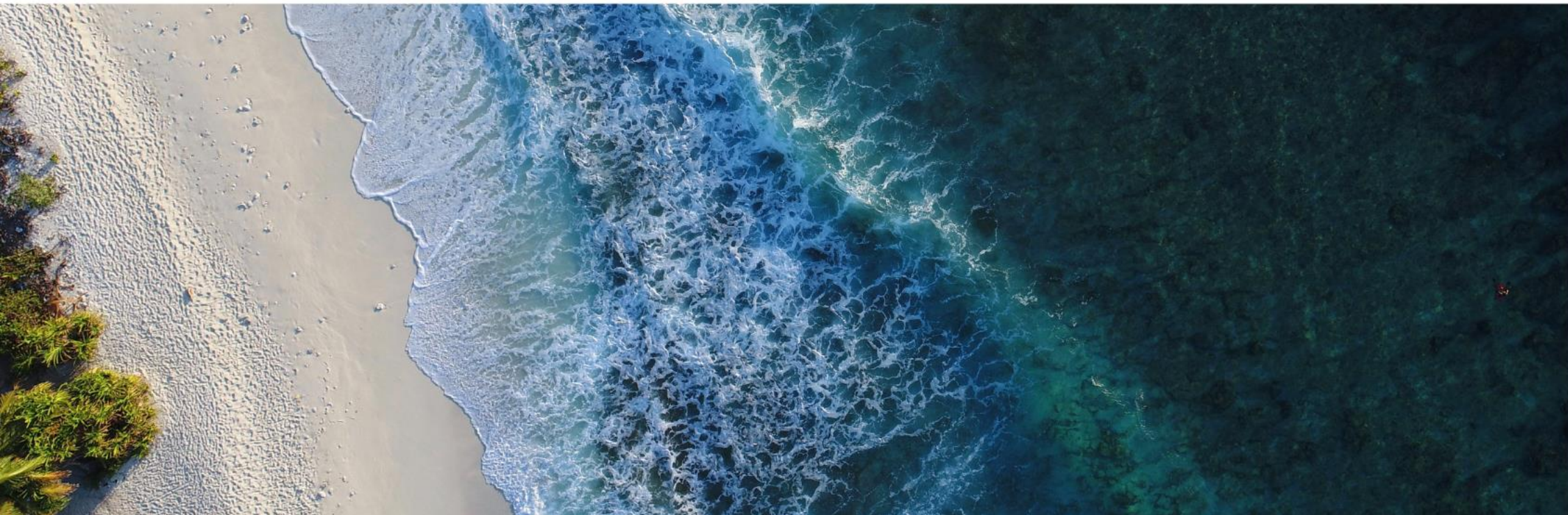




# Stormwater Fundamentals Series - Proprietary Stormwater Treatment Assets

Ocean Protect webinar by Peter Worth & Brad Dalrymple  
31 July 2024



# Stormwater Fundamentals Series

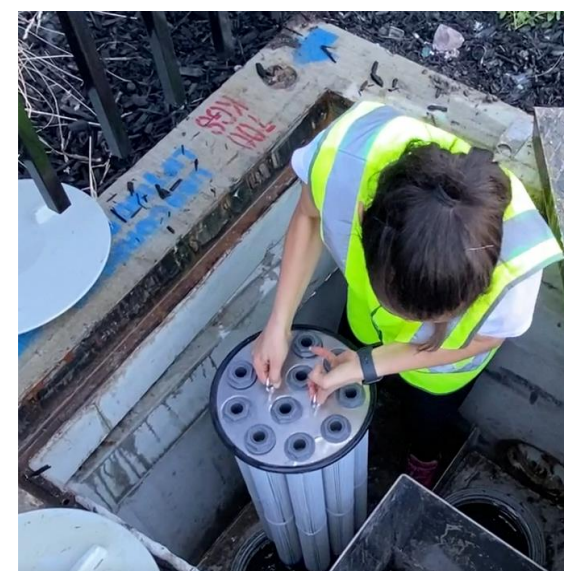
1. The Rational Method - Wednesday 7<sup>th</sup> February 2024
2. Inlet Design - Wednesday 21<sup>st</sup> February 2024
3. Pipe Design - Wednesday 27<sup>th</sup> March 2024
4. Impacts of traditional urban stormwater management - Wednesday 1<sup>st</sup> May 2024
5. Water Sensitive Urban Design - Wednesday 22<sup>nd</sup> May 2024
6. Gross Pollutant Traps - Wednesday 12<sup>th</sup> June 2024
7. Bioretention - Wednesday 3<sup>rd</sup> July 2024
8. Proprietary stormwater treatment assets - Wednesday 31<sup>st</sup> July 2024
9. Stormwater pollution in the 'real world' - Wednesday 28<sup>th</sup> August 2024
10. Development assessment (for DA reviewers) - Wednesday 25<sup>th</sup> September 2024
11. WSUD Asset Maintenance - Wednesday 23<sup>rd</sup> October 2024
12. WSUD Asset Compliance - Wednesday 13<sup>th</sup> November 2024

🕒 All info at [www.oceanprotect.com.au/webinars](http://www.oceanprotect.com.au/webinars)

🕒 Subscribe at [www.oceanprotect.com.au/newsletter](http://www.oceanprotect.com.au/newsletter)



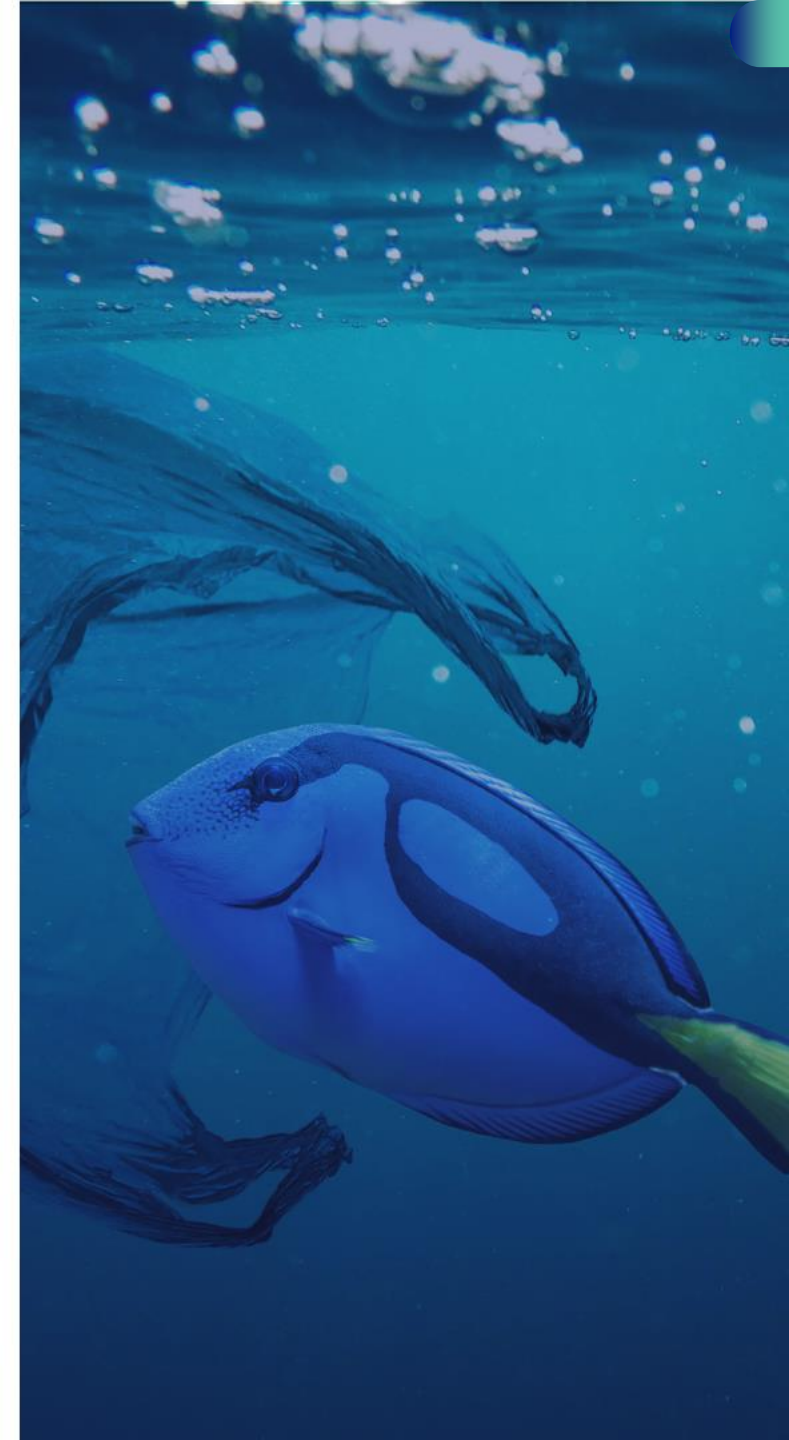
# Conflict of interest declaration





# Reminders

- ④ Please put any questions in the 'Q&A' panel
- ④ The slides & recording will be made available at [www.oceanprotect.com.au/webinars](http://www.oceanprotect.com.au/webinars)
- ④ Please email any CPD form requests to [enquiries@oceanprotect.com.au](mailto:enquiries@oceanprotect.com.au)





# Agenda

- ② What are they ?
- ② Example Ocean Protect STAs
  - OceanGuard
  - StormFilter
  - Jellyfish
- ② Myth busting





- ② “Fundamental” part of our industry
- ② Ocean Protect alone:
  - Installed 66,000+
  - Stop over 10 tonnes of pollution every day
  - Stopped over 20,000 tonnes of pollution



An underwater scene with a blue-green color palette. Numerous bubbles of various sizes are rising from the bottom towards the surface. Sunlight rays penetrate the water from the top right, creating a shimmering effect. The overall atmosphere is serene and mysterious.

**What are they ?**

# What are proprietary stormwater treatment assets ?

- ④ Definition ?
- ④ ~ *"Assets applied to improve the quality of stormwater (or otherwise protect receiving environments from the potential negative impacts of stormwater) that include multiple proprietary (or manufactured) components that, for a given project or application, can only be readily supplied by a single supplier"* ?

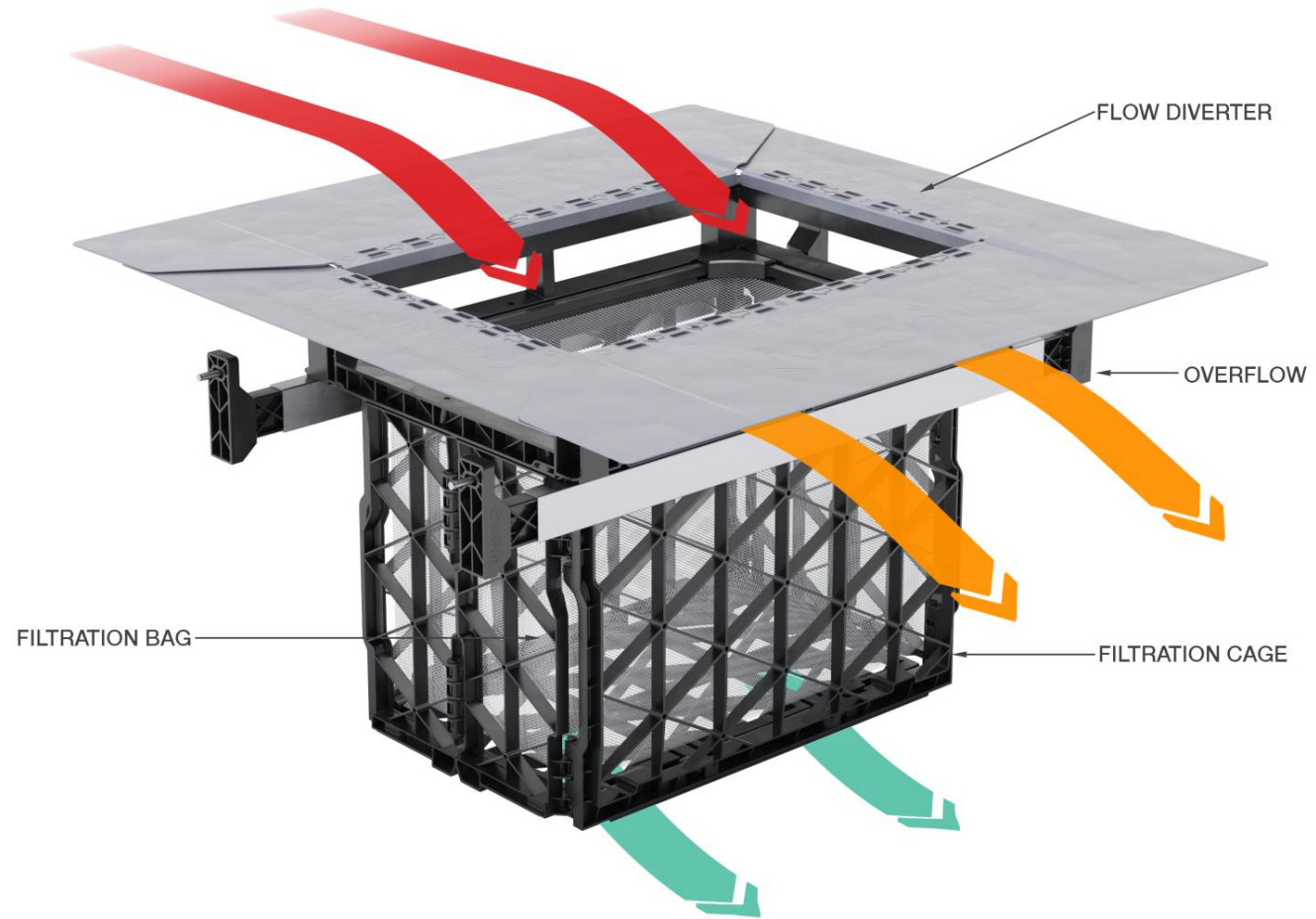




An underwater photograph showing a large plume of bubbles rising from the bottom towards the surface. Sunlight filters through the water from the right, creating a shimmering effect. The overall color palette is various shades of blue and teal.

# The OceanGuard

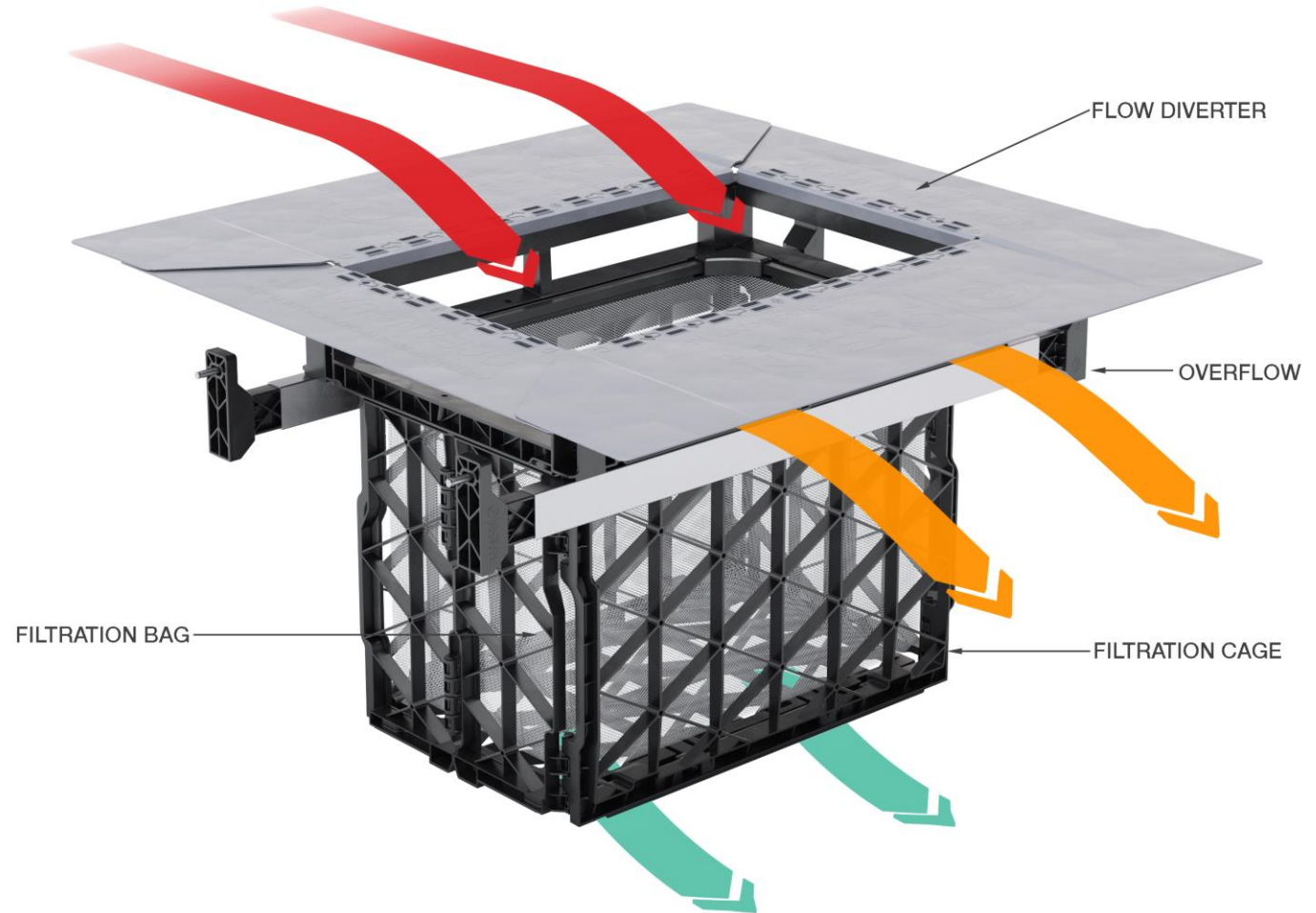
# OceanGuard





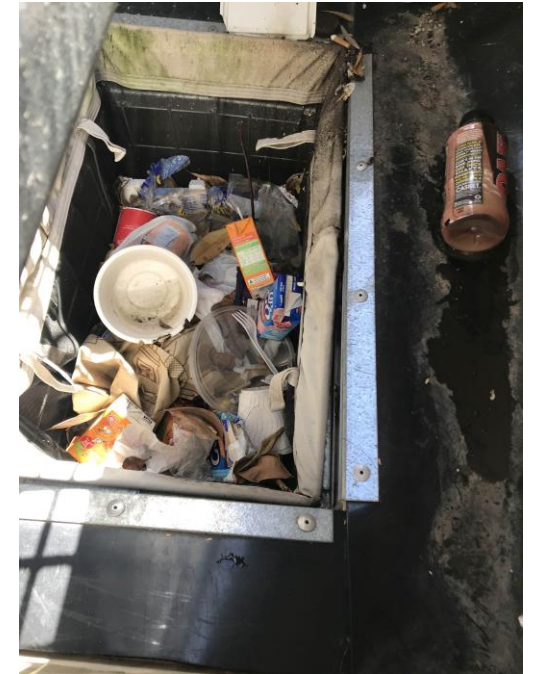
# What is OceanGuard ?

- ⦿ Gully pit basket
- ⦿ Integrated into pits
- ⦿ Different bag options
- ⦿ Ideal for pre-treatment



# Application

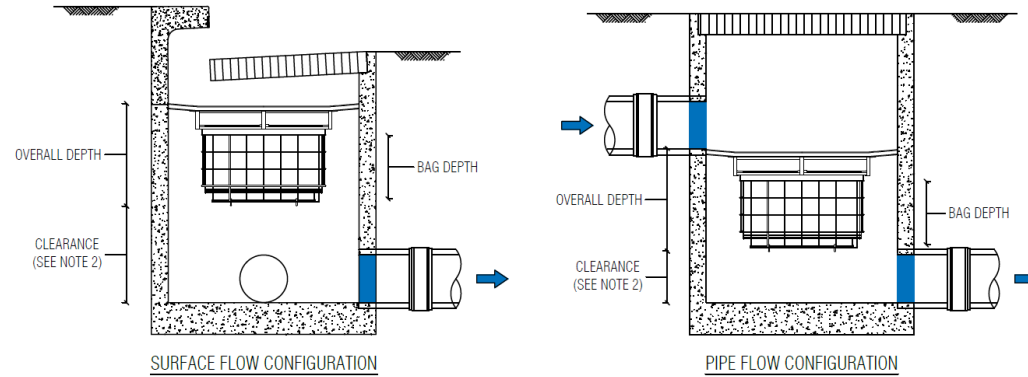
- ⦿ Commercial, industrial & residential areas
- ⦿ Other projects (e.g. roads, airports)





# Configuration

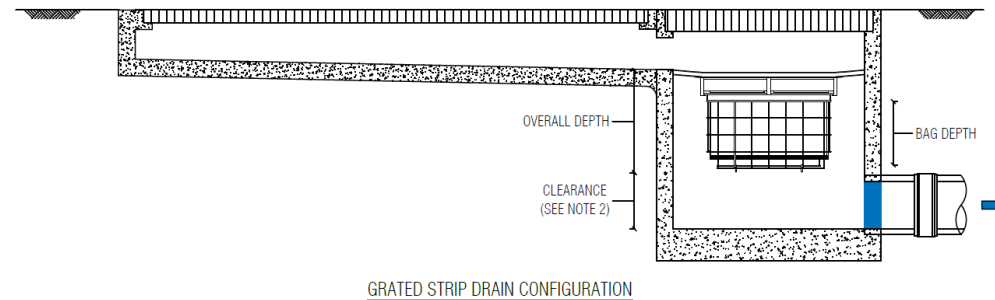
- Surface flow (typical)
- Pipe flow
- Grated strip drain
- 4 sizes
- 3 depths



PLAN ID	MAXIMUM PIT PLAN DIMENSIONS
S	450mm x 450mm
M	600mm x 600mm
L	900mm x 900mm
XL	1200mm x 1200mm

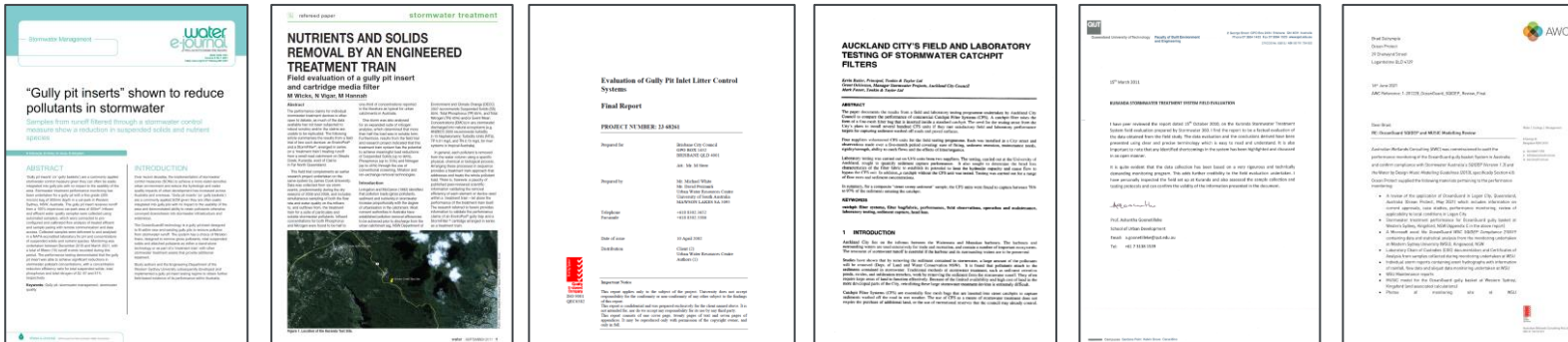
DEPTH ID	BAG DEPTH	OVERALL DEPTH
1	170	270
2	300	450
3	600	700

PLAN ID	DEPTH ID		
	1	2	3
S	■	■	■
M	■	■	■
L	■	■	■
XL	■	■	■



# Performance

- ④ 4 x 'real world', published studies
- ④ 2 x peer review reports
- ④ SQIDEP & Council approved performance values





# Maintenance

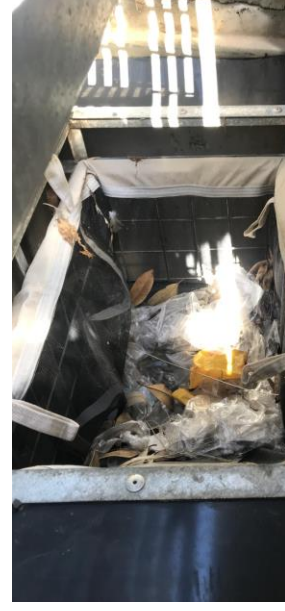


- ⌚ Manual lifting of bag & emptying
- ⌚ Can use vacuum unit
- ⌚ Replace bag (if damaged)



# Case studies

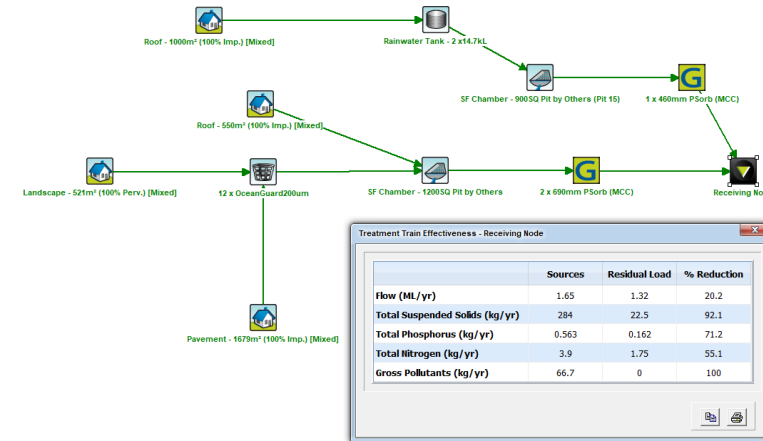
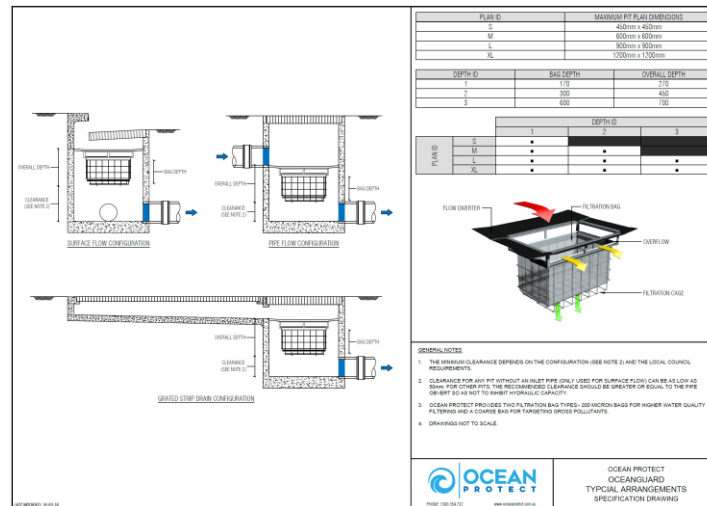
© Over 20,000 installed in Australia



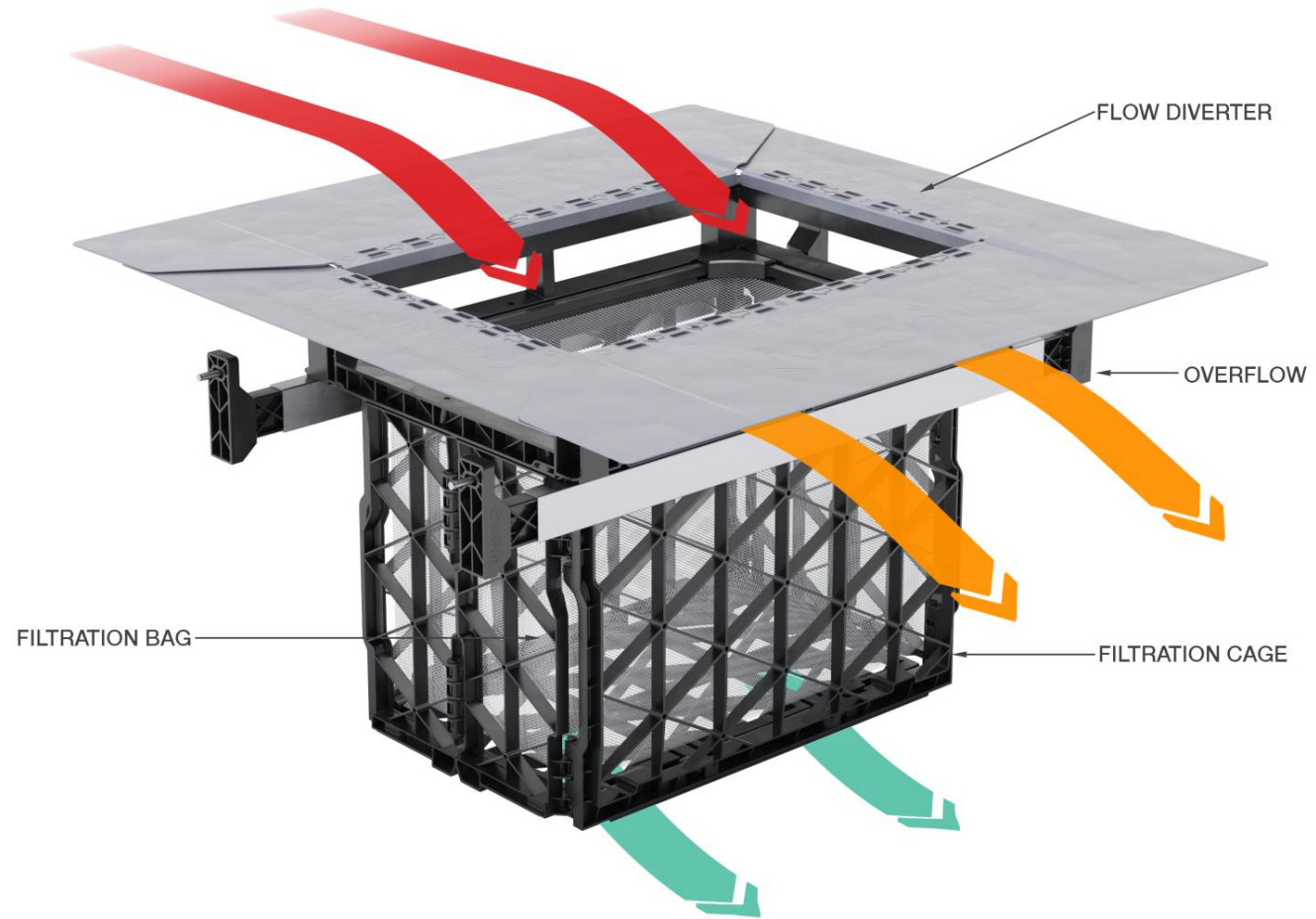


# How to specify ?

- ④ <https://oceanprotect.com.au/oceanguard/> (drawings, manuals, review paper)
- ④ Contact Ocean Protect
- ④ OP can do MUSIC modelling & site-specific drawings (no obligation)
- ④ Identifying location(s) of drawings is OK



# OceanGuard





An underwater scene with a blue-green color palette. The water is filled with numerous bubbles of various sizes, some rising and some falling. Light rays are visible, creating a shimmering effect on the water's surface. The overall atmosphere is serene and aquatic.

# The StormFilter

# StormFilter





# What is StormFilter ?

- ⌚ Radial treatment technology
- ⌚ Flexible configurations
- ⌚ Multiple media options
- ⌚ Self cleaning functionality
- ⌚ Accessible & rechargeable cartridges



# Application

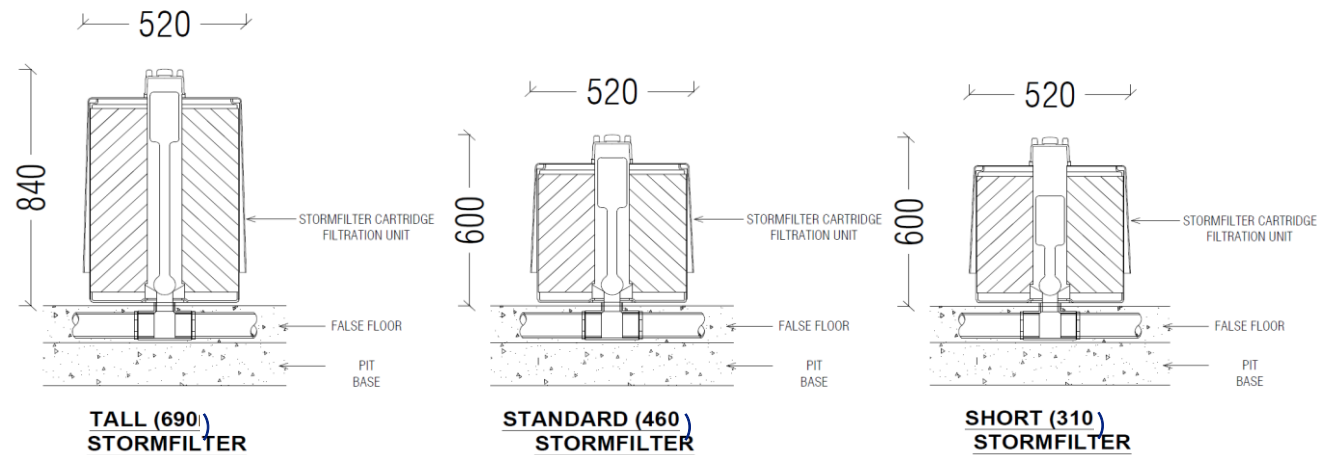
- ⦿ Commercial, industrial & residential areas
- ⦿ Other projects (e.g. roads, airports)





# Configuration

- ⌚ Precast concrete pits & tanks
- ⌚ Custom above ground HDPE/aluminium tanks
- ⌚ Integrated within on-site detention structures
- ⌚ On-line or off-line
- ⌚ 3 x cartridge heights



# Performance

- ④ 4 x 'real world', published studies
- ④ 2 x peer review reports
- ④ 1 x longevity study
- ④ SQIDEP & Council approved performance values





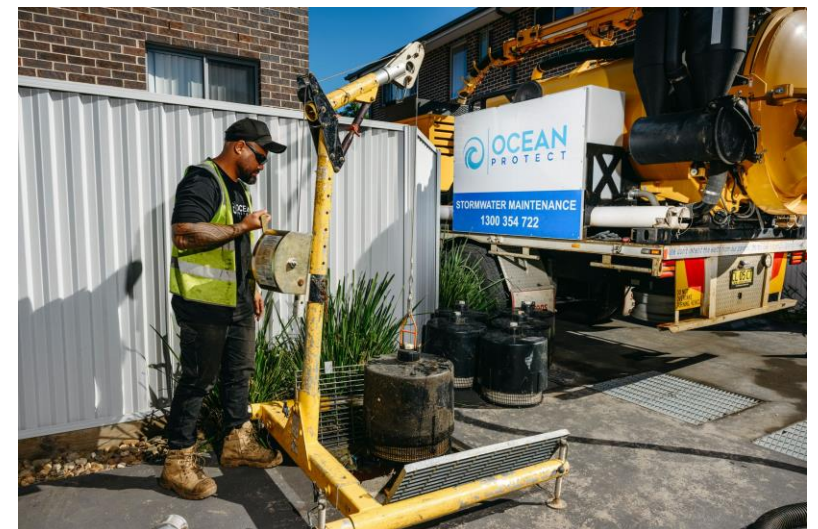
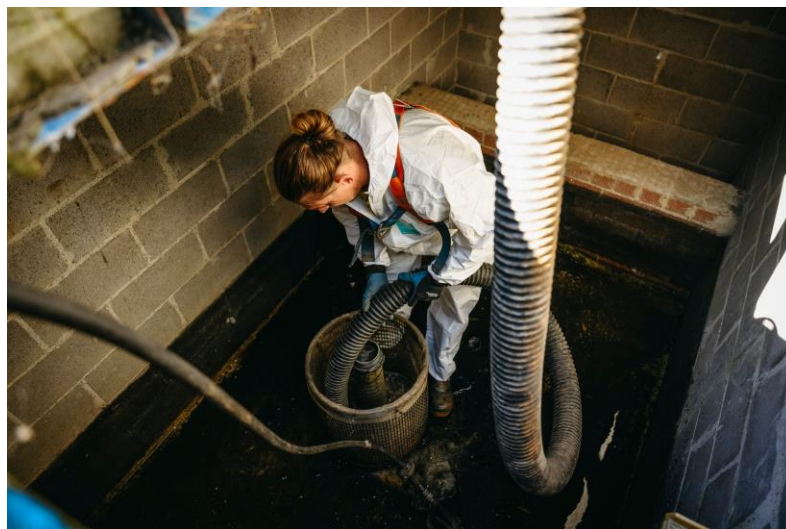
# Maintenance



OCEAN PROTECT

StormFilter®  
Operations & Maintenance Manual

Stopping Pollution Entering Waterways





# Case studies

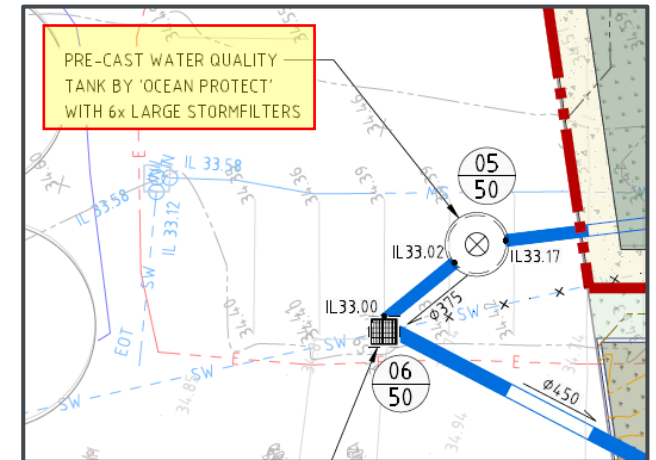
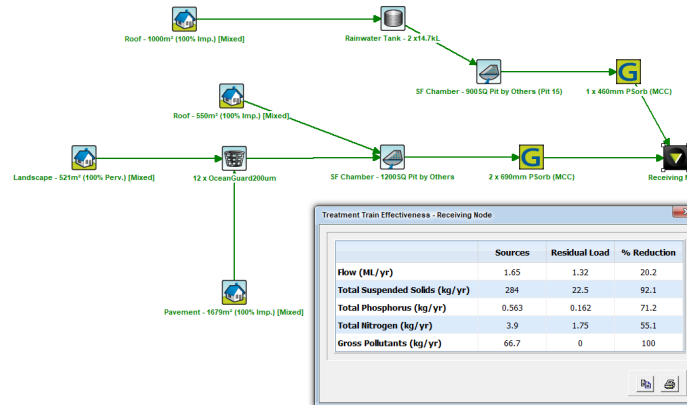
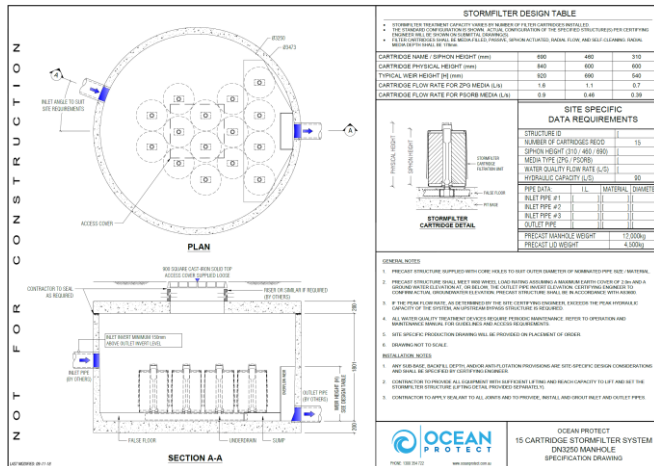
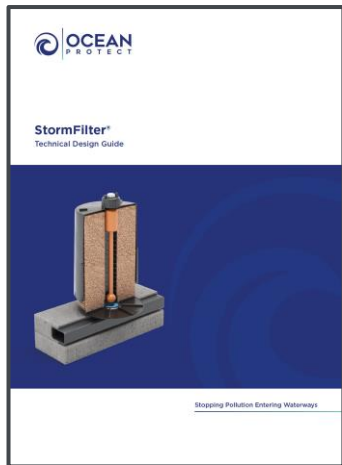
- ⌚ Over 31,000 installed in Australia
- ⌚ Over 250,000 installed overseas





# How to specify ?

- ④ <https://oceanprotect.com.au/stormfilter/> (drawings, manuals, review paper)
- ④ Contact Ocean Protect
- ④ OP can do MUSIC modelling & site-specific drawings (no obligation)
- ④ A single note &/ or circle on drawings is OK



# StormFilter

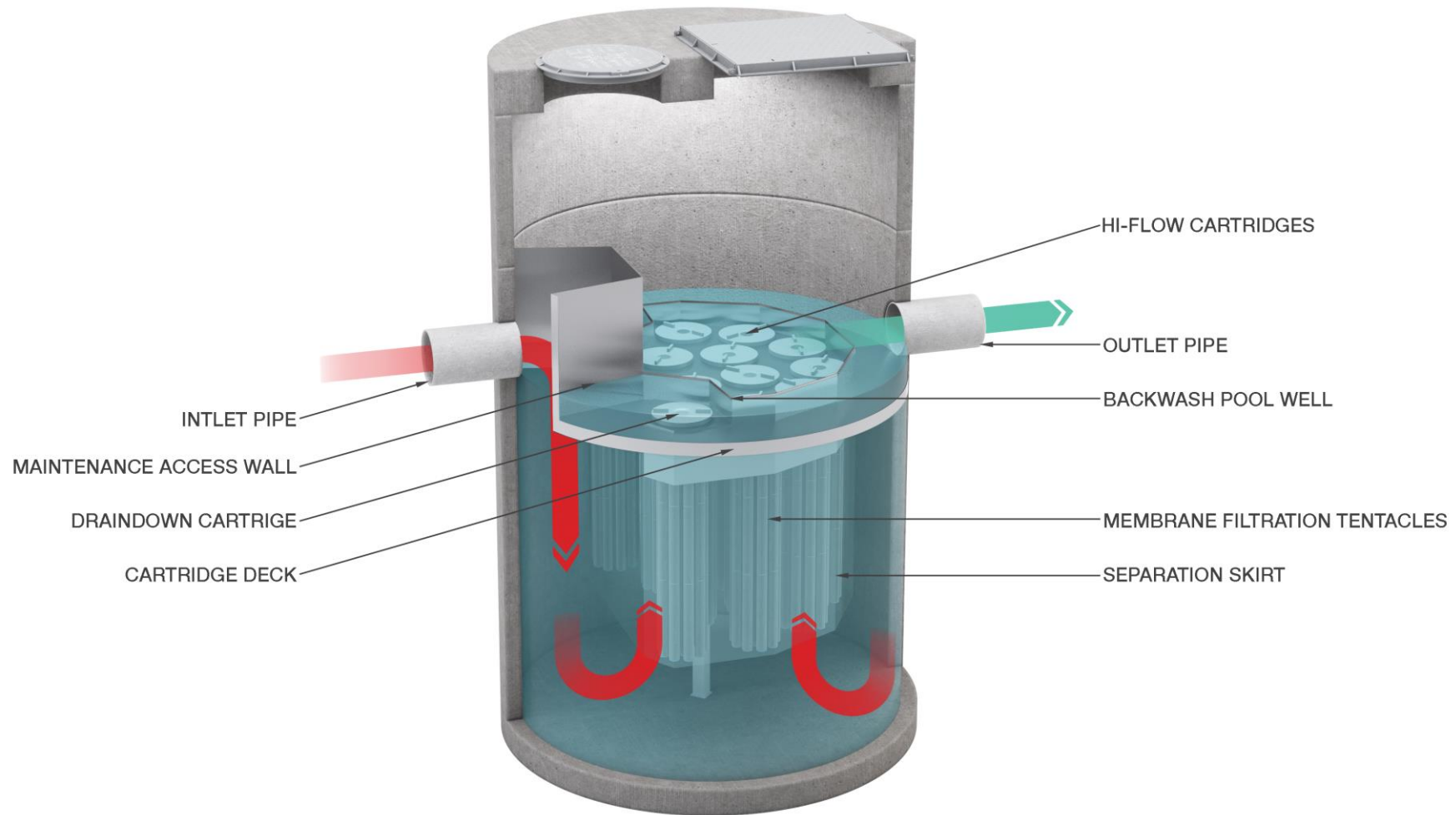




An underwater scene with a blue-green color palette. The water is filled with numerous small, clear bubbles that catch the light. Sunlight rays penetrate from the surface, creating a shimmering effect. The overall atmosphere is serene and aquatic.

# The Jellyfish

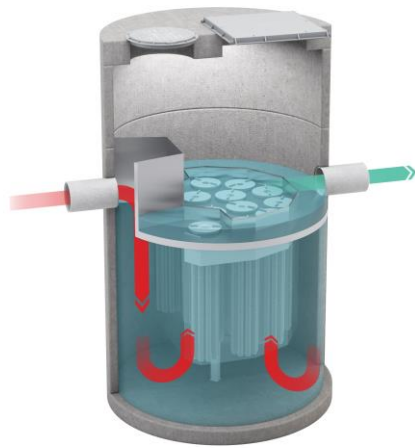
# Jellyfish





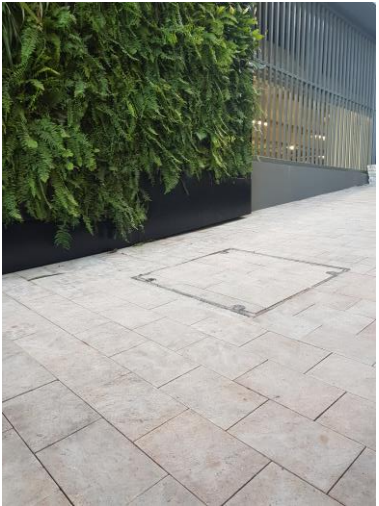
# What is Jellyfish ?

- ⦿ Membrane cartridge filtration
- ⦿ Up-flow hydraulics
- ⦿ Self cleaning functionality
- ⦿ Flexible configurations
- ⦿ Accessible & replaceable cartridges



# Application

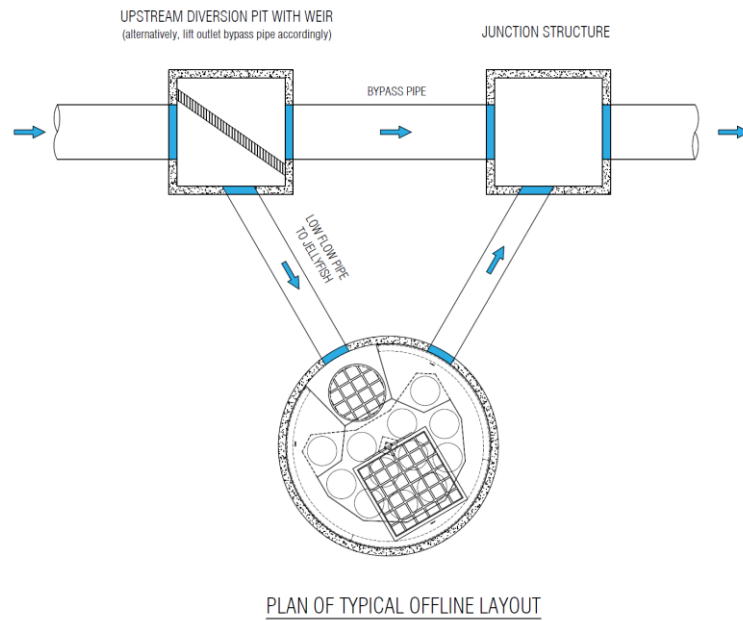
- ⦿ Commercial, industrial & residential areas
- ⦿ Special projects (e.g. highways, airports)
- ⦿ Popular for sites with low driving head





# Configuration

- ⦿ Precast concrete pits & tanks
- ⦿ Custom chambers
- ⦿ On-line or off-line



Model	High-flow Cartridges	Drain-down Cartridges	Flow Rate (L/s)	Approximate unit Diameter (m)
JF1200-1-1	1	1	7.5	1.2
JF1200-2-1	2	1	12.5	
JF2250-3-1	3	1	17.5	2.25
JF2250-4-1	4	1	22.5	
JF2250-5-1	5	1	27.5	
JF2250-6-1	6	1	32.5	
JF2250-7-2	7	2	40	
JF2250-8-2	8	2	45	
JF2250-9-2	9	2	50	3.25
JF2250-10-2	10	2	55	
JF3250-11-2	11	2	60	
JF3250-12-2	12	2	65	
JF3250-13-3	13	3	72.5	
JF3250-14-3	14	3	77.5	
JF3250-15-3	15	3	82.5	
JF3250-16-3	16	3	87.5	
JF3250-17-3	17	3	92.5	
JF3250-18-3	18	3	97.5	
JF3250-19-4	19	4	105	3.25
JF3250-20-4	20	4	110	
JF3250-21-4	21	4	115	
JF3250-22-4	22	4	120	
JF3250-23-4	23	4	125	
JF3250-24-4	24	4	130	
JF3250-25-5	25	5	137.5	
JF3250-26-5	26	5	142.5	
JF3250-27-5	27	5	147.5	
JF3250-28-5	28	5	152.5	

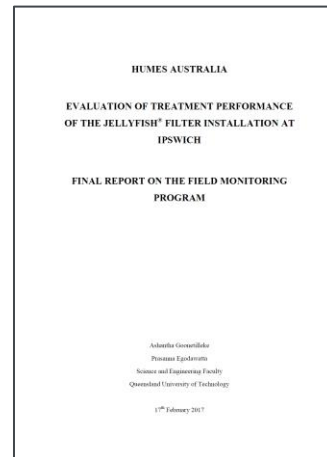
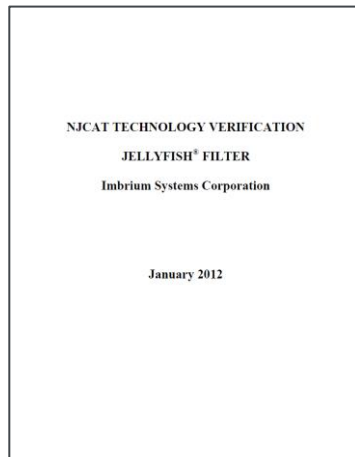
# Performance

- 2 x 'real world', published studies
- 2 x peer review reports
- SQIDEP & Council approved performance values



## A review of the application of Jellyfish® in Australia

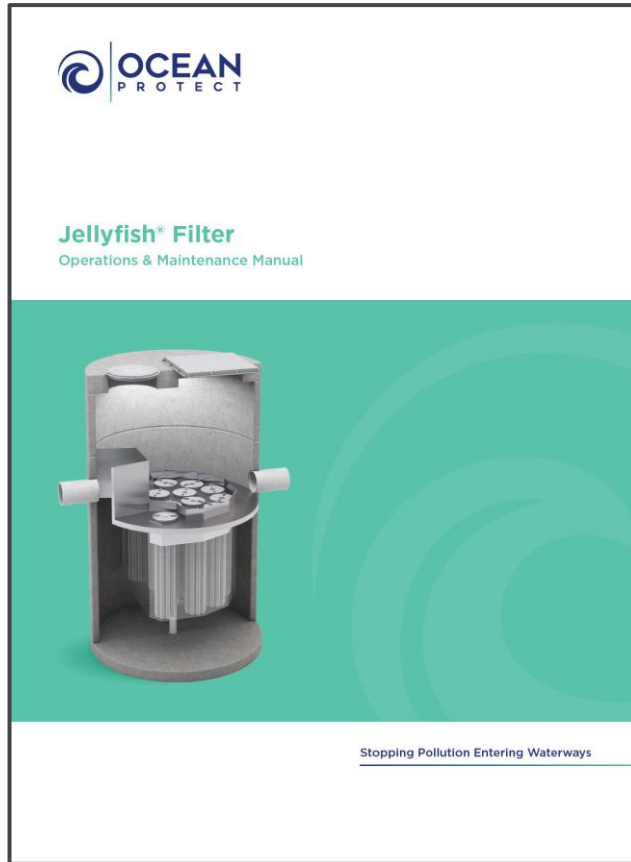
Date: September 2021





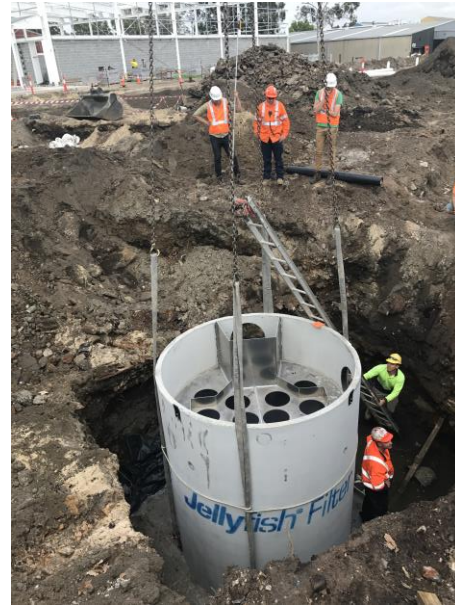
# Maintenance

- ⌚ Minor service – rinse cartridges & remove pollution (~6 months)
- ⌚ Major service – replace cartridges (as required)



# Case studies

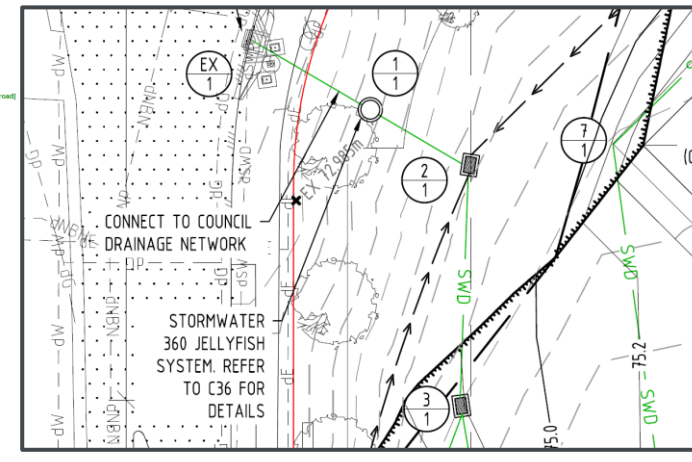
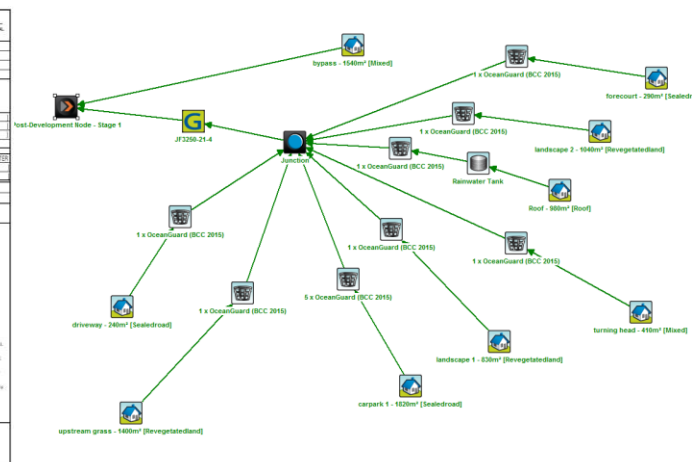
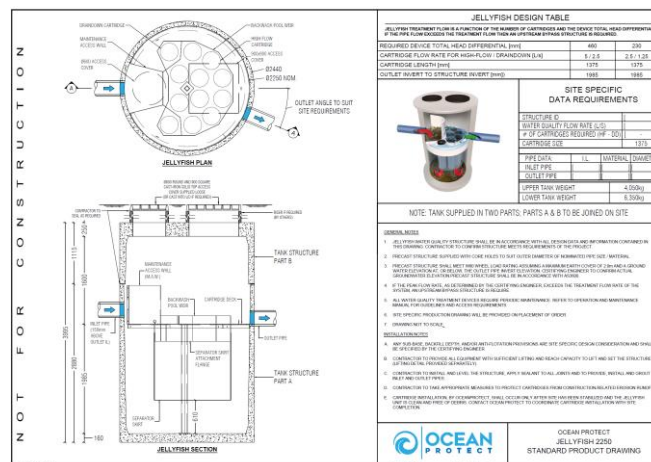
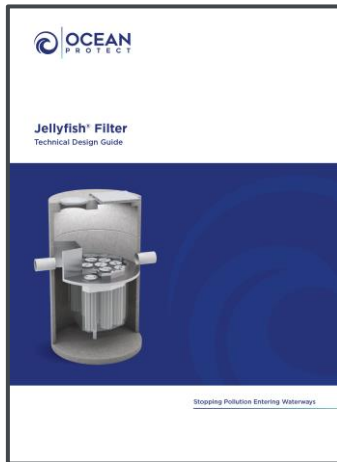
© Over 1600 installed in Australia since 2017



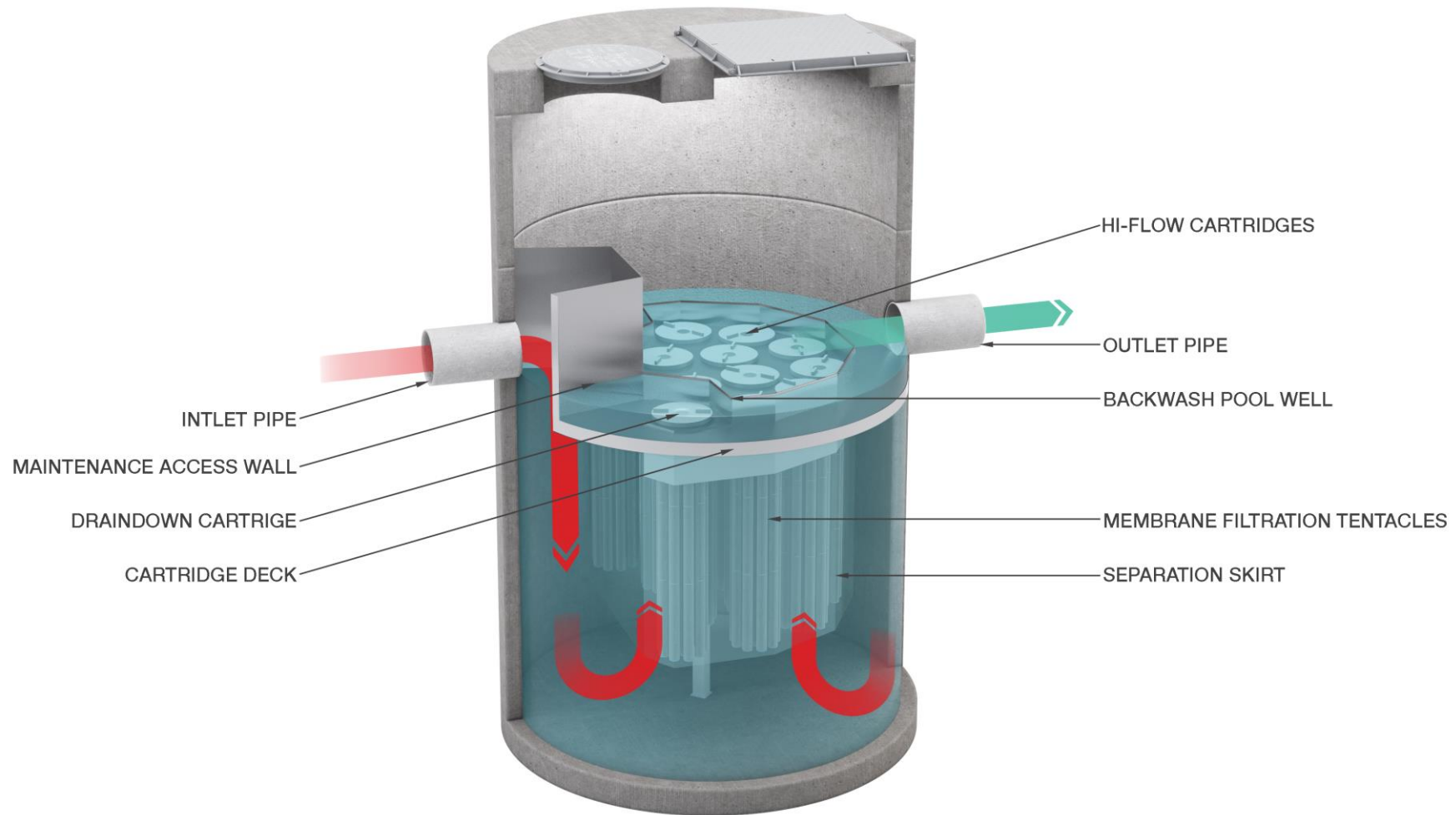


# How to specify ?

- ④ <https://oceanprotect.com.au/jellyfish/> (drawings, manuals, review paper)
- ④ Contact Ocean Protect
- ④ OP can do MUSIC modelling & site-specific drawings (no obligation)
- ④ A single note &/ or circle on drawings is OK



# Jellyfish





An underwater scene with a blue-green color palette. The water is filled with numerous bubbles of various sizes, some rising and some falling. Light rays are visible, creating a shimmering effect on the water's surface. The overall atmosphere is serene and aquatic.

# Myth busting

# Common claims

1. Parts/ components of proprietary STAs can not be sourced if the STA proprietor went “belly up”
2. Non-proprietary STA's STAs (e.g. bioretention) are much less likely to 'fail' (e.g. if not maintained) (relative to proprietary STAs)
3. Non-proprietary are much less expensive to maintain
4. Non-proprietary STAs provide other benefits (e.g. amenity, cooling, habitat, hydrology)
5. Non-proprietary STAs are much better at removing nutrients (particularly dissolved nutrients)





# Myth #1

- © Parts/ components of proprietary STAs can not be sourced if the STA proprietor went “belly up”



# Myth #1

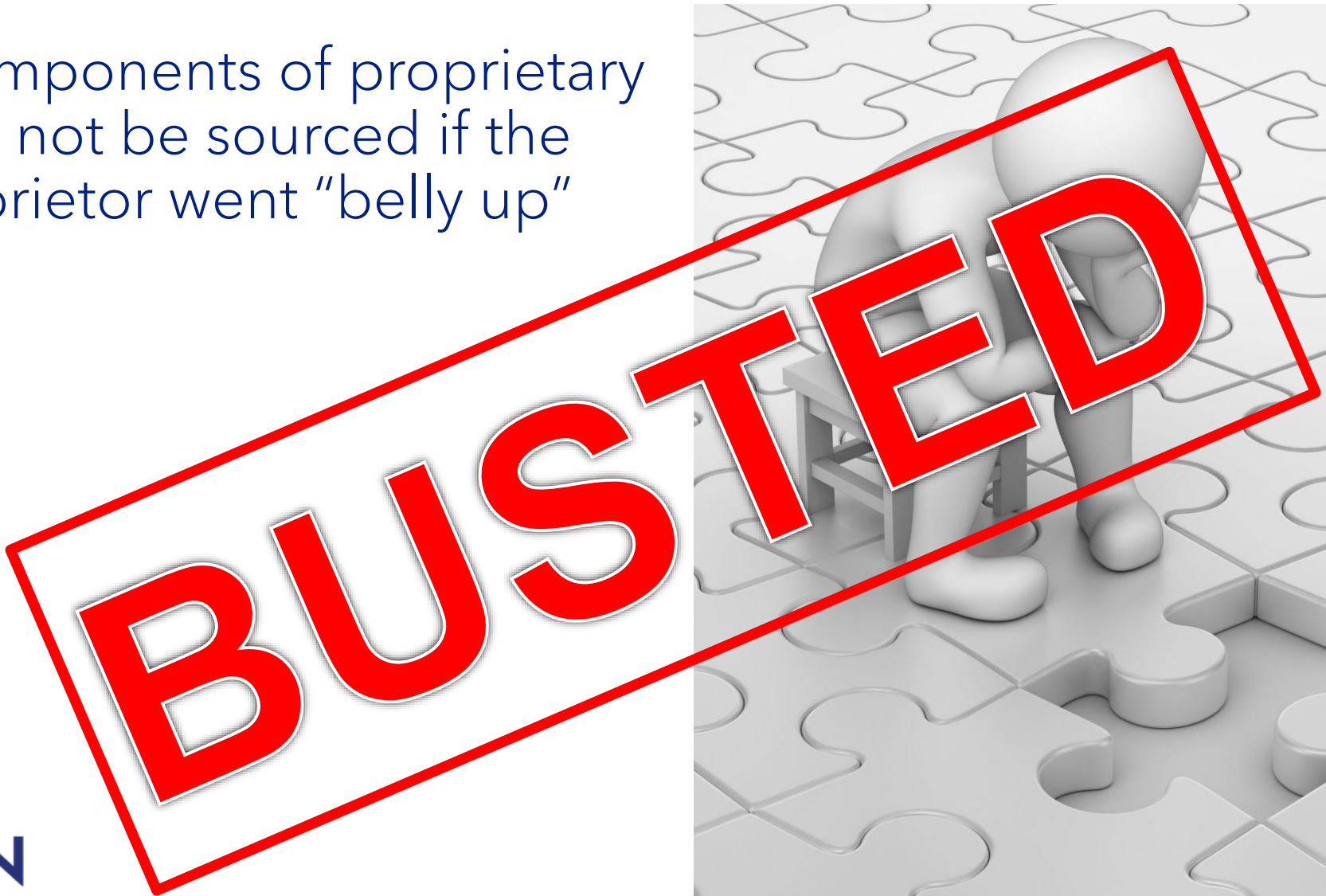
- ⦿ Extremely low risk of going 'belly up'
  - 21+ years operation in Australia
  - Very financially sound
- ⦿ If we did ...
  - Contech can provide all OP STAs (& parts/ components), & Contech is very financially sound
  - New Australian licensee would likely very quickly occur





# Myth #1

- © Parts/ components of proprietary STAs can not be sourced if the STA proprietor went “belly up”



## Myth #2

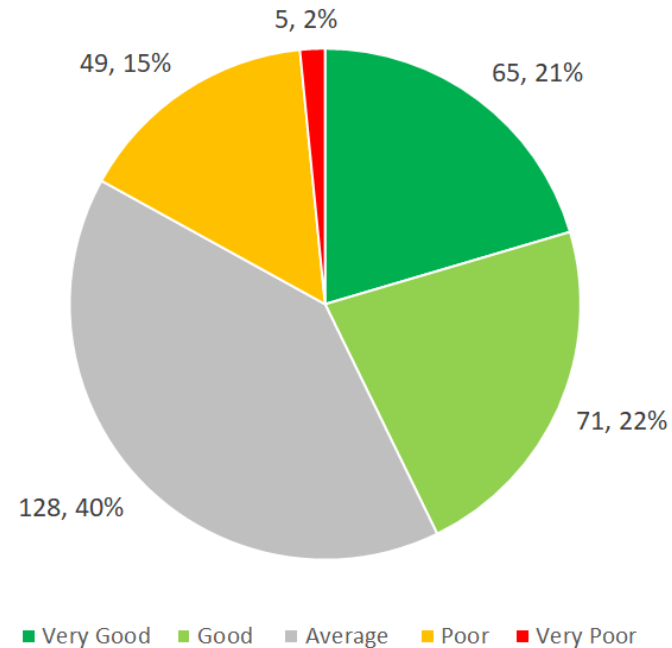
- © “Non-proprietary STA’s (e.g. bioretention) are much less likely to ‘fail’ (e.g. if not maintained) (relative to proprietary STAs)”



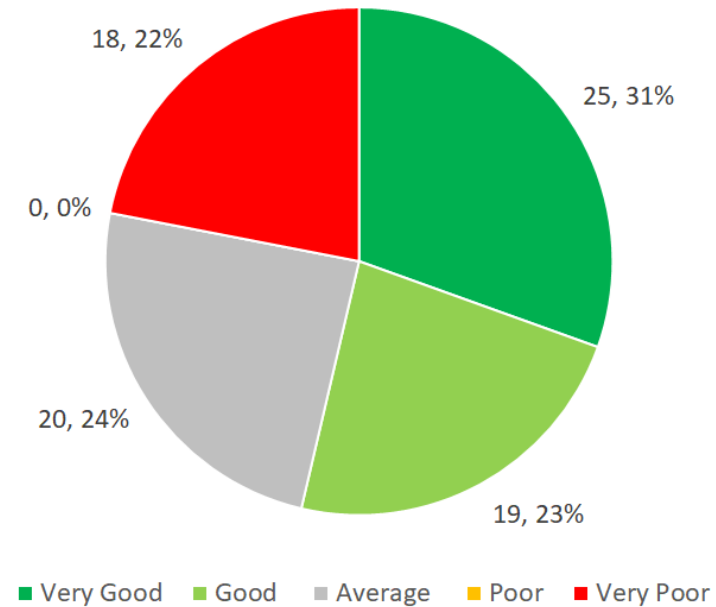


# “Real world” bioretention condition assessments

## Moreton Bay Regional Council



## Un-named SEQ Council



© *“A lack of maintenance activities is predicted to be the key reason for these poor (or very poor) condition ratings.”*

# Thomas et al (2016)

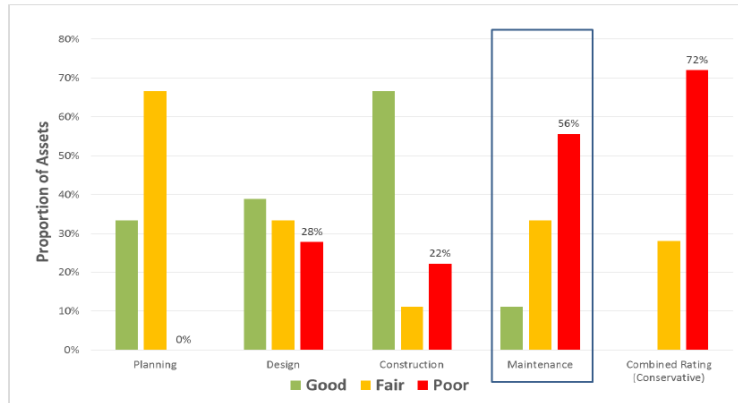


Figure 1: Condition assessment results for Council A (2013)

Council A = 17 bioretention, & 1 wetland

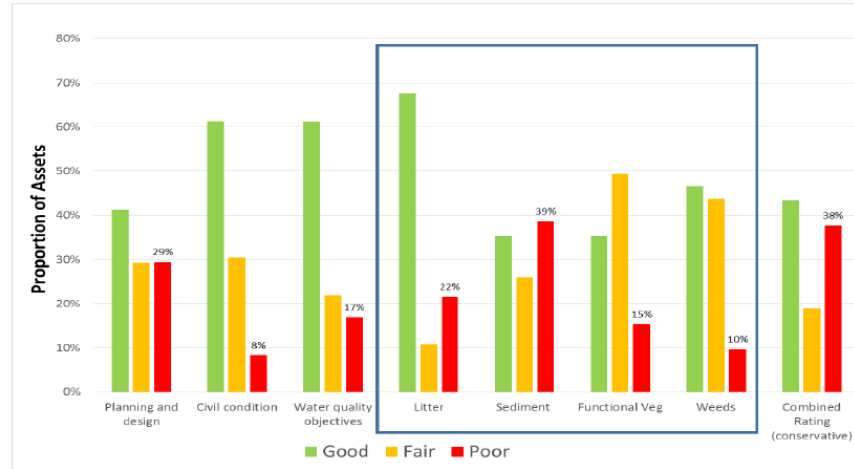


Figure 2: Condition assessment results for Council B (2014)

Council B = 4 sediment basin, 16 wetlands, 20 bioretention, 6 swale, 4 retarding basin, 3 ponds

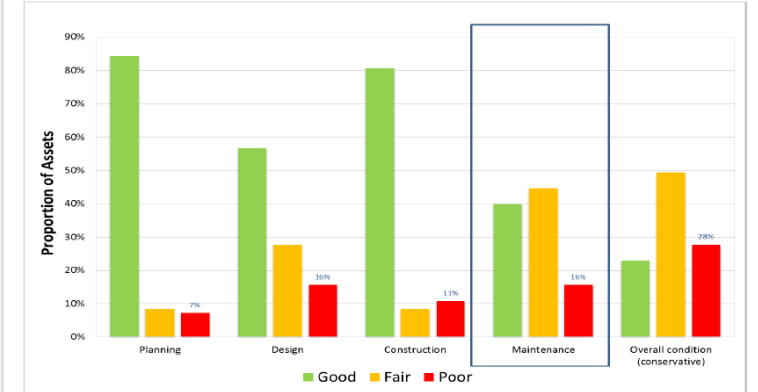


Figure 4: Condition assessment results for Council C (2015)

Council C = 83 SCMs (13 'infiltration', 64 'rain gardens', 5 swale, 1 wetland)

- ⊙ "maintenance practices (or lack-there-of) is the leading reason for the high proportion of assets being in poor condition".
- ⊙ "appropriate levels of maintenance may be the single most important issue currently facing (their) effective long-term performance"."





**“Proprietary”  
assets**





**Before**



**After**











































# 20-year old StormFilters – Menai, NSW





## Myth #2

- “Non-proprietary STA's (e.g. bioretention) are much less likely to 'fail' (e.g. if not maintained) (relative to proprietary STAs)”



## Myth #3

- © “Non-proprietary STAs are much less expensive to maintain”



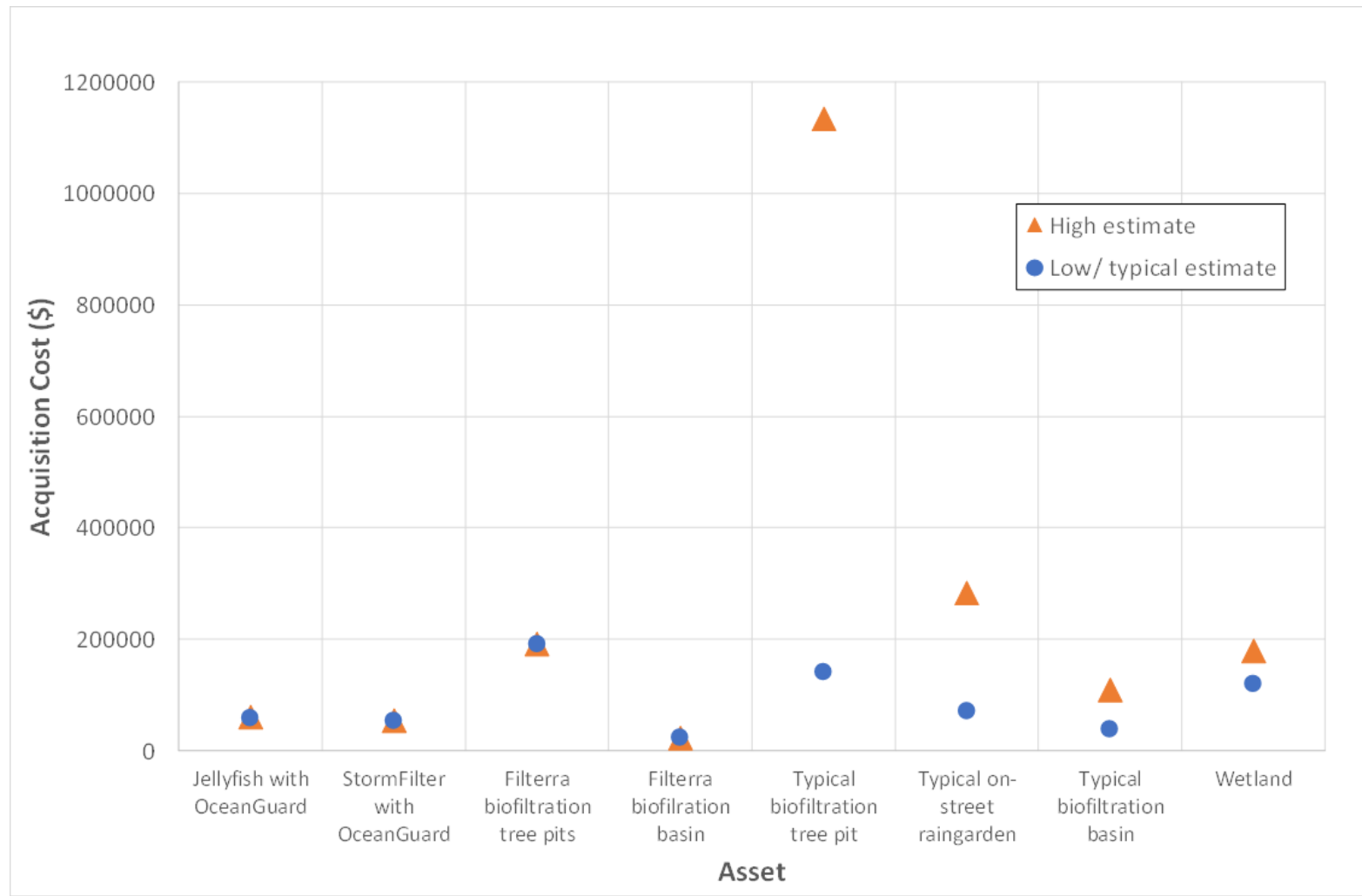


# Example scenario – life cycle cost analysis

- Example scenario:
  - Medium density residential
  - Brisbane climate
  - Designed to achieve SPP targets
- Cost data:
  - Ocean Protect cost database
  - Melbourne Water (2015) costs for typical biofiltration & wetlands
  - Excludes land costs

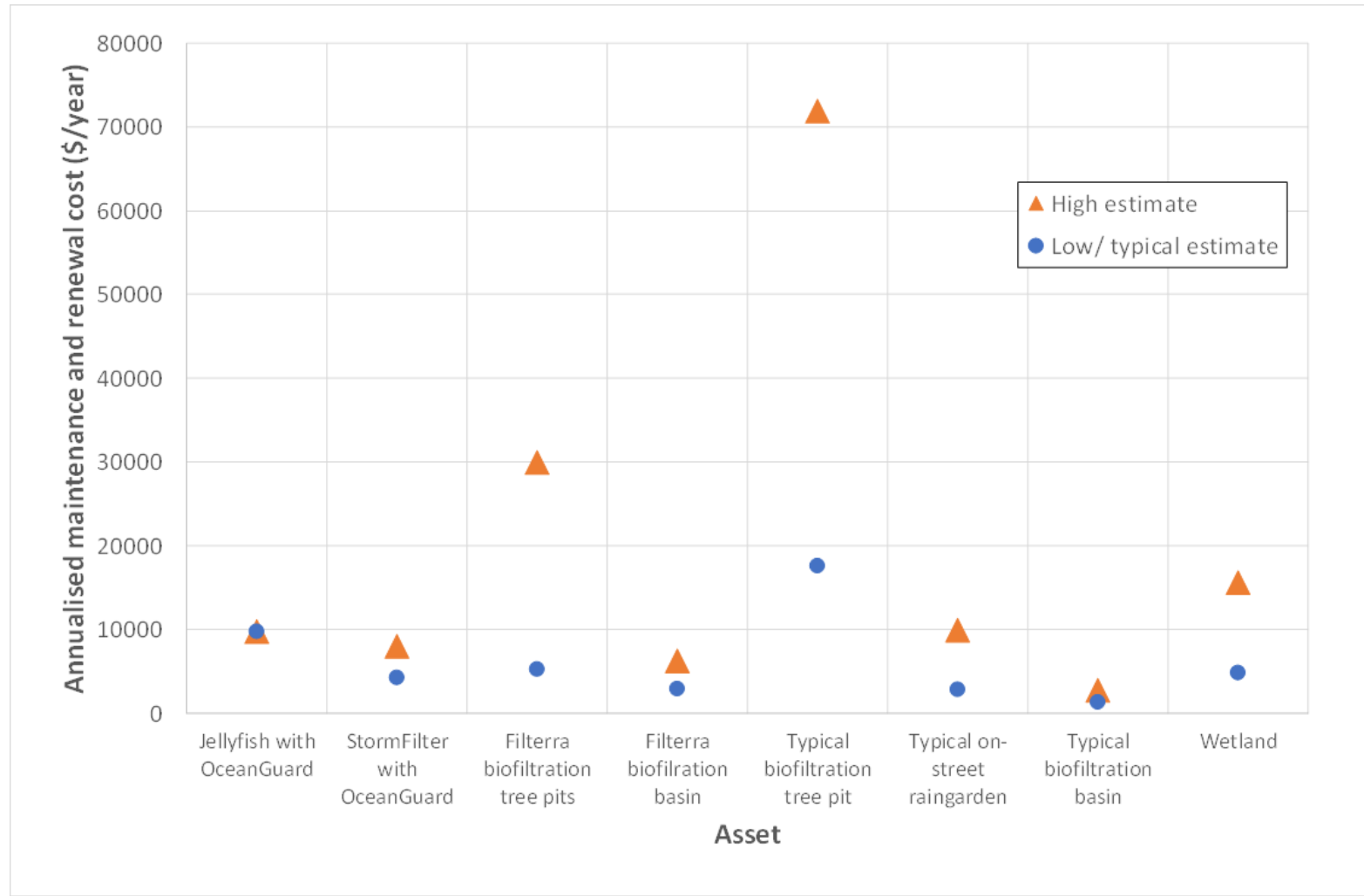


# Example scenario – acquisition costs





# Example scenario – maintenance & renewal costs

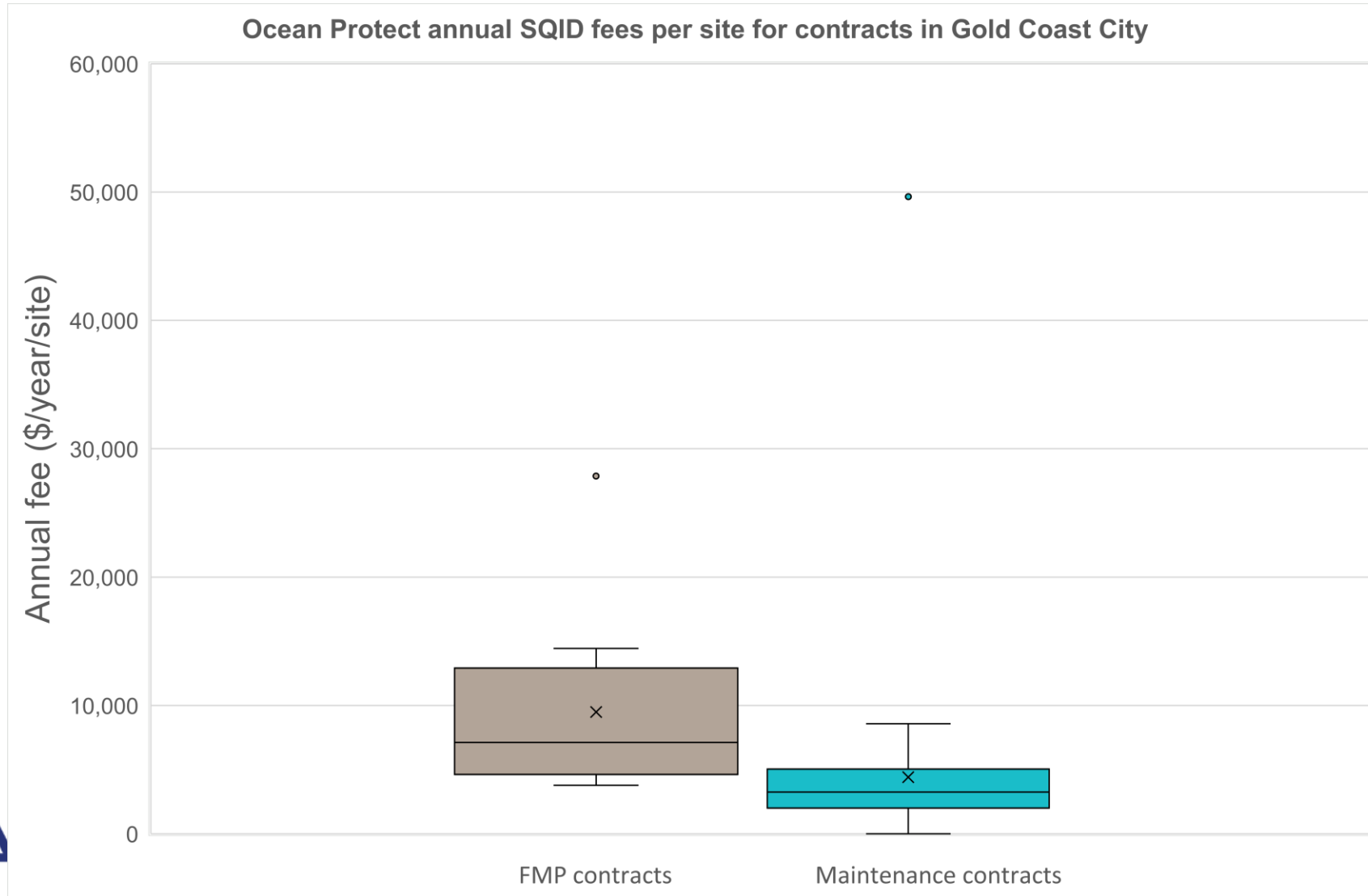


# Review of SQID maintenance on the Gold Coast (2022)

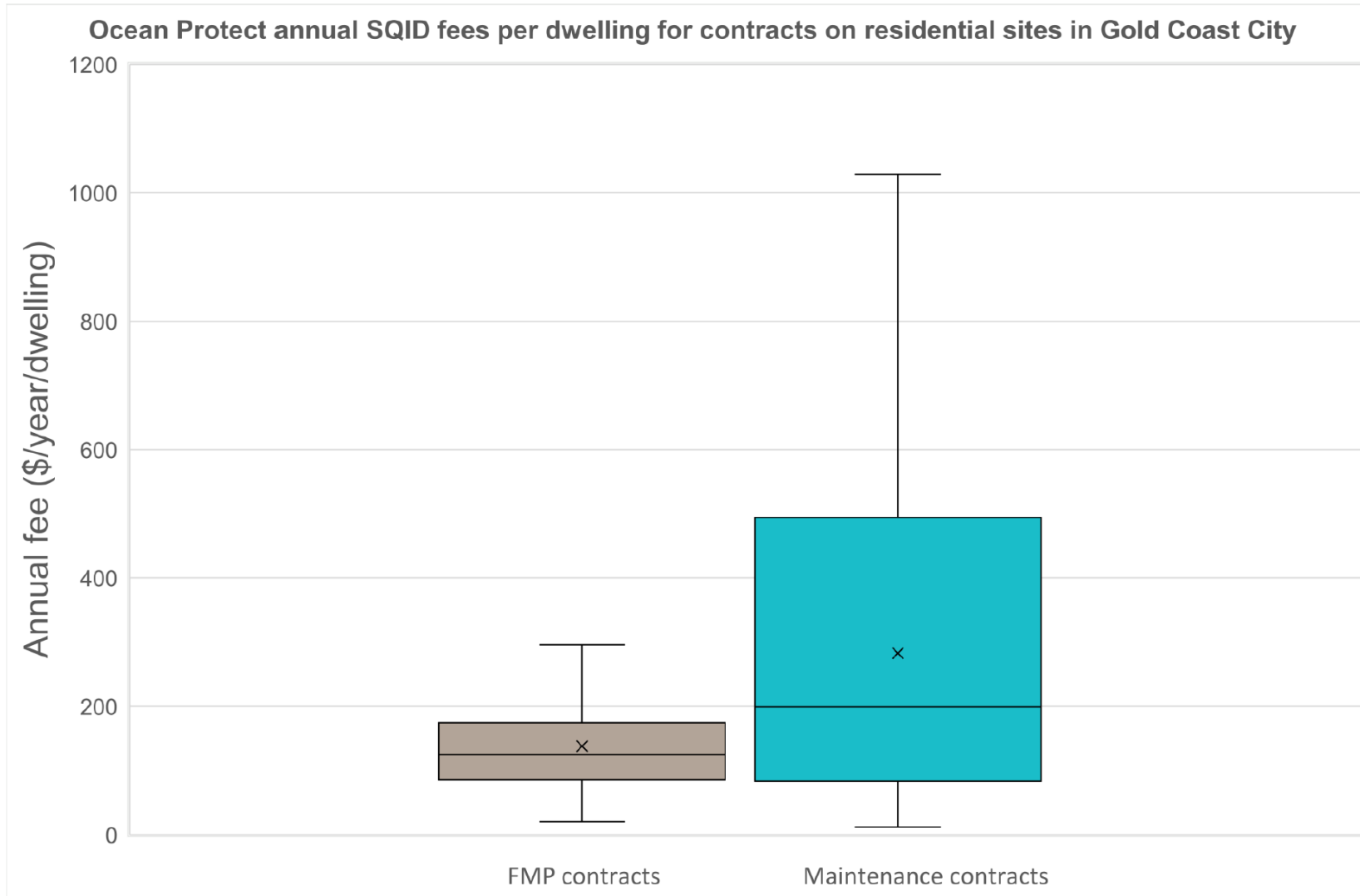
- ② OP maintain OP STAs at a total of 60 sites in Gold Coast City
  - 12 facility management plans
  - 48 maintenance contracts
- ② OP agreed to manage STAs for a specific period (generally 1 to 15 years), for a fixed sum – typically charged monthly), in accordance with an agreement/ contract with the site owner/ body corporate
- ② FMP contracts include BOTH full warranty and insurance (e.g. parts and labour) for the life of the contract for the STAs installed



# Review of SQID maintenance on the Gold Coast (2022)



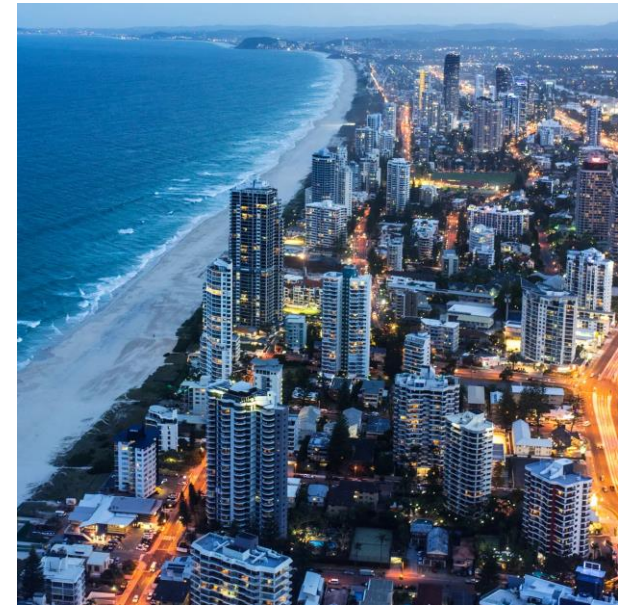
# Review of SQID maintenance on the Gold Coast (2022)





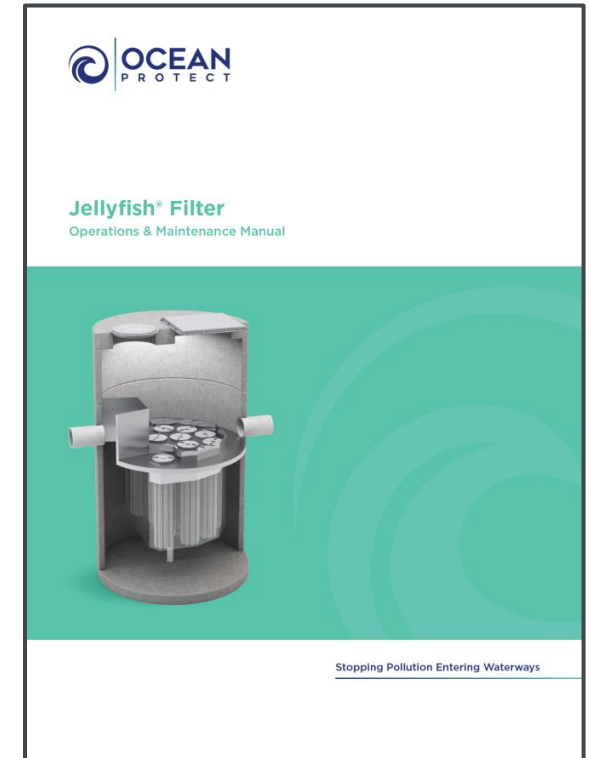
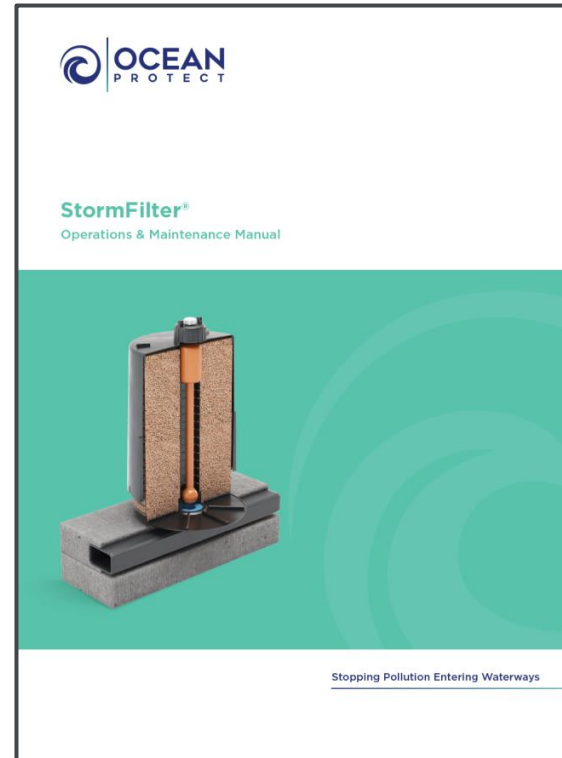
# Review of SQID maintenance on the Gold Coast (2022)

- © Average fees for residential sites:
  - \$2.65/ dwelling/ week for FMPs
  - \$5.43/ dwelling/ week for maintenance contracts



# Maintenance by others ?

- ☉ Ocean Protect STAs can be maintained by other suitably qualified personnel
- ☉ Within Australia, only Ocean Protect can provide parts/ components for our STAs to others





## Myth #3

- ⦿ “Non-proprietary STAs are much less expensive to maintain”

**Plausible**



# Maintenance

- ④ All STAs need maintenance to function properly
- ④ Preferred solution(s) (& costs) are site specific
- ④ Appropriately informed life cycle cost analyses should be undertaken for potential options





## Myth #4

- © Non-proprietary STAs provide other benefits (e.g. amenity, cooling, habitat, hydrology)







Wetland @ Redbank, QLD





Wetland @ Varsity Lakes, QLD





Conventional bioretention @ Caloundra, QLD





Conventional bioretention @ Docklands, VIC





Conventional bioretention @ Stonnington, VIC





Conventional bioretention @ Hobart, TAS





Conventional bioretention @ Kepnock, NSW





Conventional bioretention @ Thirlmere, NSW





Conventional bioretention @ Ipswich, QLD





Conventional bioretention @ Brisbane, QLD





Conventional bioretention @ Logan, QLD





Conventional bioretention  
@ Brighton, QLD





Noosa, QLD



Wakerley, QLD

Conventional bioretention





Conventional bioretention @ Toowoomba, QLD





Conventional bioretention @ Gold Coast, QLD









Installation



After





OCEAN  
PROTECT

OCEAN  
PROTECT

OCEAN  
PROTECT

OCEAN  
PROTECT

Stopping

Pollution

Entering

Waterways

We don't inherit the earth from our parents. We borrow it.

DO NOT  
OVERTAKE  
TURNING VEHICLE

JL 05







## Myth #4

- Non-proprietary STAs provide other benefits (e.g. amenity, cooling, habitat, hydrology)

**Plausible**





## Myth #5

- © Non-proprietary STAs are much better at removing nutrients (particularly dissolved nutrients)





# Performance studies – ‘Conventional’ bioretention

Asset type	Location	Reference	ER (%)						
			TSS	TP	DP	TN	NOx	NH <sub>3</sub> -N	DIN
'Conventional'* biofiltration	Sydney, NSW	Birch et al (2005)	50	65	-	N/A	-19	-	-
	Greensborough, North Carolina, USA	Hunt et al (2006)	-	-409 (G1), -2900 (G2)	- (Ortho P = -90 (G1), -3828 (G2))	-224 (G1), -312 (G2)	18 (G1), 40 (G2)	-1075 (G1), -1000 (G2)	-425 (G1), -156 (G2)
	Maryland, USA	Davis (2007)	22 (Cell A), 41 (Cell B)	74 (Cell A), 68 (Cell B)	-	-	79 (Cell A), 86 (Cell B)	-	-
	Monash University, VIC	Hatt et al (2009)	87 (Cell 1), 92 (Cell 2), 90 (Cell 3)	-2140 (C1), -1286 (C2), -1423 (C3)	-17 (Cell 1), -17 (Cell 2), -16 (Cell 3)	18 (Cell 1), 0 (Cell 2), 18 (Cell 3)	25 (Cell 1), 25 (Cell 2), 65 (Cell 3)	25 (Cell 1), 50 (Cell 2), 25 (Cell 3)	25 (Cell 1), 27 (Cell 2), 61 (Cell 3)
	Brisbane, QLD	Hatt et al (2009)	89	83	90	19	-60	96	-8
	Wakerley, QLD	Roberts et al (2012)	36 (Cell 1), 53 (Cell 2), 44 (Cell 3)	25 (Cell 1), 34 (Cell 2), 38 (Cell 3)	-	-28 (Cell 1), -11 (Cell 2), 19 (Cell 3)	-	-	-
	Chapel Hill, North Carolina, USA	Johnson et al (2019)	N/A	-21 (1st), 39 (2nd)	- (Ortho P = 29)	-38 (1st), 26 (2nd)	-20 (1st), 67 (2nd)	71 (1st), 68 (2nd)	28 (1st), 66 (2nd)
	Melbourne, VIC	Bonneau et al (2020)	93	84	82	73	-	24	-

\*: standards vary over time/ area, & may not be representative of current recommended best practice in Australia

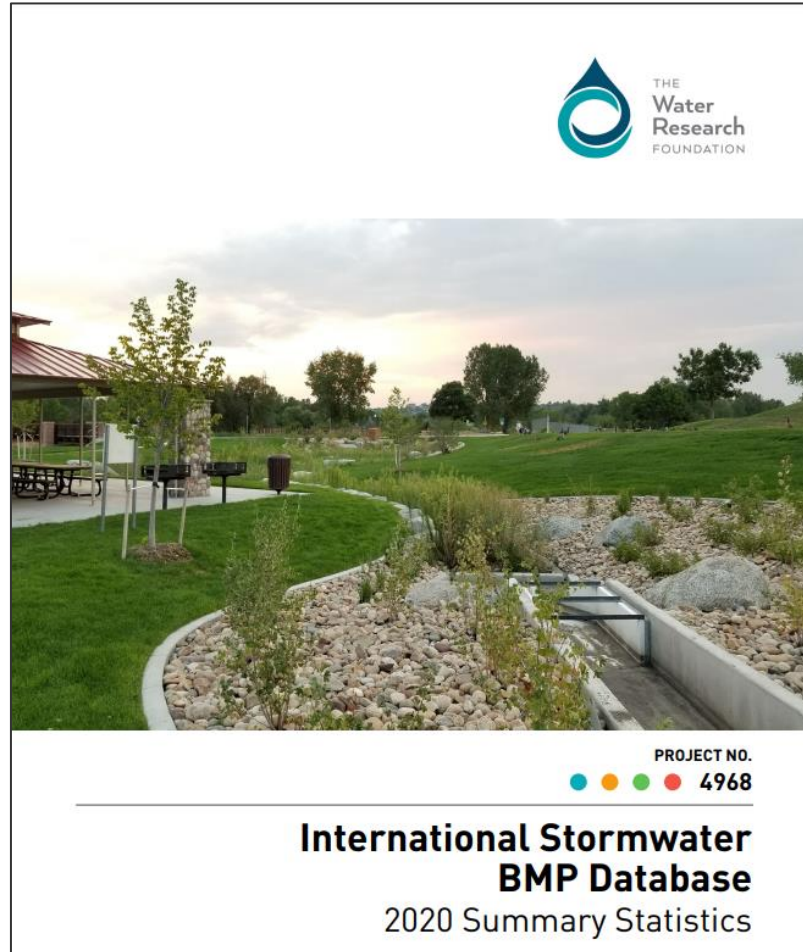



# Performance studies – ‘proprietary’ assets

Asset type	Location	Reference	ER (%)						
			TSS	TP	DP	TN	NOx	NH <sub>3</sub> -N	DIN
OceanGuard	Western Sydney, NSW	Dalrymple et al (2021)	52	67	-10	41	13	23	19
Enviropod & ZPG StormFilter	Kuranda, QLD	Wicks et al (2011)	99	47	-	44	-6	54	16
Psorb StormFilter	North Carolina, USA	Wicks et al (2014)	90	86	74	56	10	63	41
Psorb StormFilter	Oregon, USA	Contech (2015)	89	77	0	61	15	-3	5
Jellyfish	West Ipswich, QLD	Goonetilleke et al (2017)	93	55	56	50	42	-	-
Filterra biofiltration	Western Sydney, NSW	Dalrymple et al (2022)	81	83	31	49	4	61	33
	Virginia, USA	Stanford et al (2006)	88	60	-	- (40 for TKN)	-	-	-
		Stanford (2009)	-	70	-	-	-	-	-
	Washington, USA	Herrera (2014)	94	70	-	-	-	-	-
	Virginia Beach, Virginia, USA	Contech (2016)	90	66	50	49	-	-	-
	North Carolina, USA	Smolek et al (2018)	95	64	44	27	-22	48	16



# More data ...



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**International Stormwater  
BMP Database**  
2020 Summary Statistics





# International Stormwater BMP Data – Total N

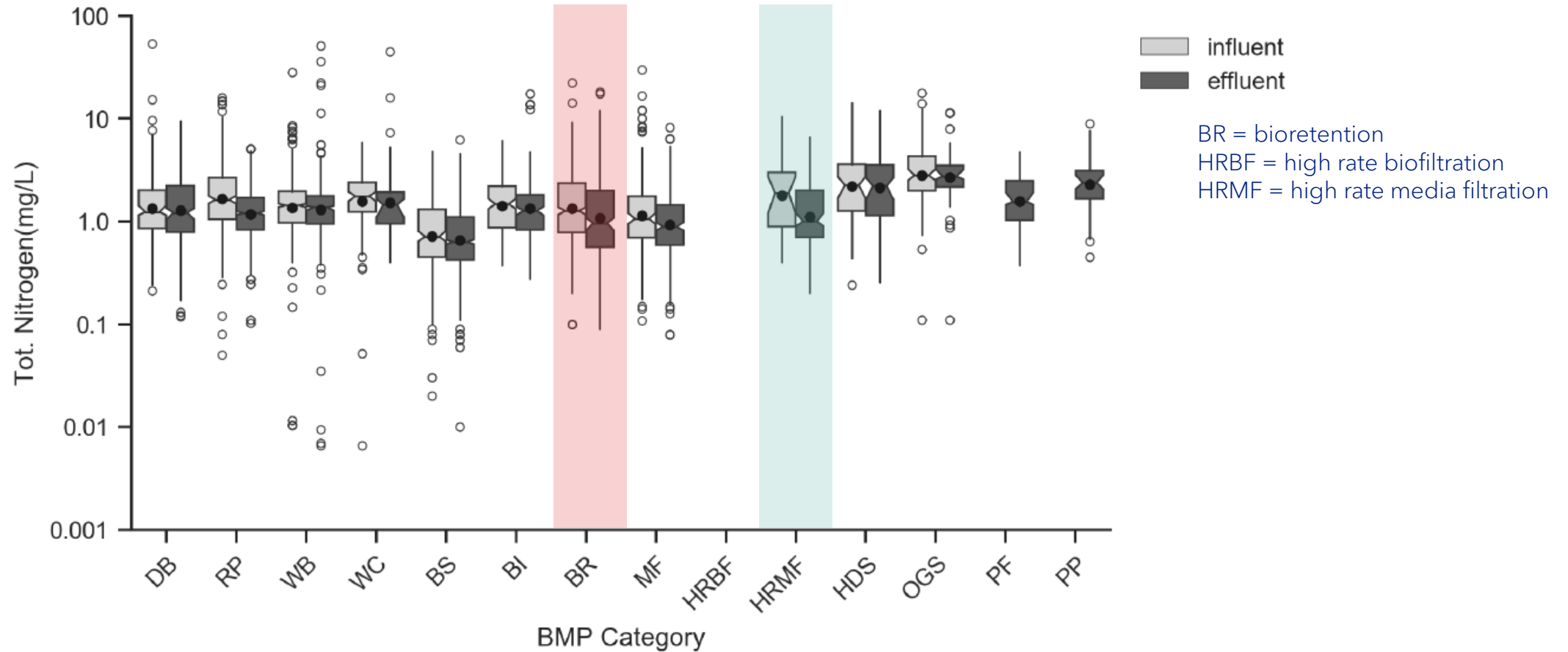
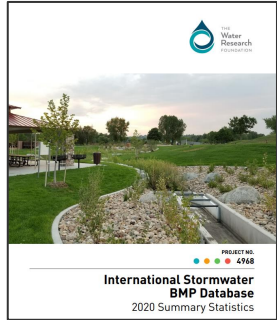


Figure 4-6. Box Plots of Influent/Effluent Total Nitrogen (mg/L).



# International Stormwater BMP Data – Ammonia-N

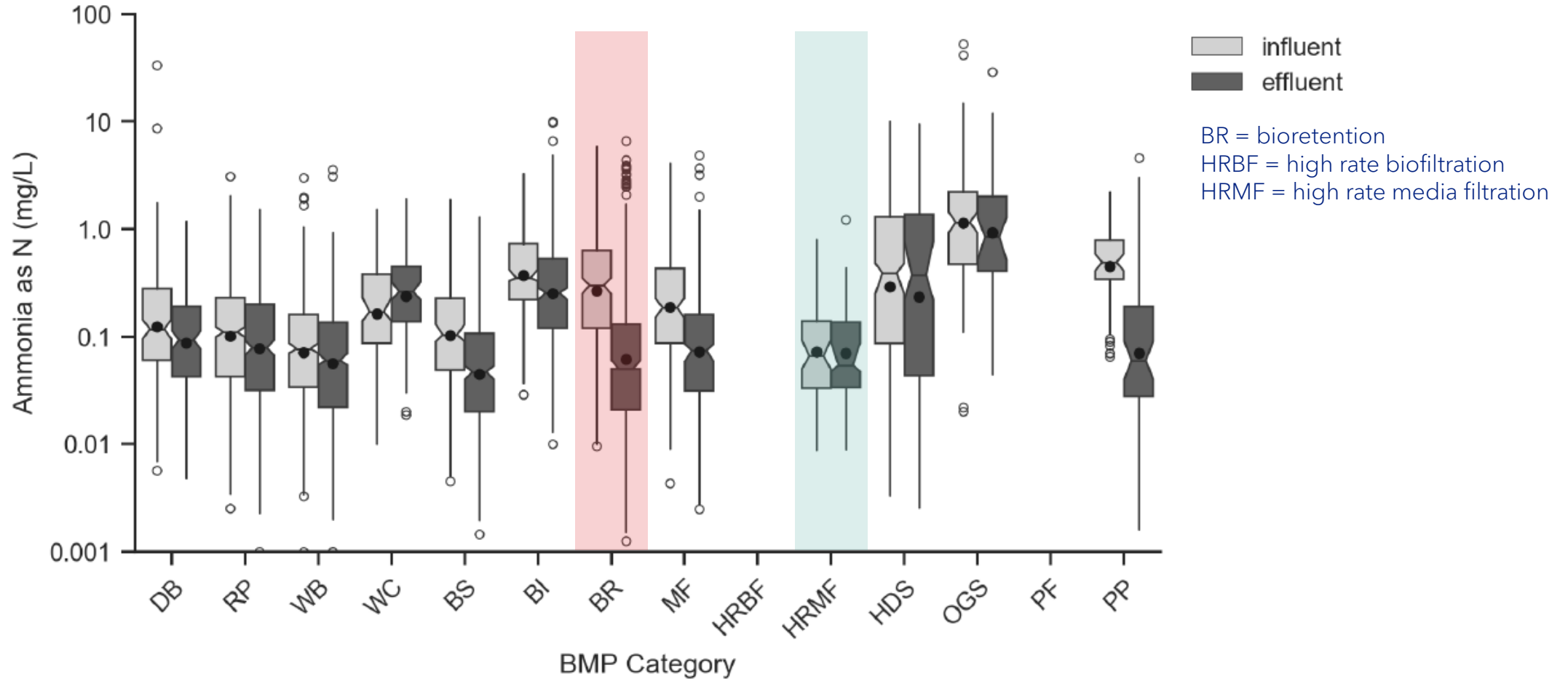
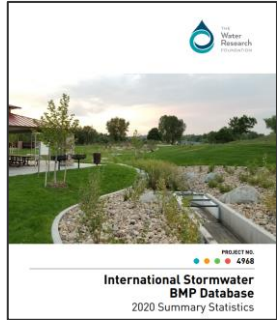


Figure 4-9. Box Plots of Influent/Effluent Ammonia as N (mg/L).



# International Stormwater BMP Data - NOx

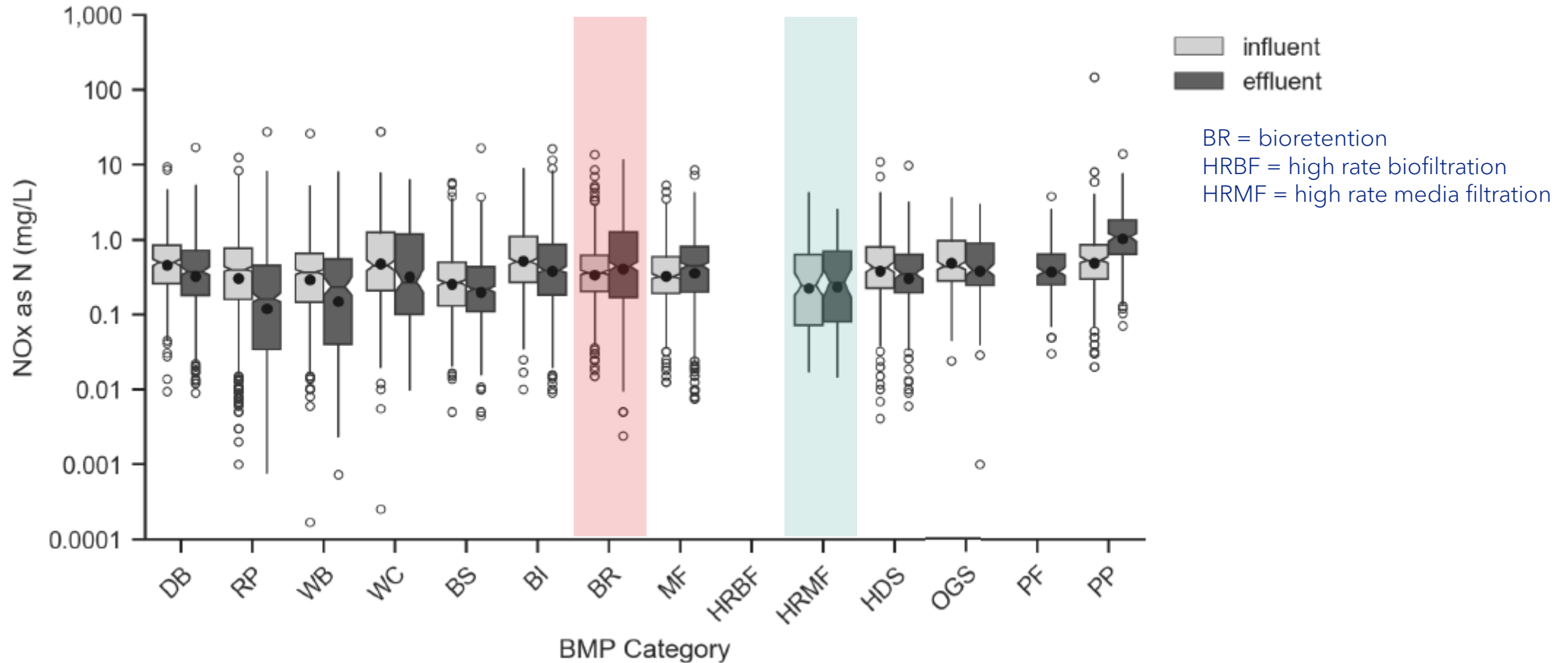
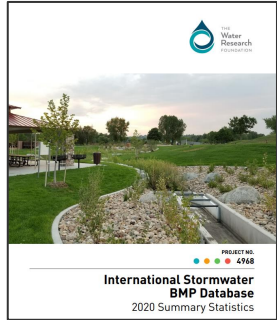


Figure 4-8. Box Plots of Influent/Effluent NOx as N (mg/L).



# International Stormwater BMP Data – Total P

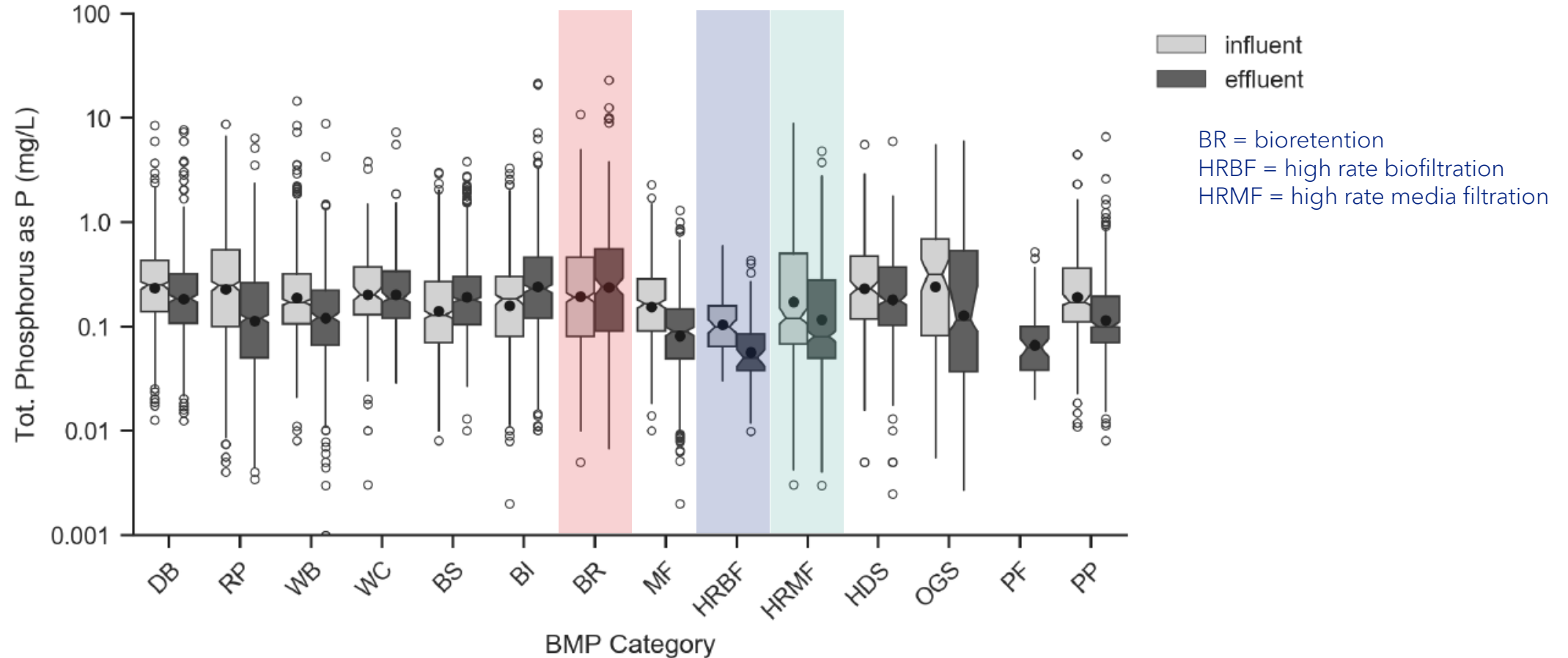
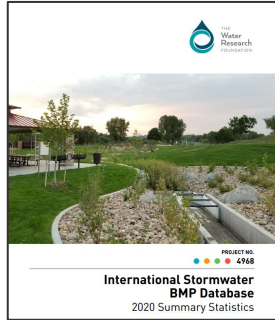
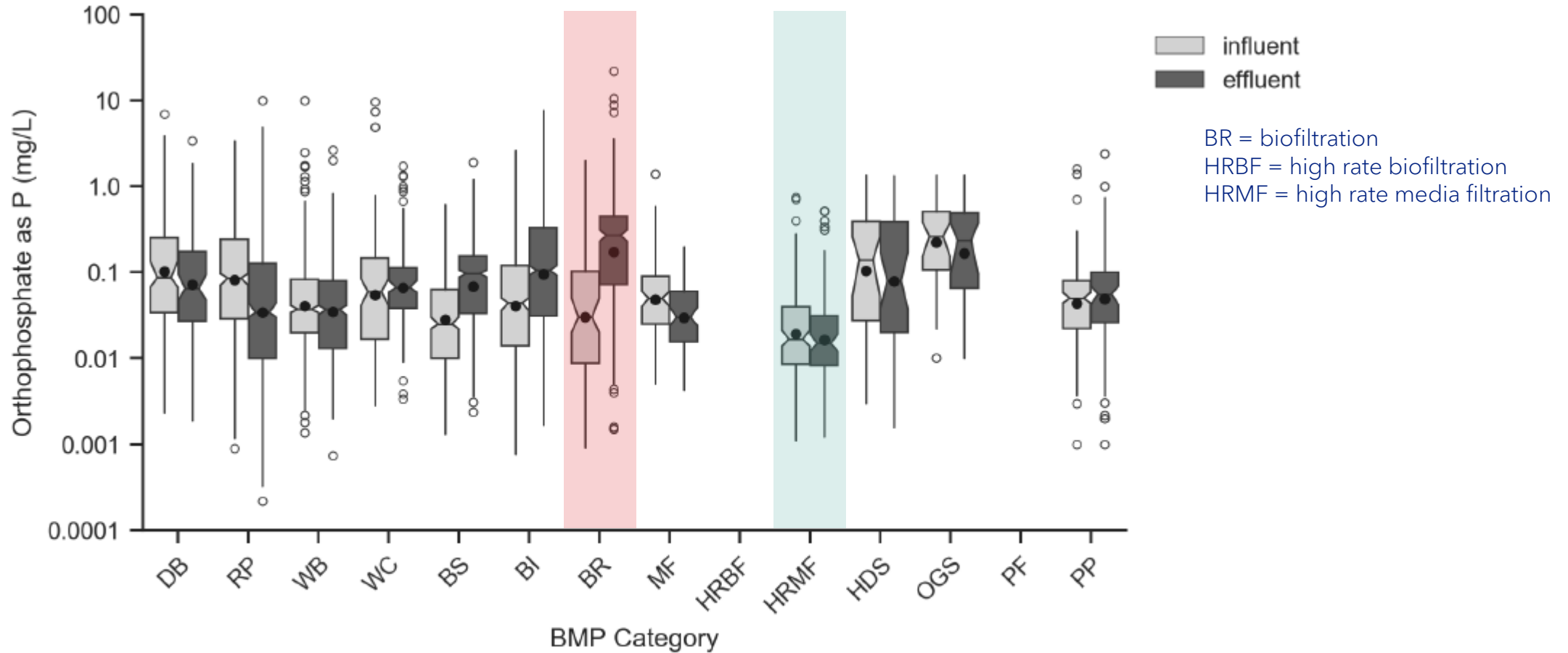
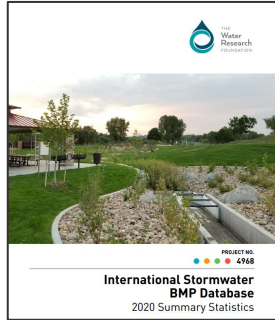


Figure 4-3. Box Plots of Influent/Effluent Total Phosphorus as P (mg/L).



# International Stormwater BMP Data – Ortho P



**Figure 4-4. Box Plots of Influent/Effluent Orthophosphate as P (mg/L).**



- ② STAs that only target solids removal (e.g. via sedimentation & filtration) likely to have low dissolved nutrient removal
  - e.g. GPTs, sediment basins, physical filters (with minimal adsorptive capacity)
- ② Studies of 'conventional' biofiltration systems show performance is variable
- ② Studies of StormFilter, Jellyfish & Filterra biofiltration systems show consistently high nutrient removal





## Myth #5

- ⦿ Non-proprietary STAs are much better at removing nutrients (particularly dissolved nutrients)







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# THANK YOU

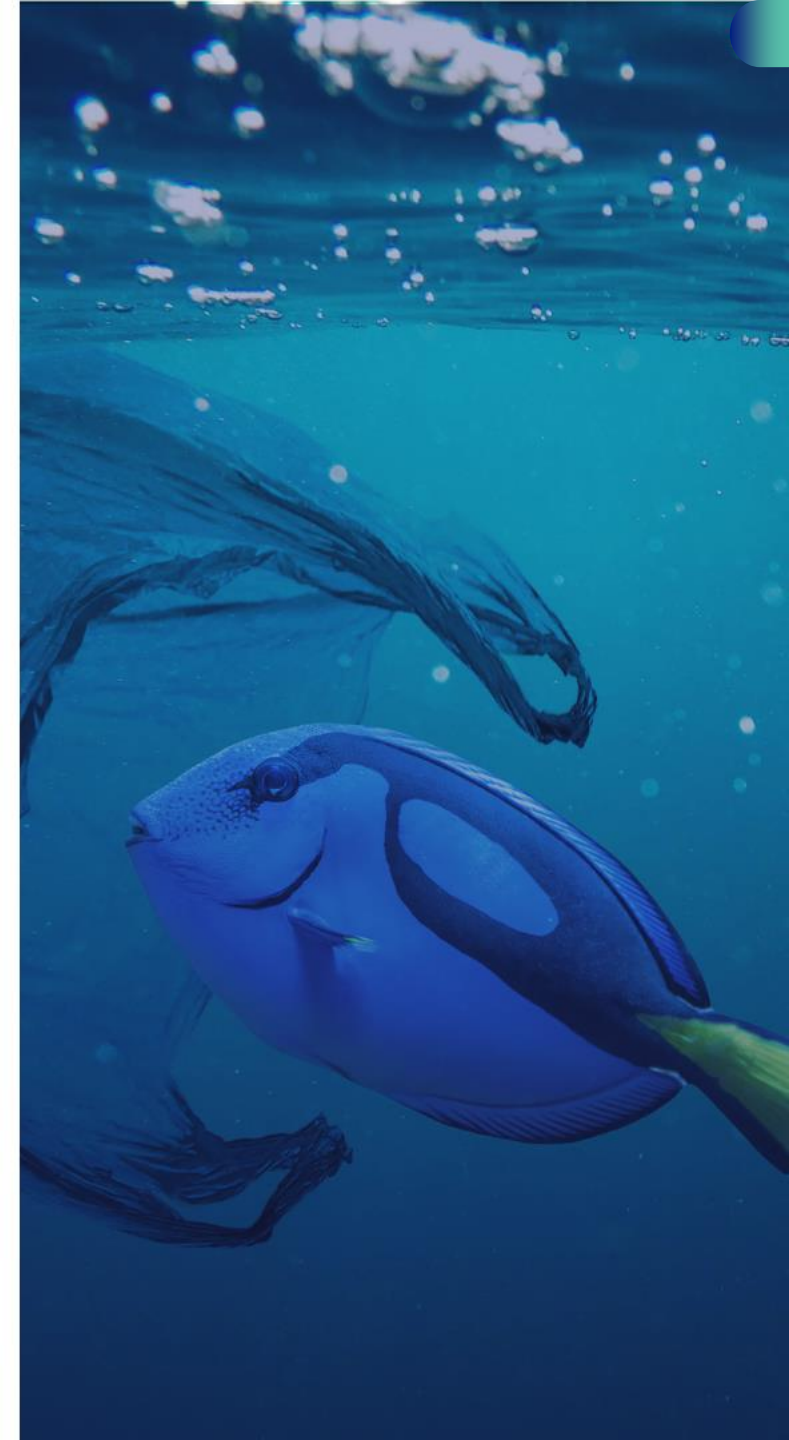
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# Reminders

- ④ Please put any questions in the 'Q&A' panel
- ④ The slides & recording will be made available at [www.oceanprotect.com.au/webinars](http://www.oceanprotect.com.au/webinars)
- ④ Please email any CPD form requests to [enquiries@oceanprotect.com.au](mailto:enquiries@oceanprotect.com.au)





# Stormwater Fundamentals Series

- ✓ 1. The Rational Method - Wednesday 7<sup>th</sup> February 2024
- ✓ 2. Inlet Design - Wednesday 21<sup>st</sup> February 2024
- ✓ 3. Pipe Design - Wednesday 27<sup>th</sup> March 2024
- ✓ 4. Impacts of traditional urban stormwater management - Wednesday 1<sup>st</sup> May 2024
- ✓ 5. Water Sensitive Urban Design - Wednesday 22<sup>nd</sup> May 2024
- ✓ 6. Gross Pollutant Traps - Wednesday 12<sup>th</sup> June 2024
- ✓ 7. Bioretention - Wednesday 3<sup>rd</sup> July 2024
8. Proprietary stormwater treatment assets - Wednesday 31<sup>st</sup> July 2024
9. Stormwater pollution in the 'real world' - Wednesday 28<sup>th</sup> August 2024
10. Development assessment (for DA reviewers) - Wednesday 25<sup>th</sup> September 2024
11. WSUD Asset Maintenance - Wednesday 23<sup>rd</sup> October 2024
12. WSUD Asset Compliance - Wednesday 13<sup>th</sup> November 2024

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