# Small Coastal Stormwater Outlets: Literature Review & SA Design Guidelines

by

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**IMESA Conference, Durban**
**1 October 2019**


Photos: A Theron

# Design Guidelines for Small Coastal Stormwater Outlets

## Course Programme:

Institute of Municipal Engineering of Southern Africa

### Tuesday, 1 October 2019

| Module | Time | Topic focus |
|---|---|---|
| 0 | 08:45 – 08:55 | *Welcome & introduction of attendees* |
| 1 | 09:00 – 09:40 | Course introduction & background |
| 2 | 09:40 – 10:20 | Coastal processes & information required for design & construction - 1. |
| 10:20 – 11:00 Tea break | | |
| 3 | 11:00 – 11:40 | Coastal processes & information required for design & construction - 2. |
| 4 | 11:40 – 12:20 | Guidelines for design - 1. |
| 5 | 12:20 – 13:00 | Guidelines for design - 2. |
| 13:05 – 13:45 Lunch | | |
| 6 | 13:45 – 14:05 | Construction guidelines; Conclusions and recommendations. |
| 7 | 14:05 – 14:45 | Case studies and discussion – 1. |
| 14:45 – 15:05 Tea break | | |
| 8 | 15:05 – 15:45 | Case studies and discussion – 2. |
| End | 15:45 – 16:00 | *Final discussions and questions from attendees.* |
| Note: Discussion/questions ~10 minutes per presentation | | |

# Contents



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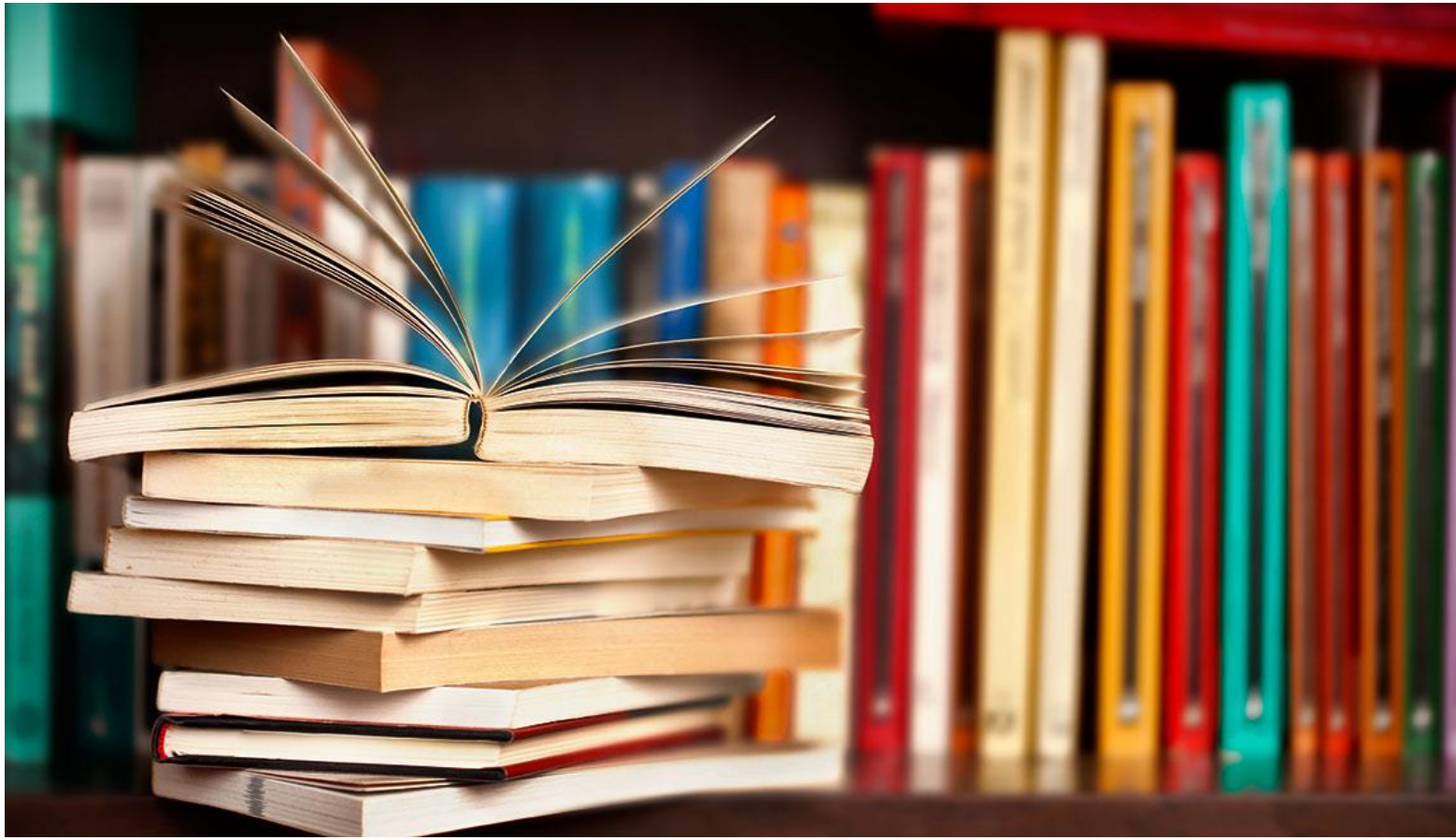
# 1. Introduction

## 1.1 Background

## 1.2 Outlet problems and failures

## 1.3 Literature review



www.aarp.org

# 1.1 Background

Stormwater drains into rivers, lakes, dams, pans, wetlands and the sea

Land factors: Ground slope, runoff…
Coastal factors: Waves, currents, wind-blown sediment…

Photo: K Schoonees

Manuals for:
Stormwater management & Hydraulics (Drainage Manual…)
Coastal engineering (Coastal Engineering Manual…)
→ Limited guidelines for coastal outlets.


Limited funds

Failures of stormwater outlets

# Aim

www.fineartamerica.com

## Design Guidelines for Small Coastal outlets

### Phase 1 - Literature review:

Review guidelines & evaluate for SA application.

→ Available guidelines - limited & insufficient for coastal design.

### Phase 2 – Design guidelines:

Existing guidelines + focus on coastal problems & design factors.

→ How should design of coastal stormwater outlets be undertaken?

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# Size

## Small – Medium outlets

Ø < 1 m

☐ < 1 m x 1 m


(Photo: A Theron)


Southern Cape
(Photo: A Theron)

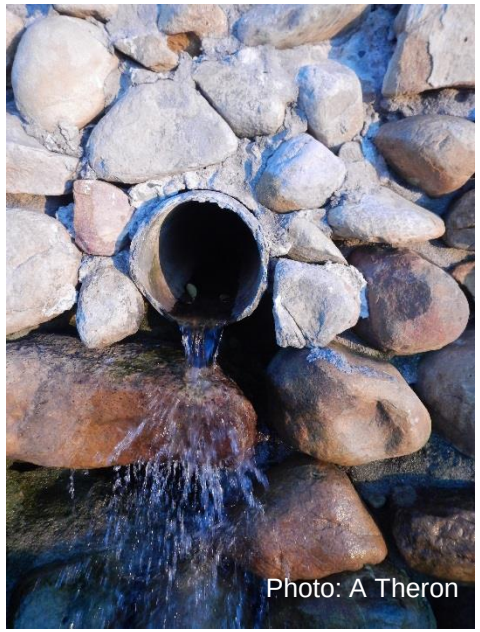


Photo: A Theron


Gordons Bay
Photo: A Theron


Photo: K Schoonees


Photos: A Theron

# Stormwater Outlets in Seawalls (medium)

# Culvert stormwater outlets (medium - large)

(Photo: A Theron)

(Photo: A Theron)

(Photo: A Theron)

(Photo: K Schoonees)

Before repair

# Large stormwater outlets at Durban

Photos: A Theron

# 1.2 Typical SA Coastal Problems & Failures of Small Stormwater Outlets

- Beach erosion and/or scour.
- Accretion of sand at outlets.
- Stability of the outlets.
- Backshore inundation / flooding.
- Coastal pollution.
- Beach usage impacts.
- Aesthetic impacts.

Photo: K Schoonees

# Stability of the outlet

Mossel Bay, False Bay & Saudi Arabia
Photos: MVD, 2011;
A Theron; K Schoonees

Photos: MVD (2011)

**Eroded embankments due to stormwater outflows**

**Scour / undercutting of a gabion outlet structure in the Mossel Bay area resulting in structural collapse**

# Accretion of sand at an outlet

Photos: A Theron

**Sand ingress into the stormwater system in backshore areas**

# 1.3 Literature survey

Photo: www.stormwatersystems.com

**Prevention is better than cure**

**Best Management Practices**

**Reduce flow with rain tanks, swales, wetlands, bioretention ponds, exfiltration trenches**

**Reduce pollution: Street sweeping; picking up rubbish; skimming off floating debris and oil; grit traps**

**Hydraulic & coastal design**

Photo: NCSU

# Recommendations

**Reduce erosion: outlet on rocky area or headland**

**Combine outlets**

**Incorporate outlet into a beach structure**

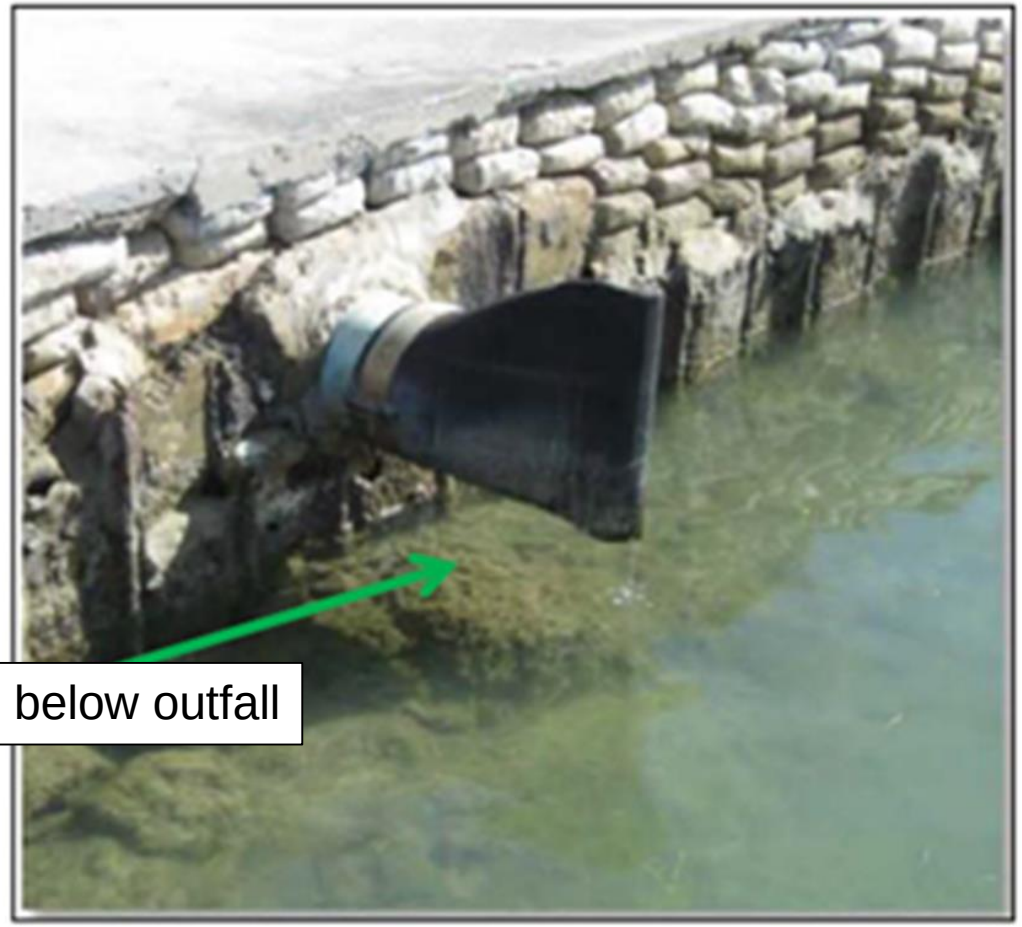
**Outlet as small as possible, yet functional**

**Outlets should blend in with surrounding area**

**Public access**

**Prevent backflow: flap or duckbill valve**

**Duckbill valve** (from City of Miami, no date)



# Recommendations

**Allow for differential settlement of rock; use monolythic construction**

**Support outlets on slopes by piles**

**Blocking by sand and stone: use a duckbill valve or a flap**

Photo: A Theron