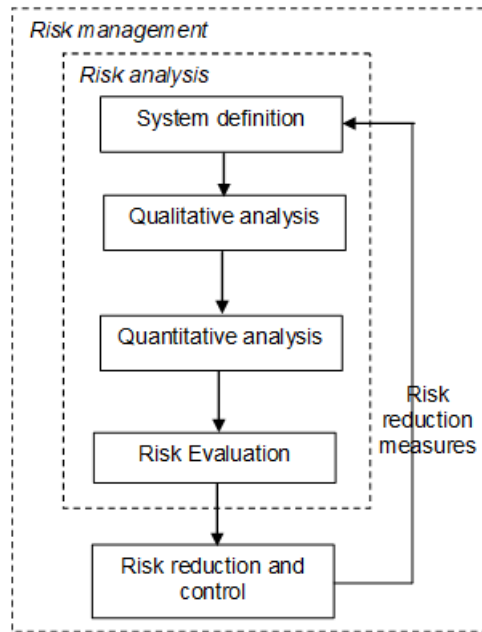
## Reliability-Based Design Philosophy

Robert Lanzafame

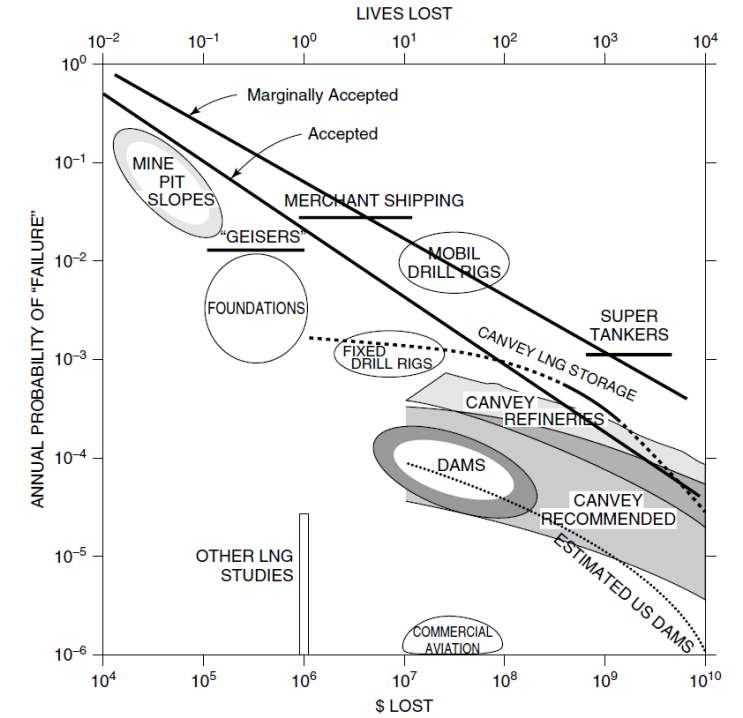
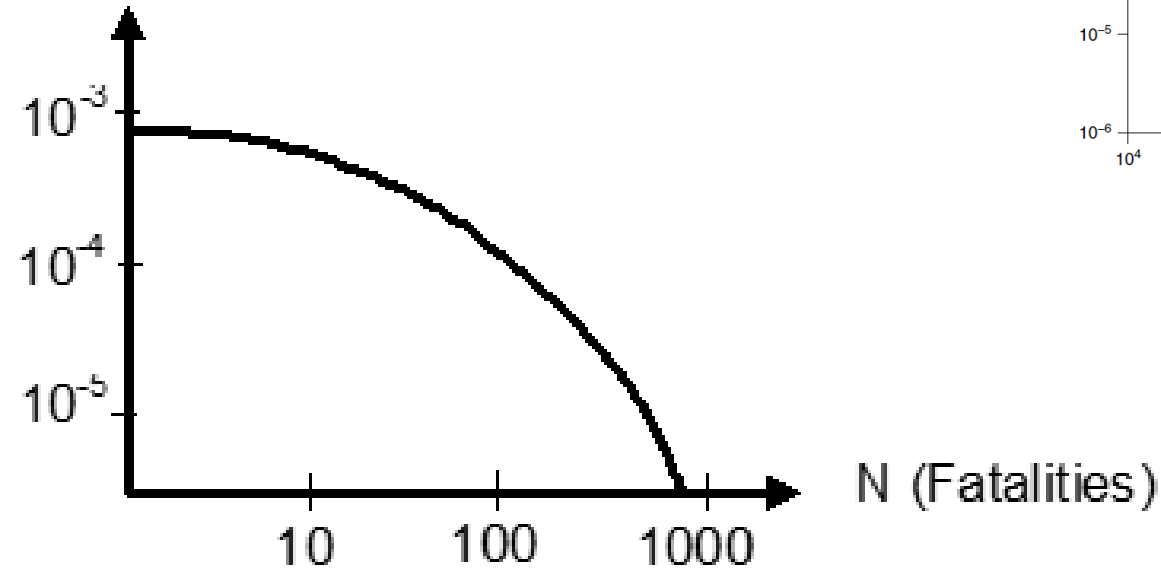




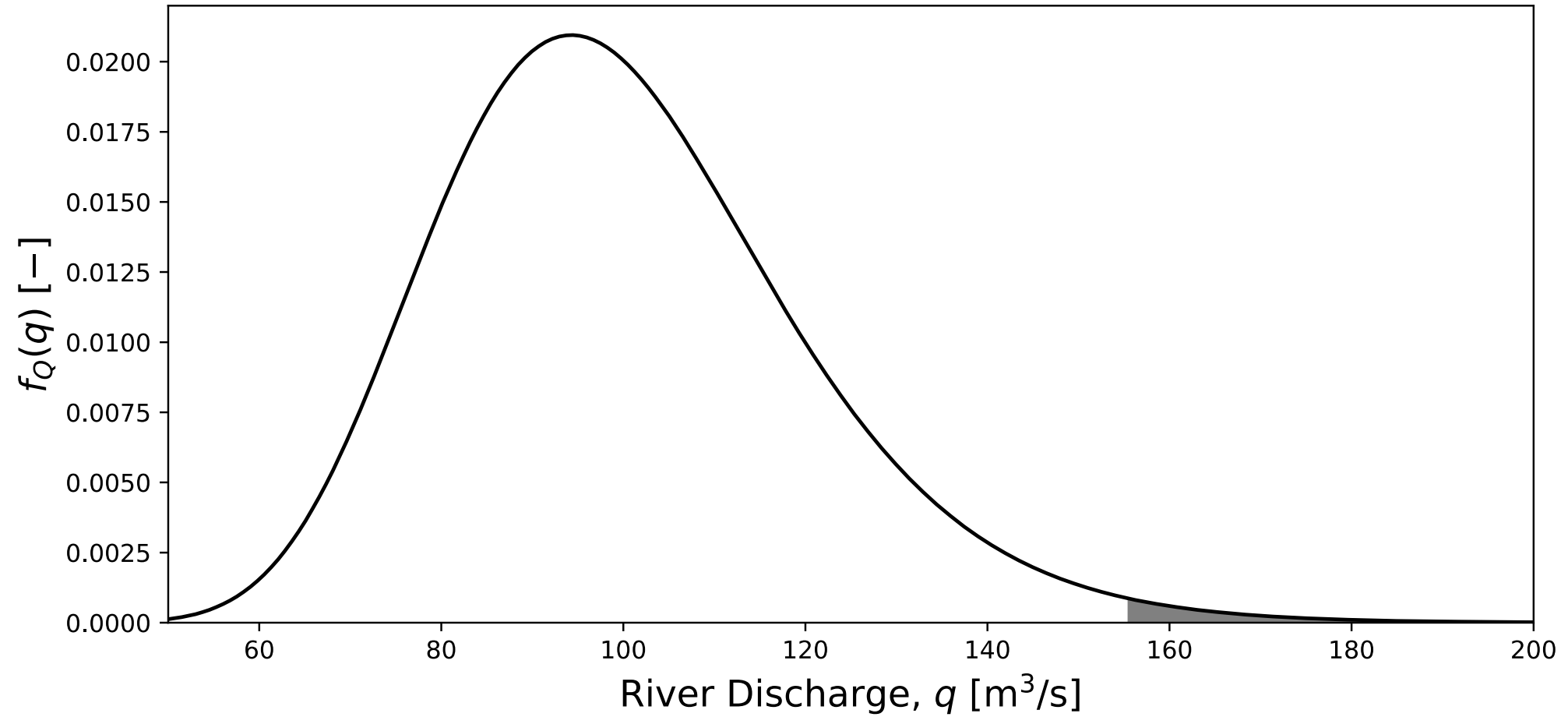
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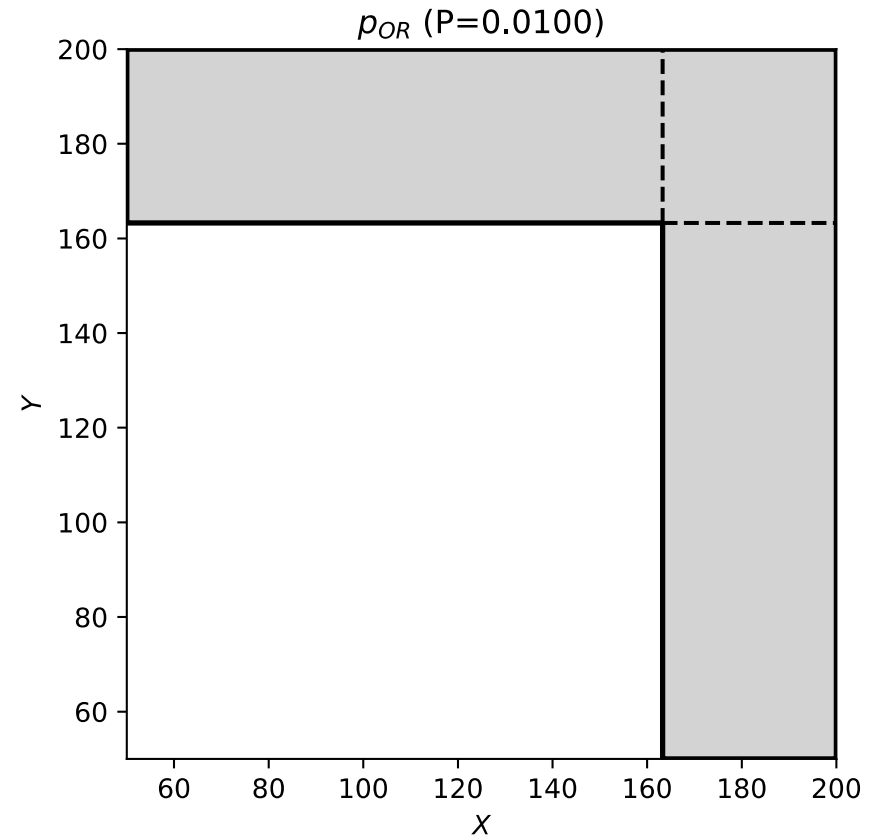
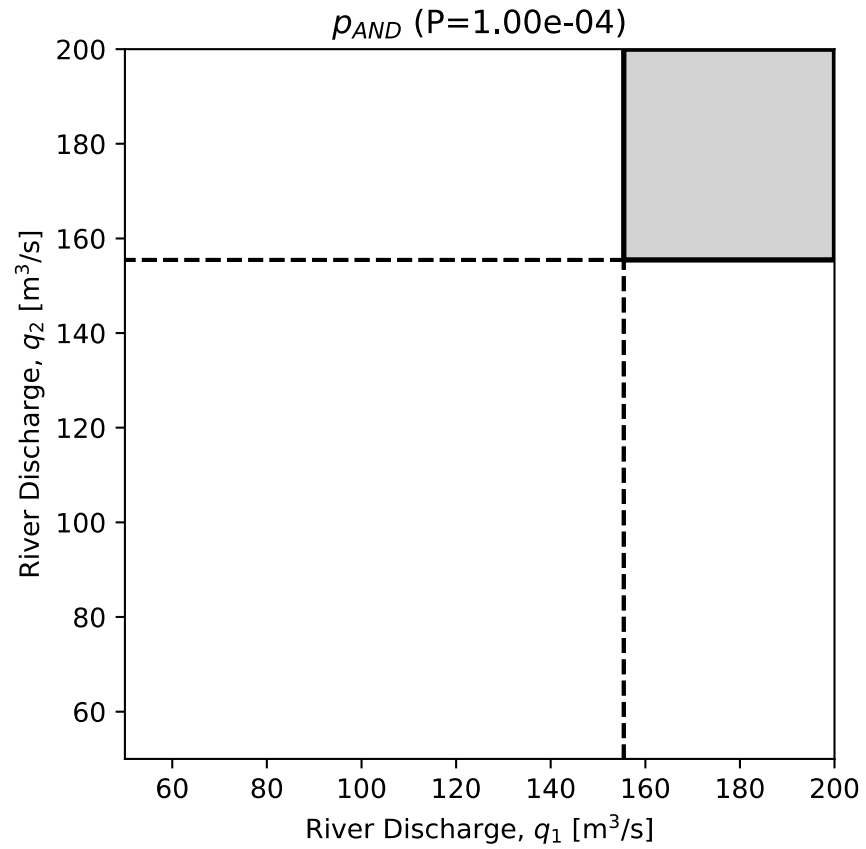
Probability of exceedance (1/yr)



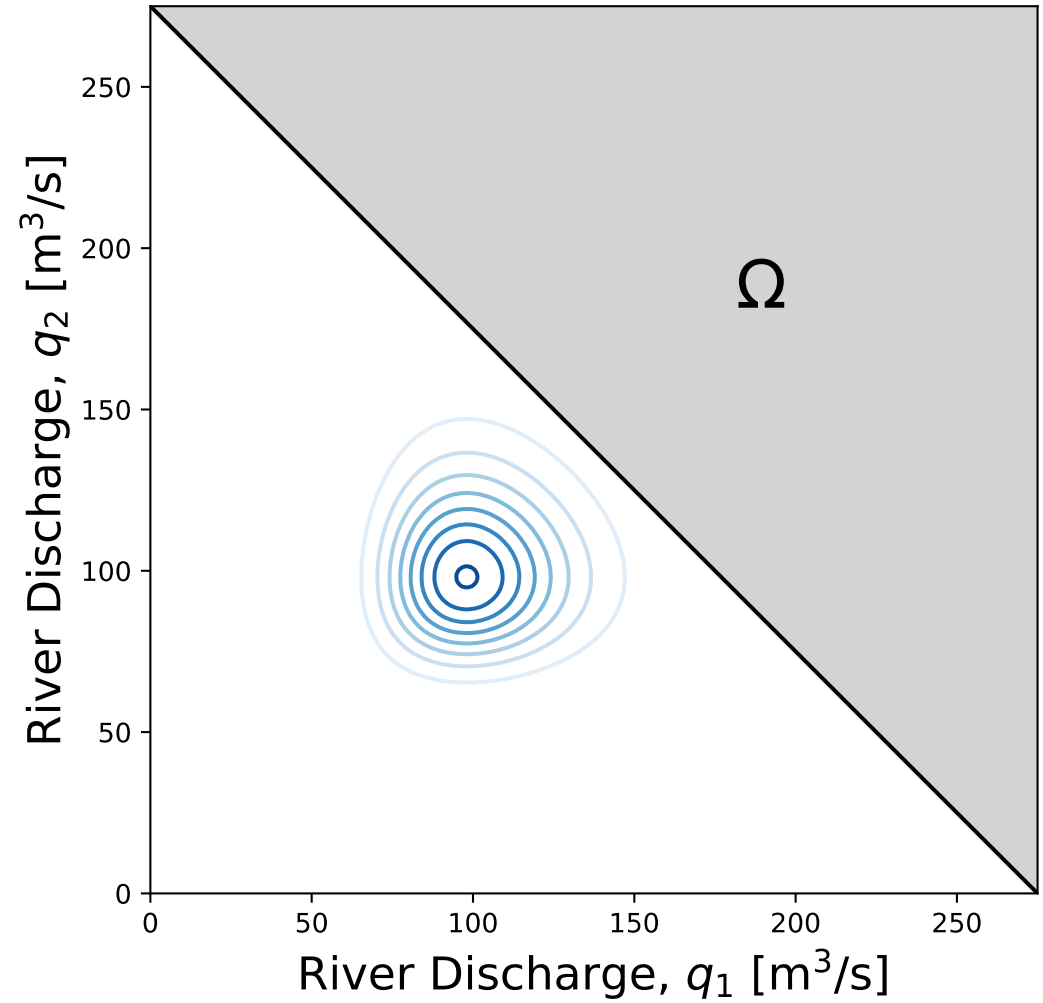
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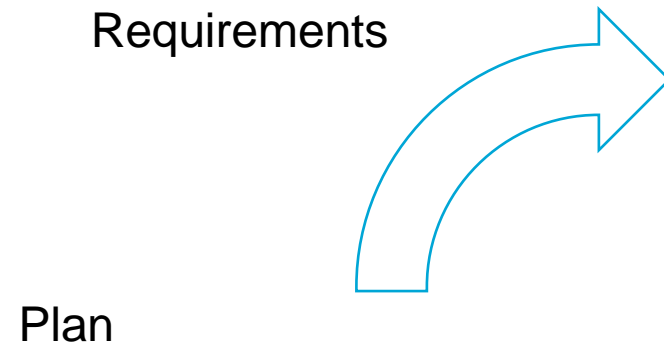
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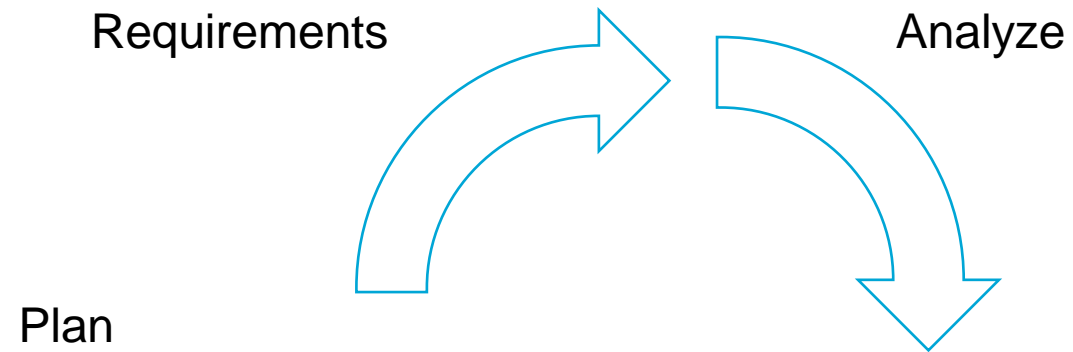
# Reliability-Based Design Philosophy

Plan

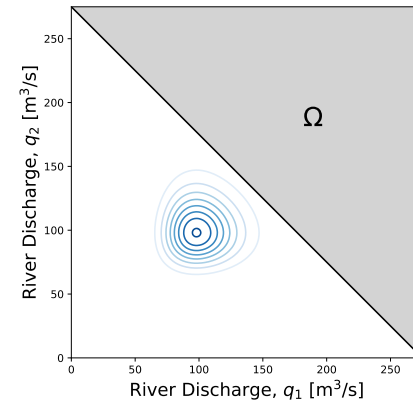
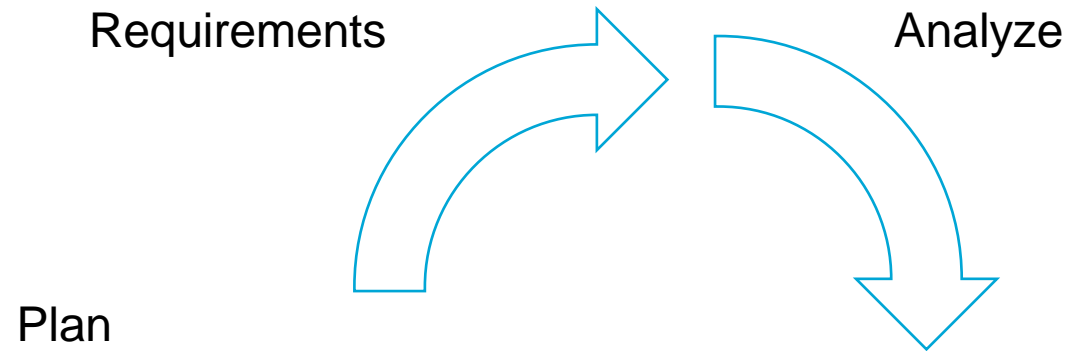
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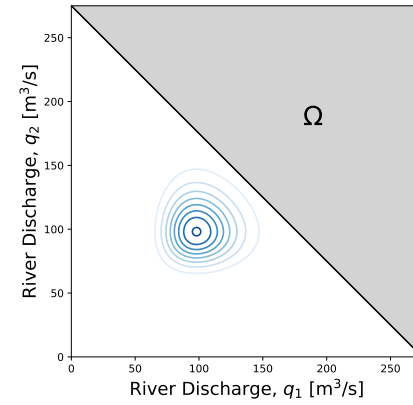
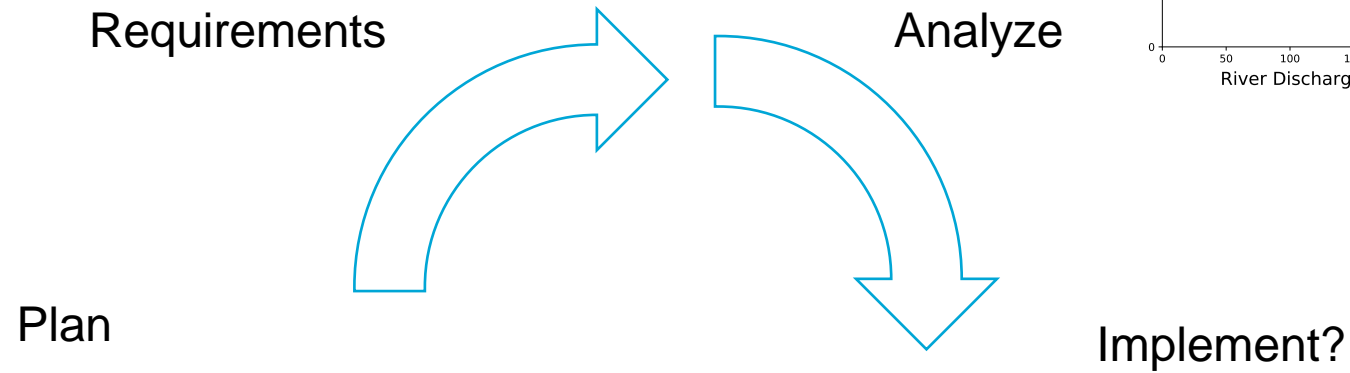


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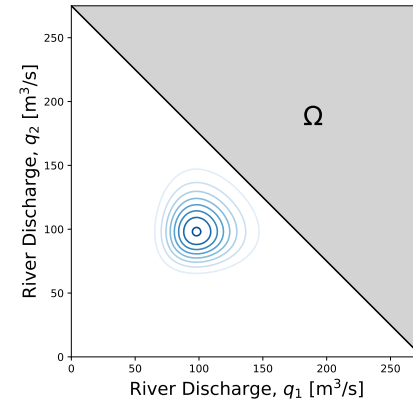
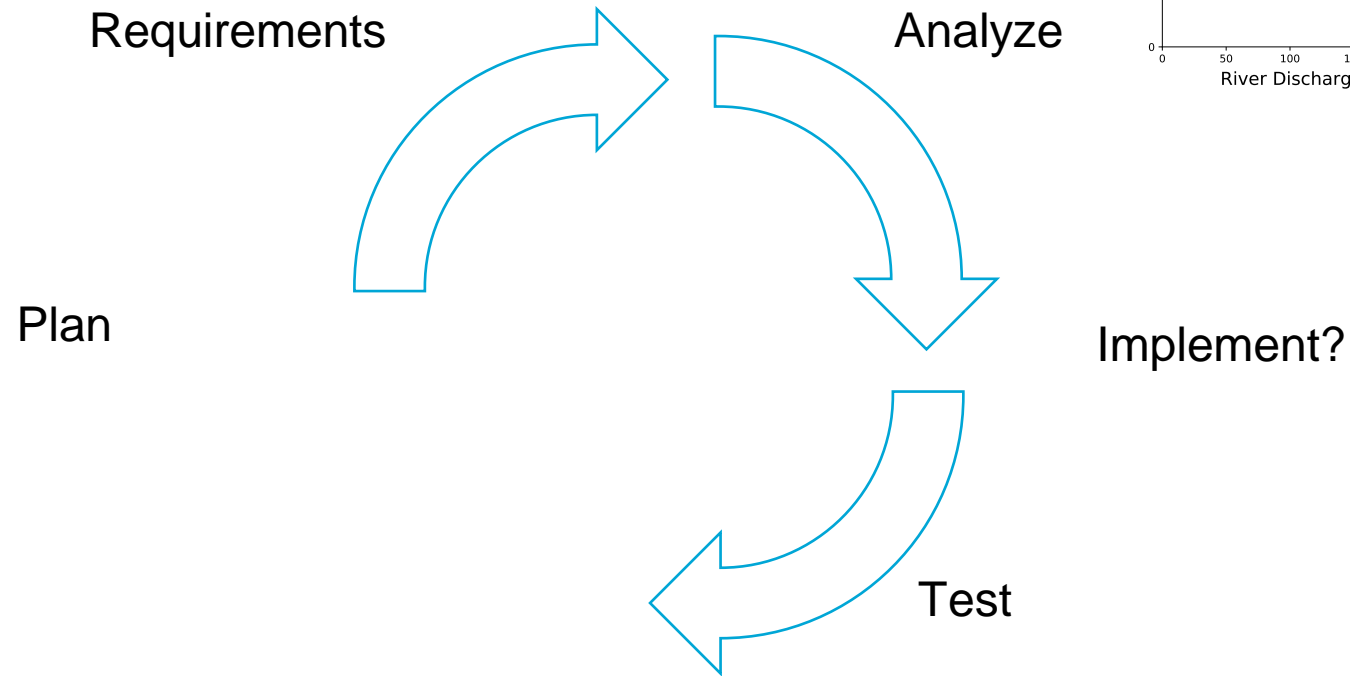




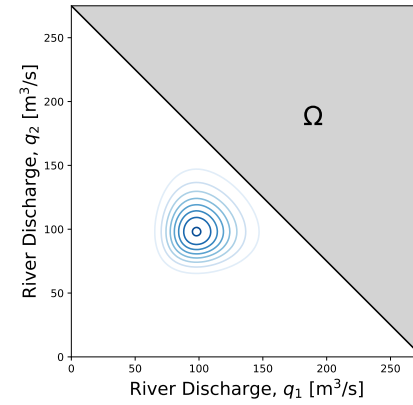
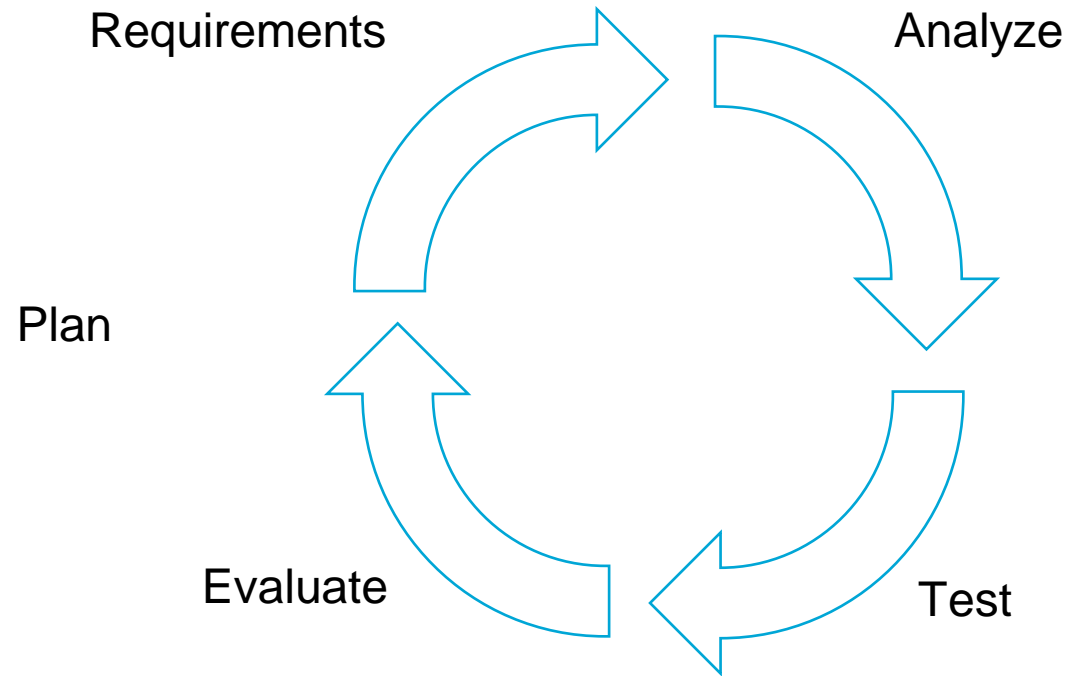
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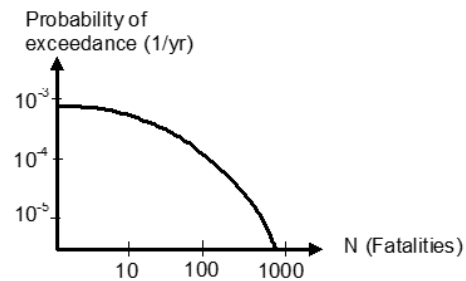
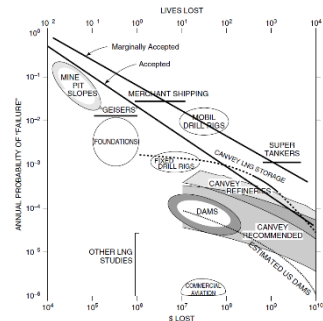
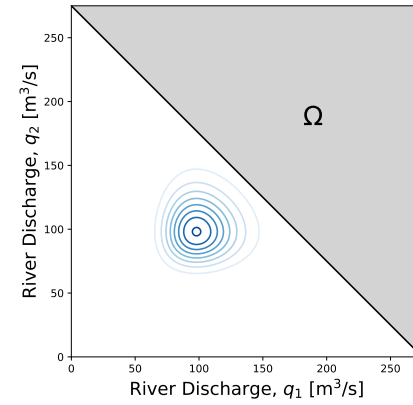
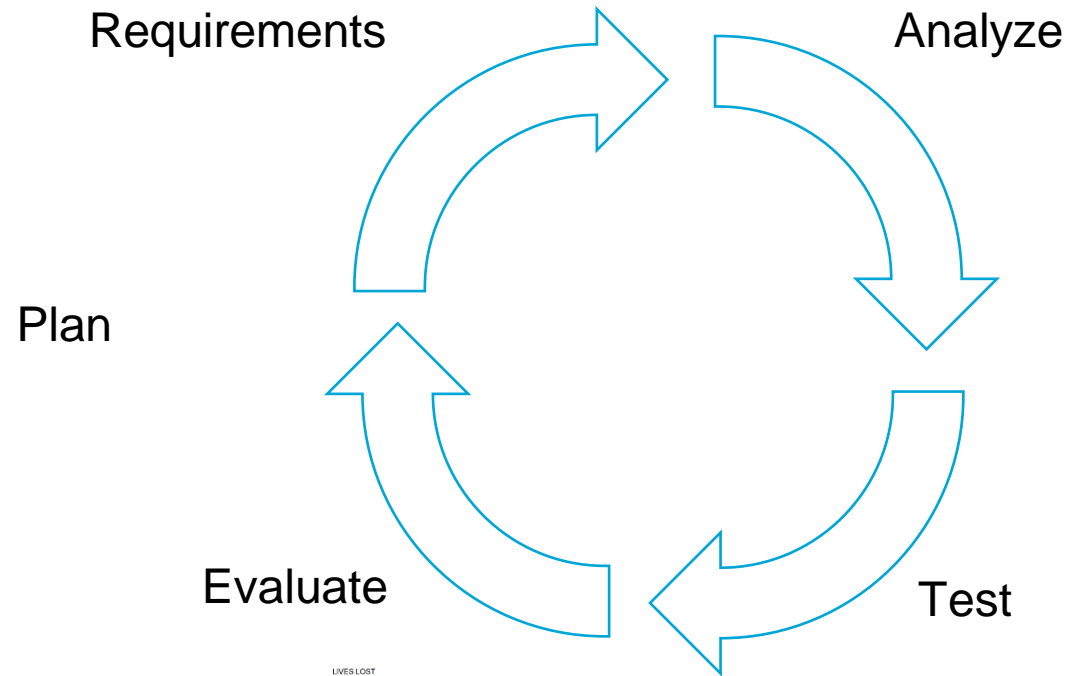
# Reliability-Based Design Philosophy



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# Reliability-Based Design Philosophy



# Summary of Reliability-Based Design Philosophy

- Reliability methods for analysing and evaluating structures/system
- Risk analysis provides a framework for evaluation
- We will apply this to your design case in our unit!

## Video 3 – Examples of RBD for each unit

# Video 4 – 3 main parts of course