Innovative Desalination Design: Location, Pre-treament, Intake and Outfall

7 December 2018

Today

Desalination Plant

Procurement

Evaluation

FIDIC Gold Book

Risk Allocation

Summary

Desalination Plant

1. Water supply Augmentation
2. Desalination as an Option
3. Desalination Processes
4. Desalination Plant Components

Why Augment?

Water Shortage

Why Augment?

Likelihood			Consequence				
			Insignificant	Minor	Moderate	Major	Catastrophic
			1	2	3	4	5
	< 1 year	5	L	M	H	E	E
	1-3 years	4	L	L	M	H	E
	4-10 years	3	N	N	L	M	H
	11-50 years	2	N	N	N	L	M
	> 50 years	1	N	N	N	N	L

Water Shortage

Why Augment?

Inherent Risk	Controls	Residual Risk
Risk of water shortage: **Major** to **Extreme**	1. **Reduce/moderate demand** 2. **Improve regulation of existing source (s)** 3. **Add to existing source(s)** a) **Similar source** b) **Different source**	Risk of water shortage: **Moderate** to **Low**

Why Augment?

Likelihood			Consequence				
			Insignificant	Minor	Moderate	Major	Catastrophic
			1	2	3	4	5
	< 1 year	5	L	M	H	E	E
	1-3 years	4	L	L	M	H	E
	4-10 years	3	N	N	I	M	H
	11-50 years	2	N	N	N	L	M
	> 50 years	1	N	N	N	N	L

Sufficient Water

Why Desalination?

Why Desalination?

No other option

High Cost Sources: City Supply

cost spread over large number of users

Low Cost Sources: Rural Supply

saved for strategic uses such as food production

‘Desalination is the only climate independent source of water available.’

Strategic Analysis Paper, Global Food and Water Crises Research Program, Future Directions International, July 2011

Why Reverse Osmosis?

Multi-Stage Flash
Multi Effect Distillation
Mechanical Vapour Compression
Reverse Osmosis

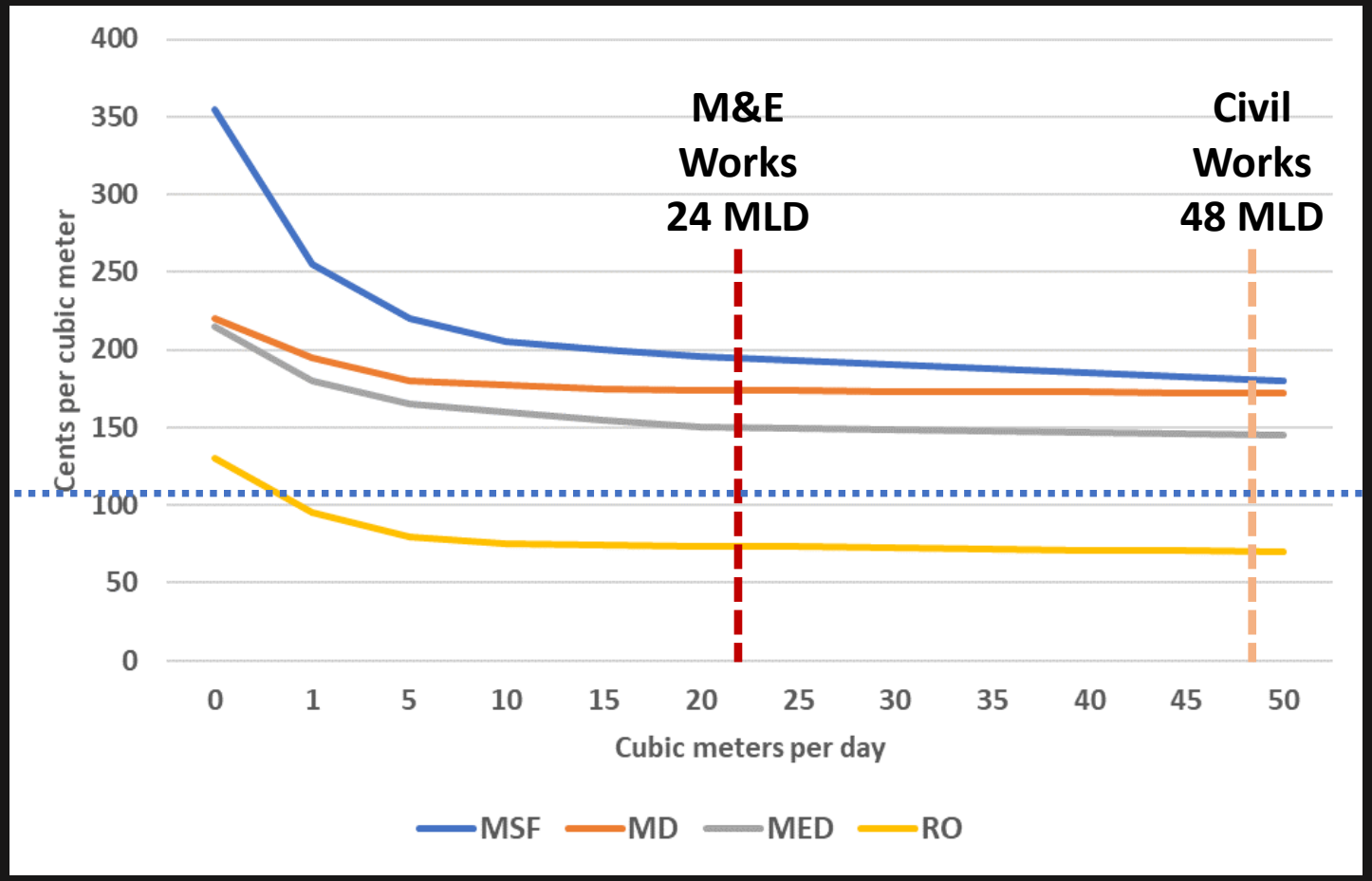
Why Reverse Osmosis? Lowest Energy

Process	MSF	MED	MVC	RO
	Multi-Stage Flash	Multi-Effect Distillation	Mechanical Vapour Compression	Reverse Osmosis
Technique	Thermal	Thermal	Thermal	Pressure
Total Equivalent Electrical Energy (kWh/m^3)	**13.5 to 25.5**	**6.5 to 11**	**7.0 to 12**	**2.6 to 7.5**

Why Reverse Osmosis?

The energy required to produce safe drinking water from different water sources					
Sources	Seawater	Wastewater Reuse	Wastewater Treatment	Groundwater	Inland Water
Total Equivalent Electrical Energy (kWh/m^3)	2.6 to 7.5	1.0 to 2.5	0.6 to 0.8	0.4 to 0.5	0.3 to 0.4
		1.6 to 3.3			

Why Reverse Osmosis? Lowest Cost



Small	<0.1 MLD
Medium	<0.2 MLD
Large	>0.2 MLD

Literature

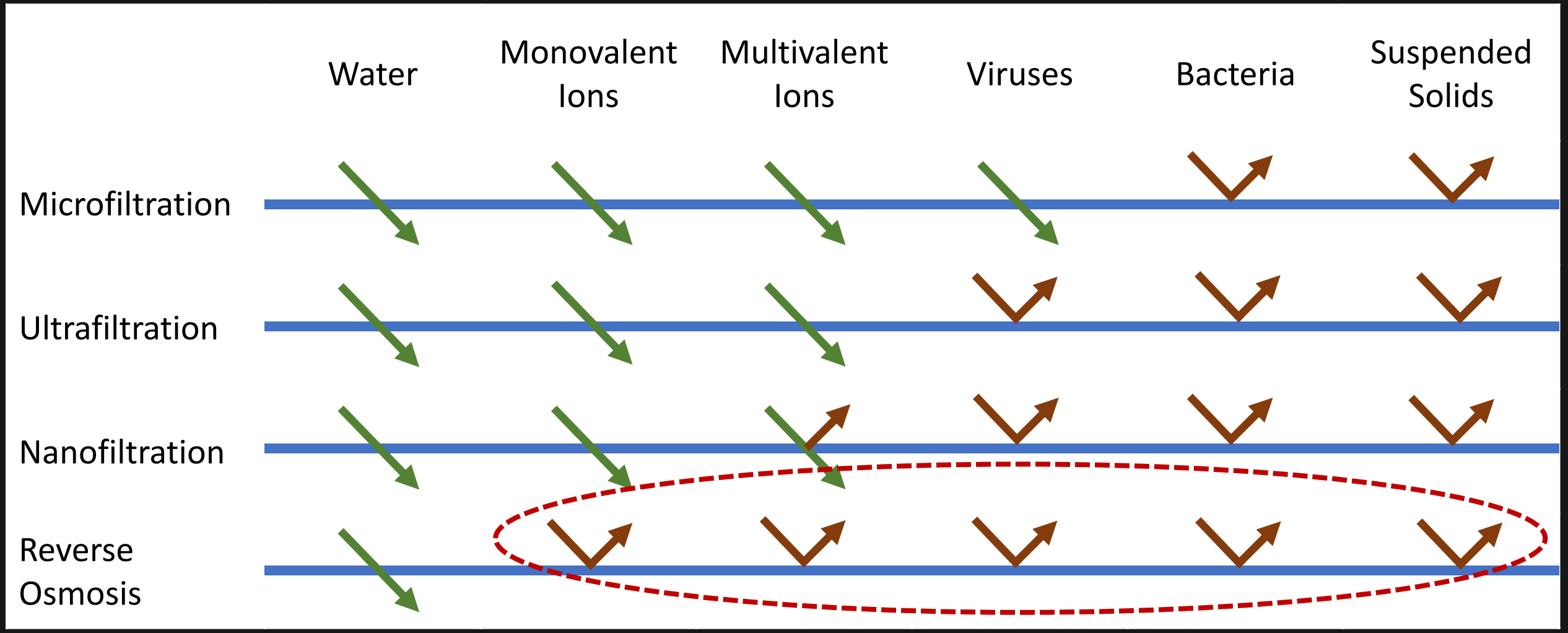
Small	<5 MLD
Medium	<30 MLD
Large	<100 MLD
Very Large	>150 MLD

MG

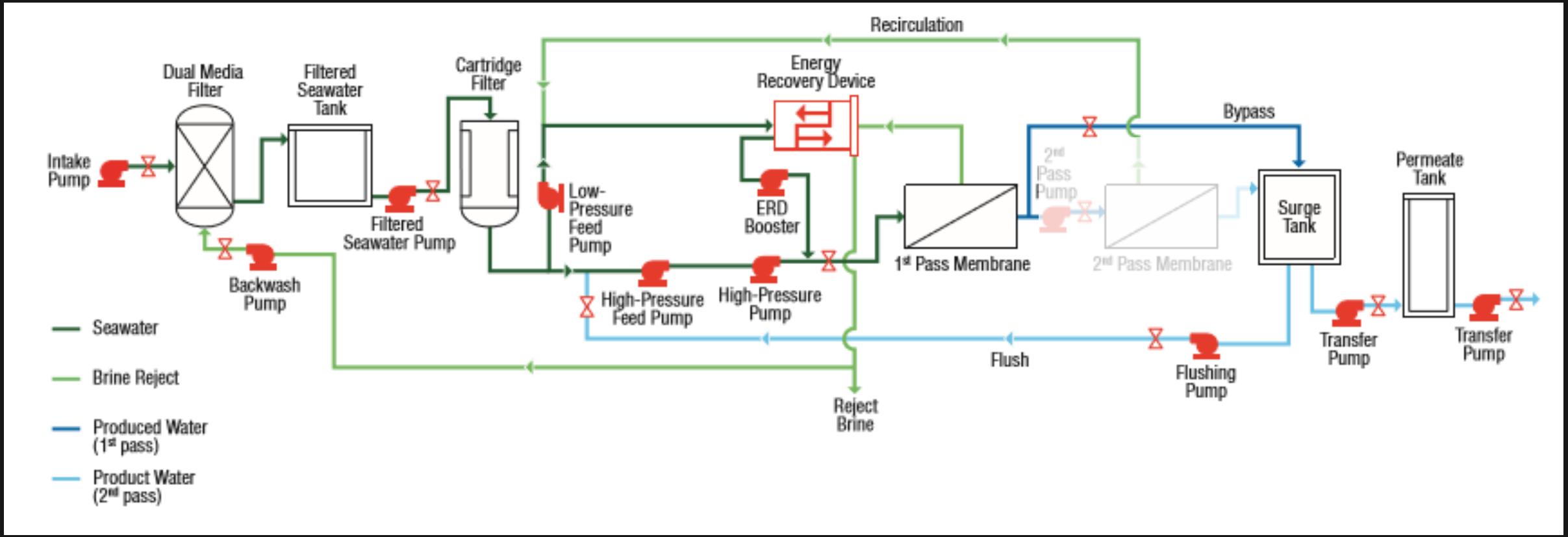
MSF	Multi Stage Flash
MD	Membrane Distillation
MED	Multi-Effect Distillation
RO	Reverse Osmosis

True Cost

Why Reverse Osmosis? Safest Water

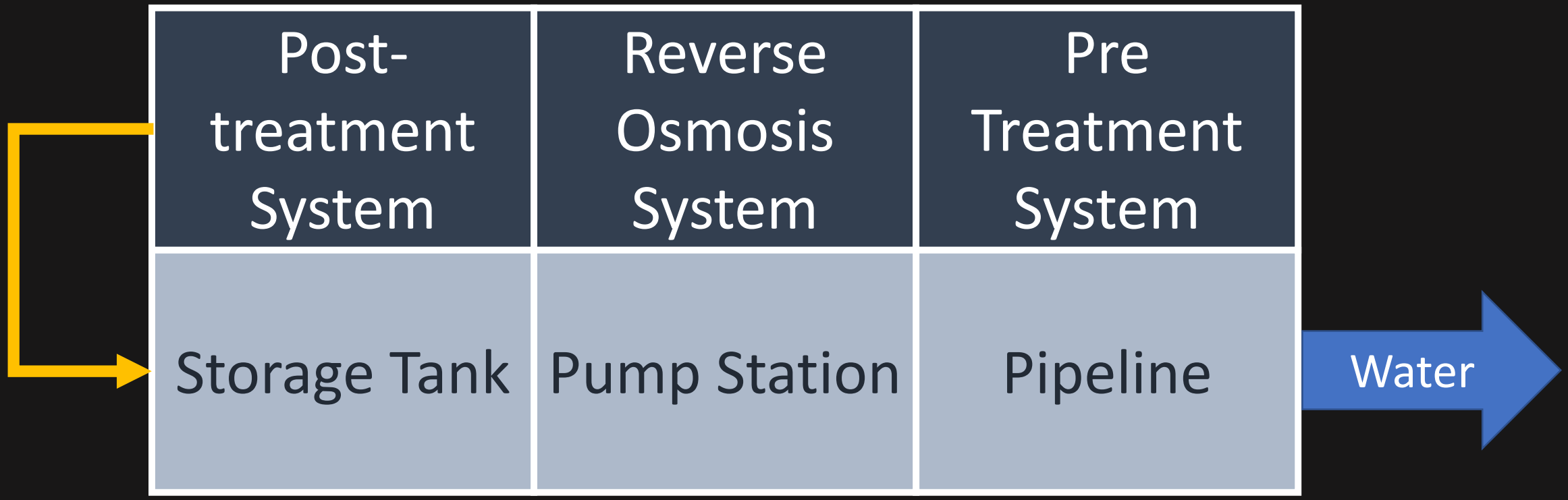


Possible Jaffna SWRO Plant

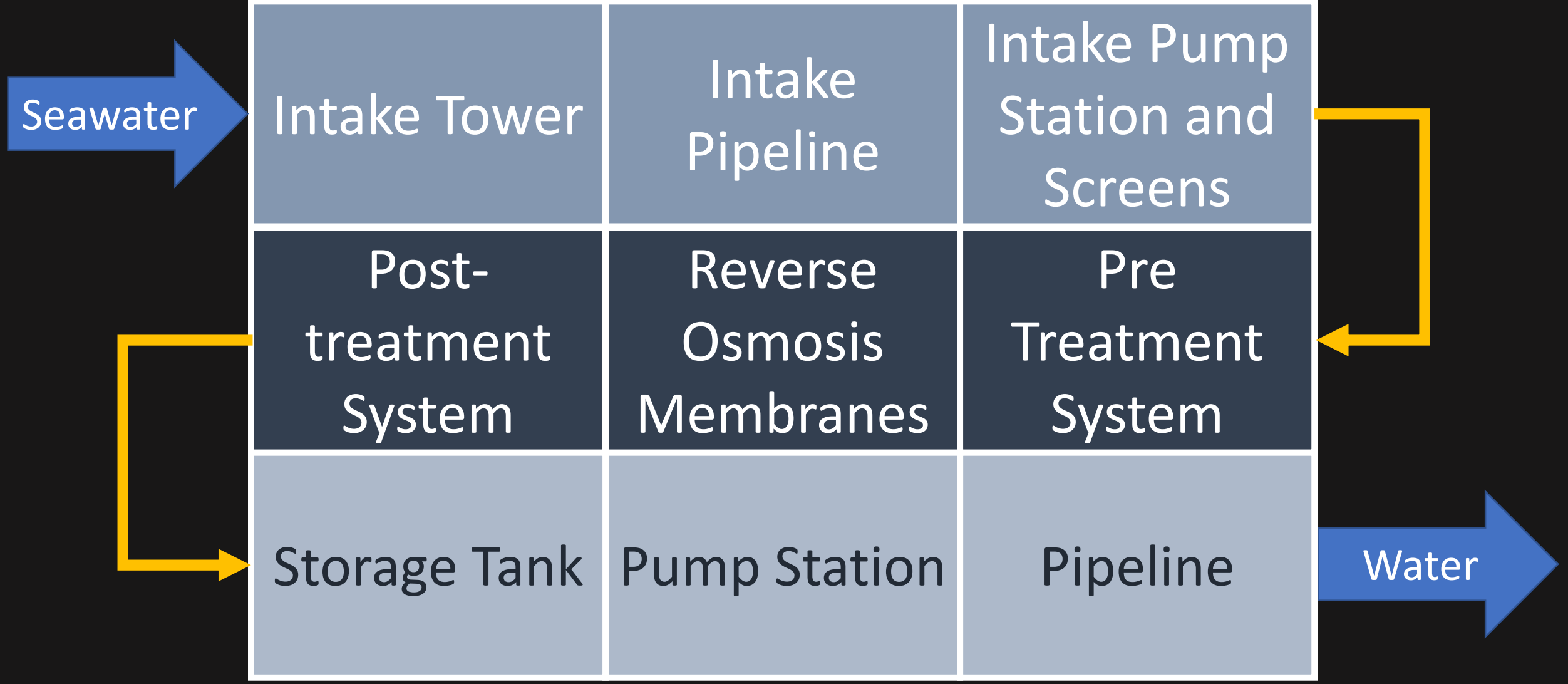


Post-treatment System	Reverse Osmosis System	Pre Treatment System

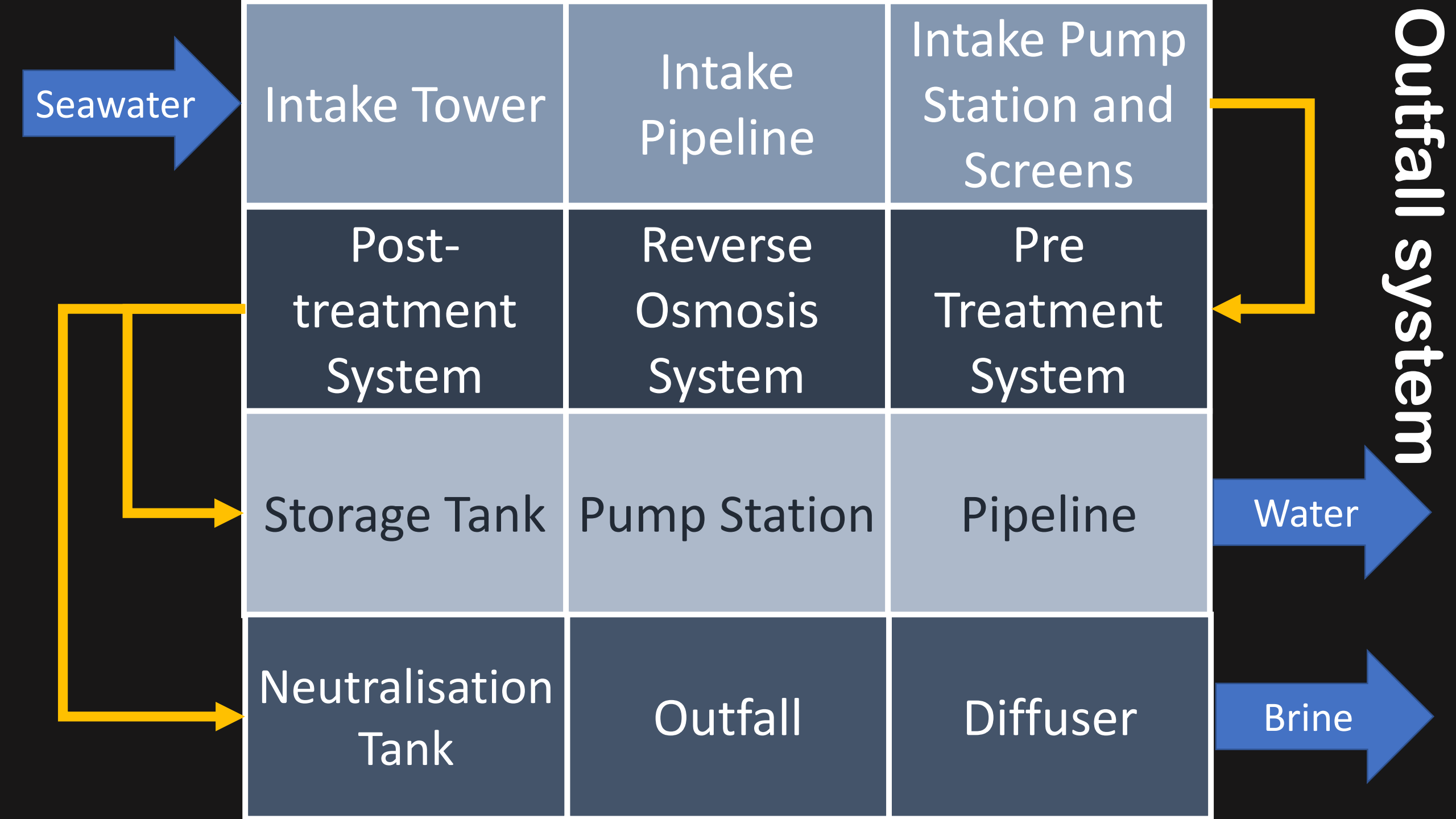
Treatment system

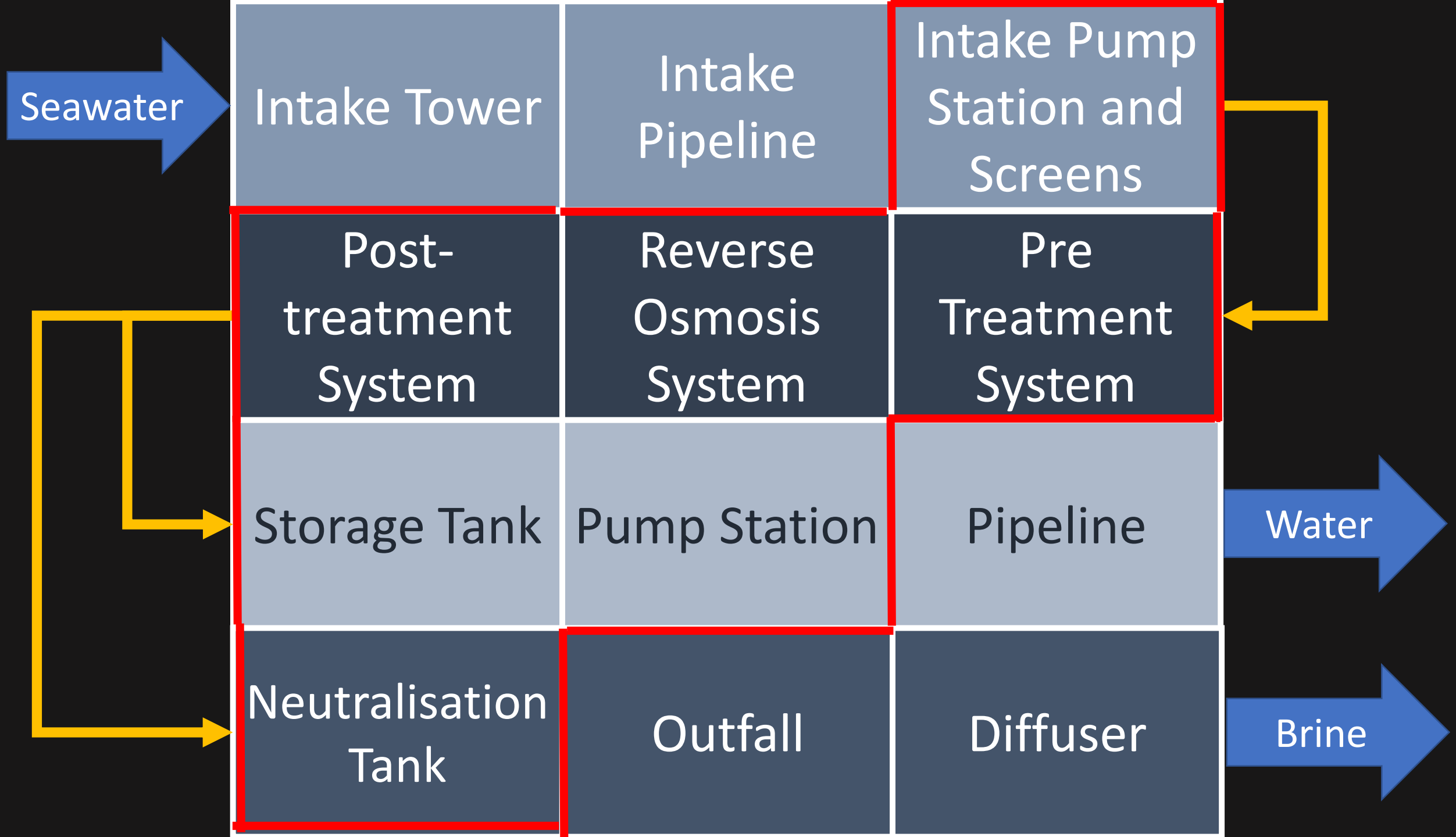


Transfer system



Intake system


Seawater
Intake Tower
Intake Pipeline
Intake Pump Station and Screens
Post-treatment System
Reverse Osmosis System
Pre Treatment System
Storage Tank
Pump Station
Pipeline
Neutralisation Tank
Outfall
Diffuser
Water
Brine
Outfall system


Seawater
Intake Tower
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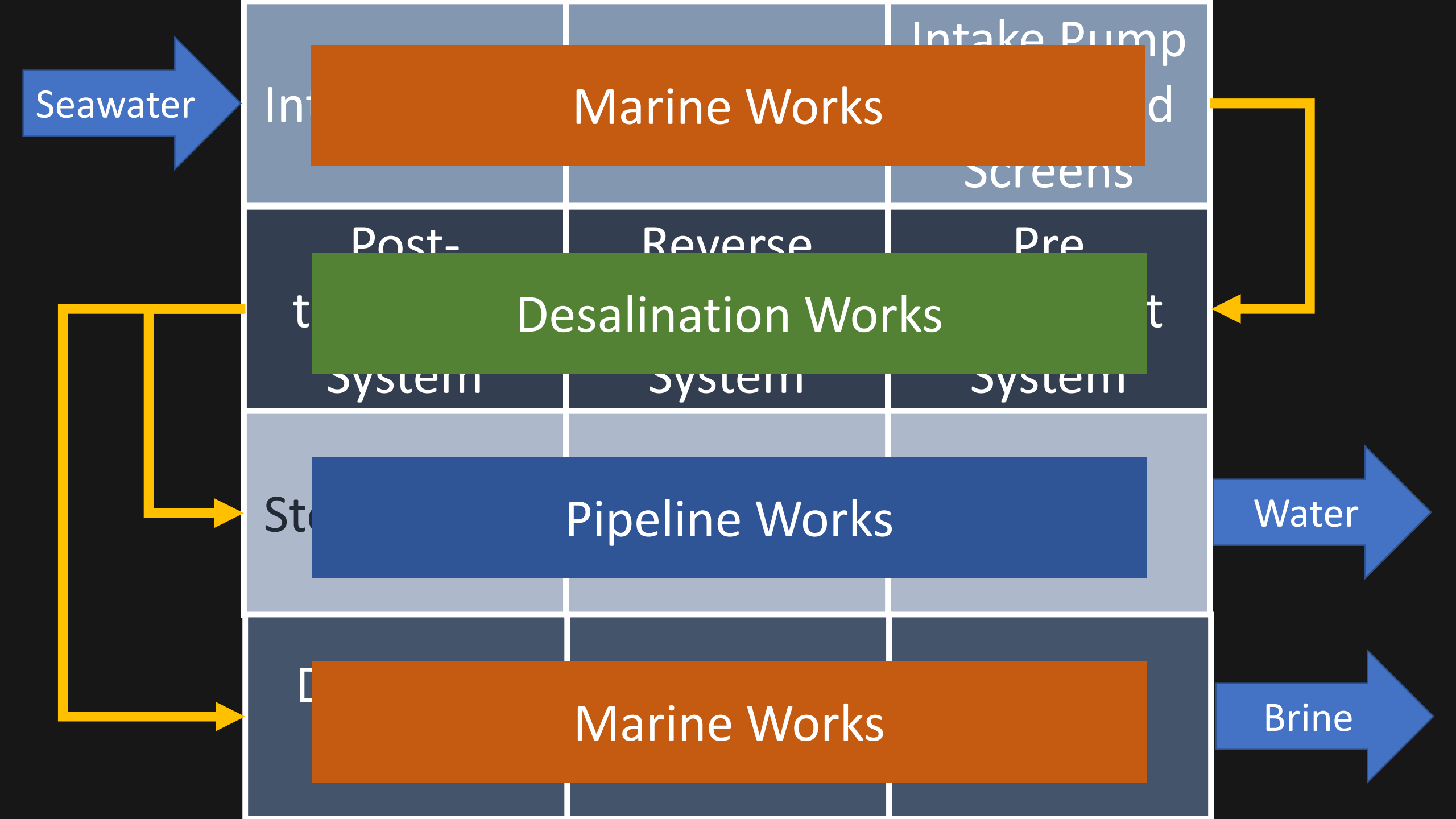
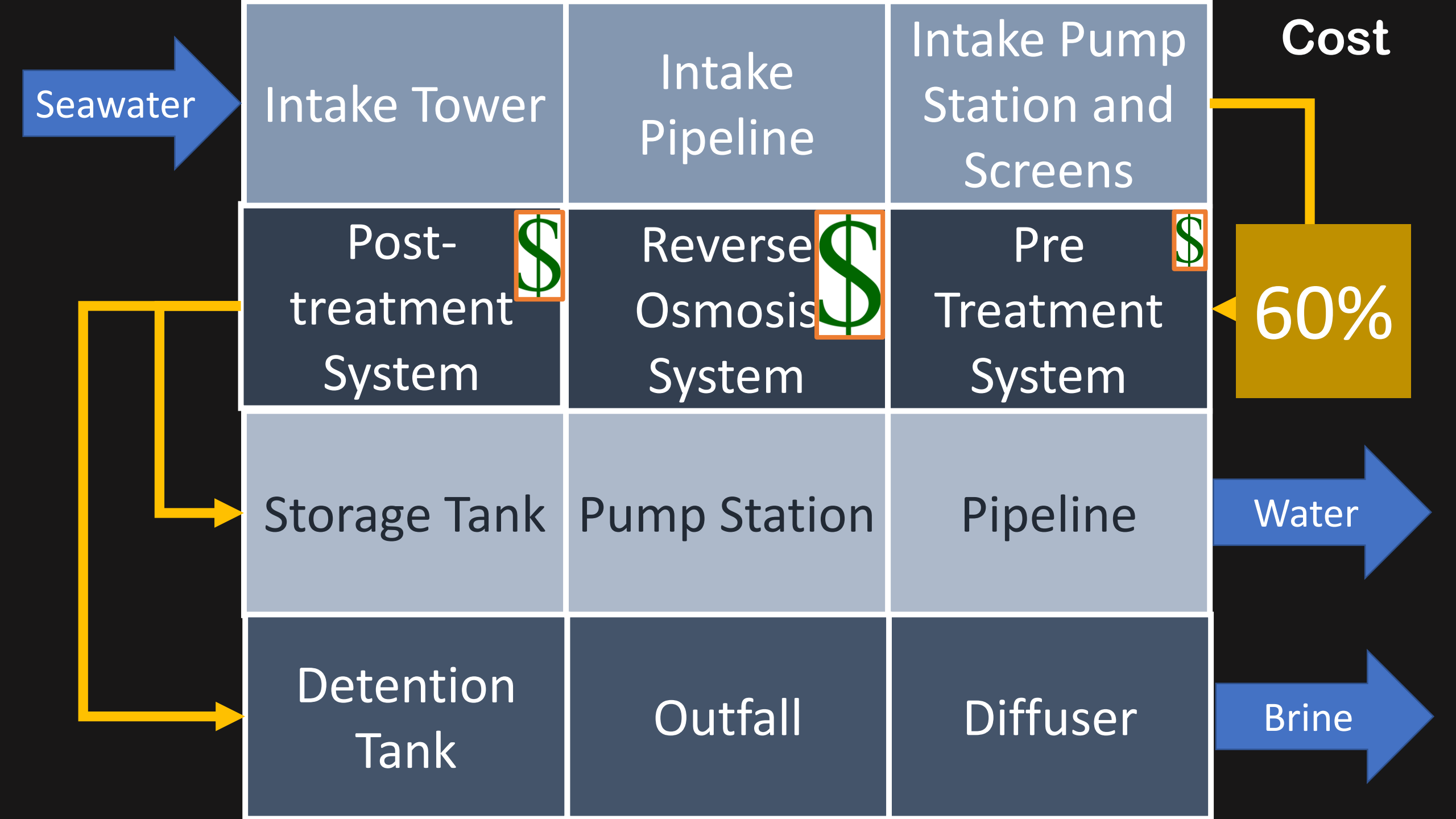
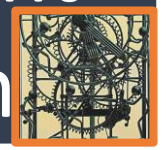
Brine


Seawater
Marine Works
Desalination Works
Pipeline Works
Water
Marine Works
Brine


Seawater
Intake Tower
Intake Pipeline
Intake Pump Station and Screens
Cost
Post-treatment System
$
Reverse Osmosis System
$
Pre Treatment System
$
60%
Storage Tank
Pump Station
Pipeline
Water
Detention Tank
Outfall
Diffuser
Brine

Seawater

Intake Tower	Intake Pipeline	Intake Pump Station and Screens
Post-treatment System $	Reverse Osmosis System $	Pre Treatment System $ 
Storage Tank	Pump Station	Pipeline
Detention Tank	Outfall	Diffuser

Cost

Water

Brine

Seawater

Intake Tow

Intake Pipeline

Intake Pump Station and Screens

Interest

Post-treatment System

Reverse Osmosis System

Pre Treatment System

Storage Tank

Pump Station

Pipeline

Water

Detention Tank

Outfall

Diffuser

Brine

Seawater

Intake Tow

Intake Pipeline

CRITICAL

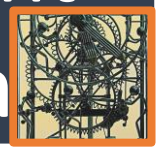
Intake Pump Station and Screens

Interest

Post-treatment System

Reverse Osmosis System

Pre Treatment System



Storage Tank

Pump Station

Pipeline

CRITICAL

Water

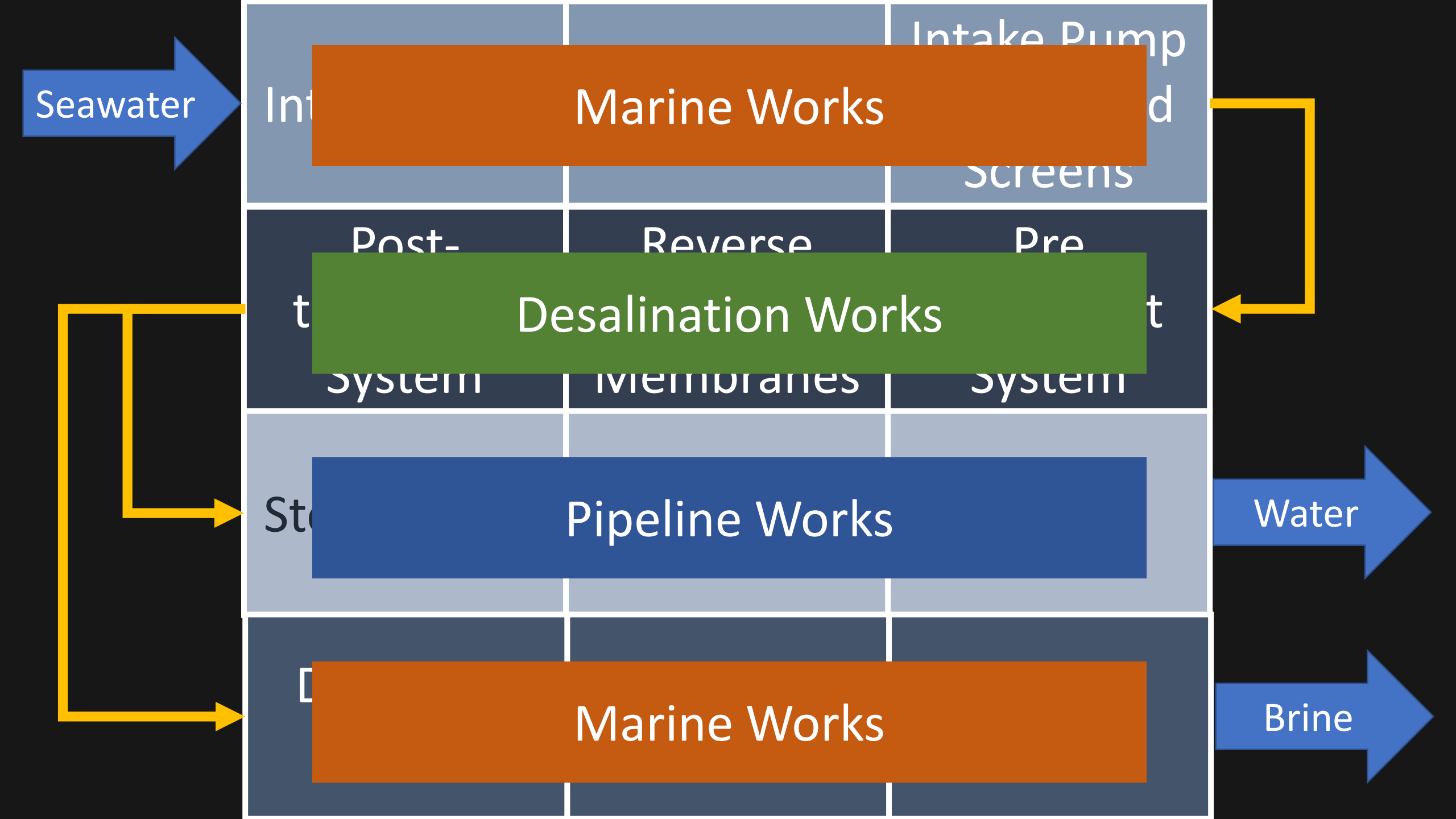
Detention Tank

Outfall

CRITICAL

Diffuser

Brine

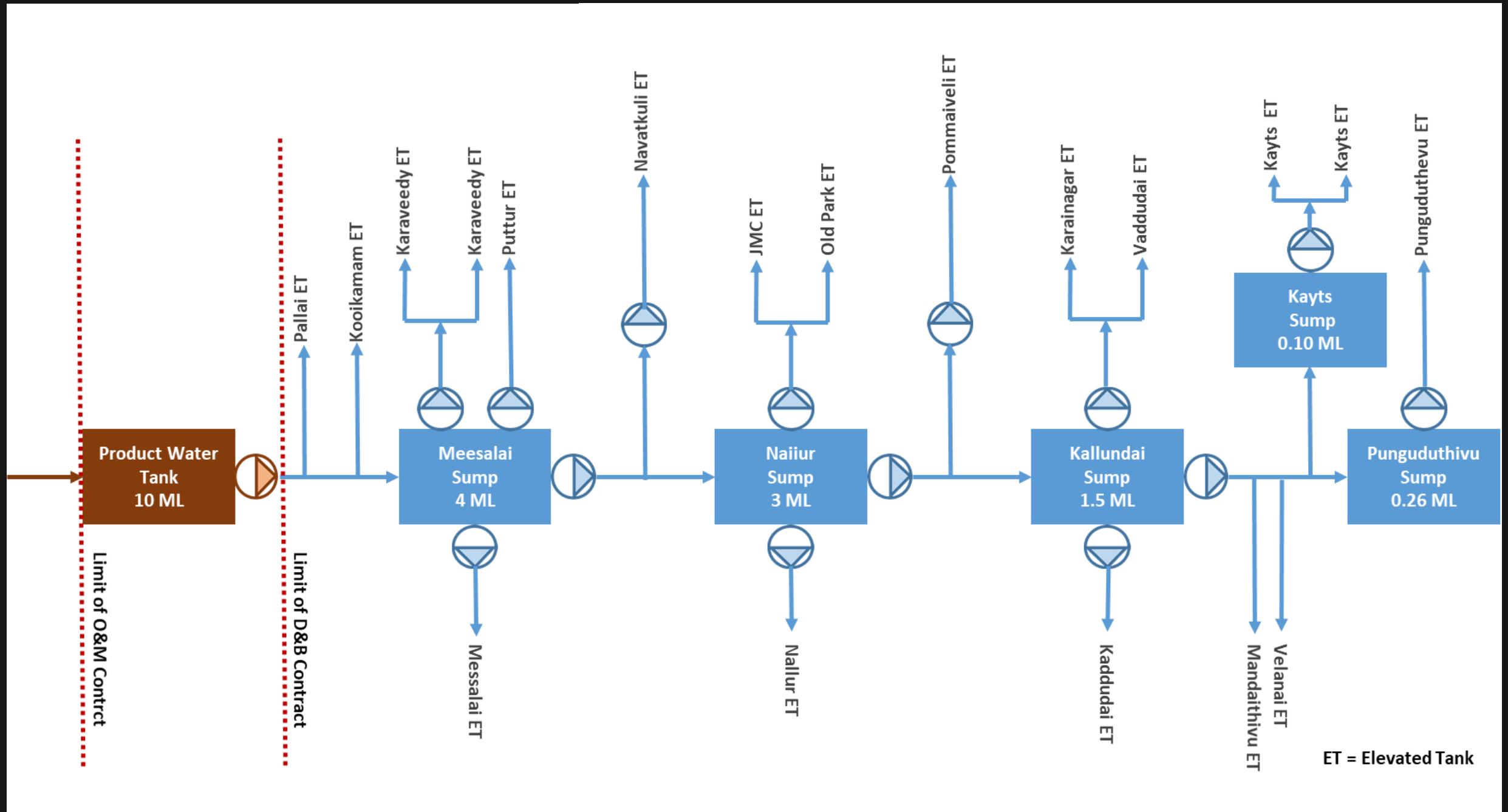

Seawater
Marine Works
Intake Pump
Screens
Post-
Reverse
Pre
System
Membranes
System
Desalination Works
Pipeline Works
Water
Marine Works
Brine

Typical Desalination Plant: Cartridge Filters

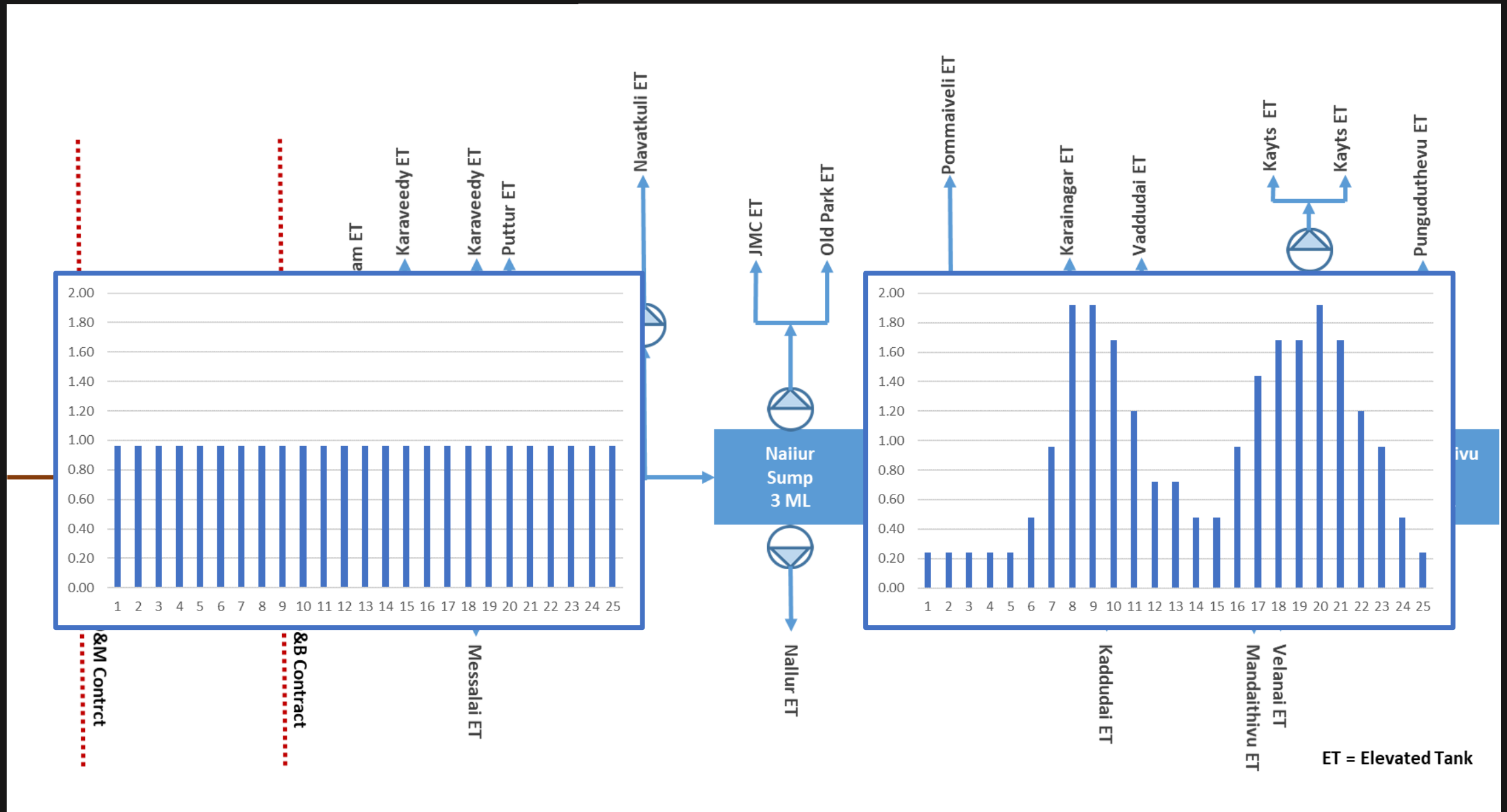
Typical Desalination Plant: Reverse Osmosis Filters

Typical Desalination Plant: General Layout

Supply to Customers



Downstream Network



Project Context

- Single source of supply
- No local desalination experience
- Limited in-country market
- Little local allied industry
- 400km from port facilities (Colombo)
- 40km from nearest town (Jaffna)
- Selection by qualification and price only
- Medium desalination plant

Simplest pre-treatment system that can prepare the seawater for the reverse osmosis membranes

Marine Works

- Functional design
- Construction method
- Address social and environmental safeguards
- Supporting hydraulic calculations
- Common trenching for intake and outfall pipelines
- Online monitoring

Treatment Plant Works

- Outcome based
- Processes and equipment selection
- Supporting design calculations and drawings
- All forms of waste
- Consider project risks
- Address social and environmental safeguards

Pipeline Works

- 8 km pipeline
- Construction method
- Single access road
- Waterway crossings
- Supporting calculations
- Address social and environmental mitigation measures
- Interface to network

Operations and Maintenance

- Transition to supply
- Maintenance methodology
- Asset replacement
- Experience
- Monitoring and reporting
- Performance guarantees
- Health and safety

Summary

1. A desalination project is more than a desalination plant
2. The preferred technology is reverse osmosis
3. The pre-treatment solution should be matched to the seawater quality
4. A desalination plant must be matched to its downstream infrastructure
5. The proposed technology for a desalination project should be selected in the context of its setting

Procurement

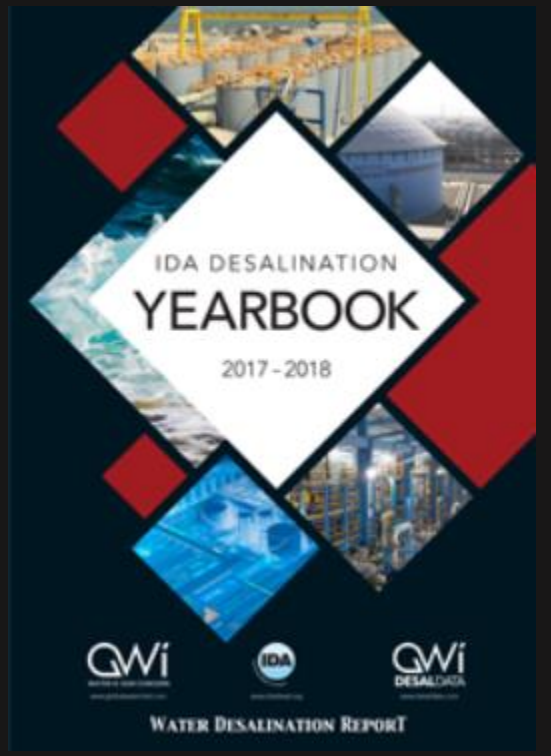
Procurement

1. Market Assessment
2. PQ and One or Two Stage
3. Time to Bid
4. Operation Service Period

Market Assessment

- Veolia
- Doosan
- GE
- Fisia
- Degremont
- IDE
- Acciona
- Hydro Chem
- Befesa
- Sadyt

- Global
- Proprietary
- Competitive
- Financing
- DBOM
- 80% RO
- Asian Interest



Procurement

A	Pre-qualification	Stage 1 (Technical)	Stage 2 (Technical and Financial)
B	Prequalification	Stage 1 (Technical and Financial)	
C	Stage 1 (Technical and Financial)		

Factors to consider?

If most boxes are ticked use a two stage process

Need to understand technical offers
Need to evaluate technical offers
Need to seek the best technical solution
Unable to prepare technical specifications
More than one technically qualified supplier
Sufficient lead time
Need for certainty of price (with economic adjustments)
Technology is changing rapidly

Which to choose?

PQ and Two Stages

- Not for desalination plants

PQ and One Stage

- Desalination Plants
- Secondary and Tertiary Waste Water Treatment Plants
- Hard Waste Processing Plants

One Stage

- Conventional Water Treatment Plants
- Primary Waste Water Treatment Plants

Provide Time to Bid

Action	Date
Advertised	07 December 2016
Meeting	17 February 2017
Close	12 May 2017
Extension	17 July 2017
Award	31 March 2018

270 day bid validity period
>500 questions
Each received a written answer:
Analysis

1. Qualifications
2. Site Layout
3. Commercial Arrangements
4. Pre-Treatment
5. Electricity Supply
6. Standards
7. Spares
8. Reverse Osmosis
9. Conveyance Pipeline
10. Waste Disposal

Operation Service Period

What is the preferred duration of the operation service period for a desalination plant?

10 years?

15 years?

25 years?

Operation Service Period

Case for long duration operation service periods	Case for against long duration operation service periods
• International contractors • Certainty • Asset Replacement Fund • Core business • Expertise • Re-bid costs	• Locked to service provider • Uncertainty (demand, technology) • Locked to annual payments • Capacity building
• Privately Financed (>25 years)	• Size/Experience

Seven to ten years is a good period to choose (WB ten years)

Procurement

Time, Cost, Quality

A	Pre-qualification	Stage 1 (Technical)	Stage 2 (Technical and Financial)
B	Prequalification	Stage 1 (Technical and Financial)	
C	Stage 1 (Technical and Financial)		

Summary

1. There are competent international desalination providers in the market (which is competitive)
2. Consideration should be given to using a PQ and one stage process for desalination plants if time permits
3. Bidders must be allowed time to understand the project, form partnerships, attend the site and prepare their bids
4. The operation service period for a small and medium size plant could be seven to ten years (if using public finance)

Evaluation

1. Technical
2. Financial

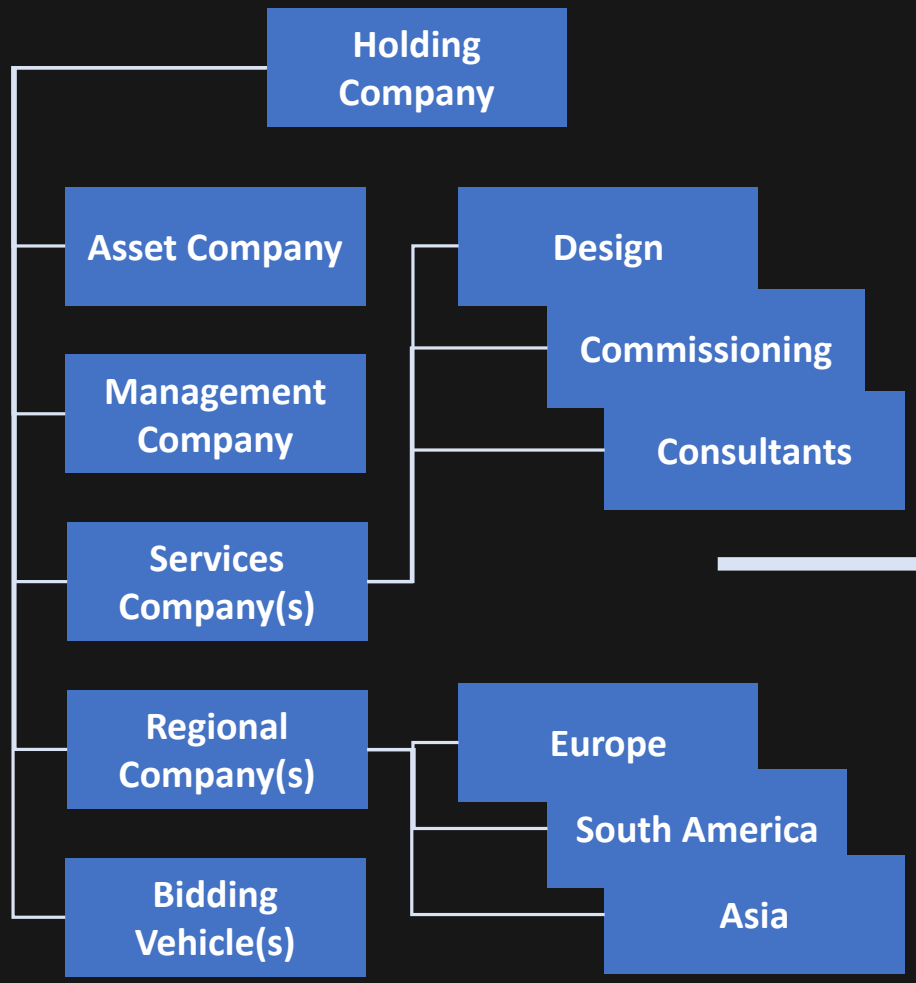
Evaluation

Technical Evaluation

1. Qualification Criteria
2. Technical Criteria
3. Performance Guarantees
4. Employer’s Requirements

Technical Evaluation Qualification Criteria

Qualification Criteria



- Parent Company
- Sibling Company
- Child Company

Financial Requirements

1. Historical Performance
2. Average Annual Turnover
3. Financial Resources

Bidder's Experience

1. Similar Size and Nature
2. Key Activities

Subcontractors

Qualification Criteria

- 3 technologies / 3 skill sets
- 3 histories

- Multiple combinations of companies
  - Medium-sized Companies: specialise (joint venture)
  - Large-sized Companies: organise (and subcontract)

Summary

1. Qualification criteria must allow for different company structures
2. Qualification criteria must allow for different skill sets
3. Qualification criteria must be easy to for a bidder to support
4. Qualifications criteria must be easy to for an assessor to evaluate

Technical Evaluation
Technical Criteria

Technical Evaluation

1. Should we evaluate the bidders' technical proposals (Section 6) and use the results in the decision making?
2. Should we use a scoring system?

Technical Criteria

History shows many desalination plants fail to:

- Deliver required output
- Deliver required water quality
- Deliver required reliability
- Run over time
- Cost more to run than anticipated
- Suffer early technical problems
- Suffer reduced asset lives

Technical criteria should address the underlying causes

Section 3 Qualification Criteria

Eligibility

Litigation/Arbitration

Financial Position

- Historical Performance
- Turnover

Experience

- Similar Contracts
- Key Activities

Section 6 Employers Requirements

Purpose and Scope

Supporting Data

Technical Requirements

- Design-Build
- Operation Service

Project Management

Asset Management

Audit Body

Minimum Resources

- People
- Equipment

Social Safeguards

Environmental Safeguards

Section 3 Qualification Criteria

Eligibility

Litigation/Arbitration

Financial Position

- Historical Performance
- Turnover

Experience

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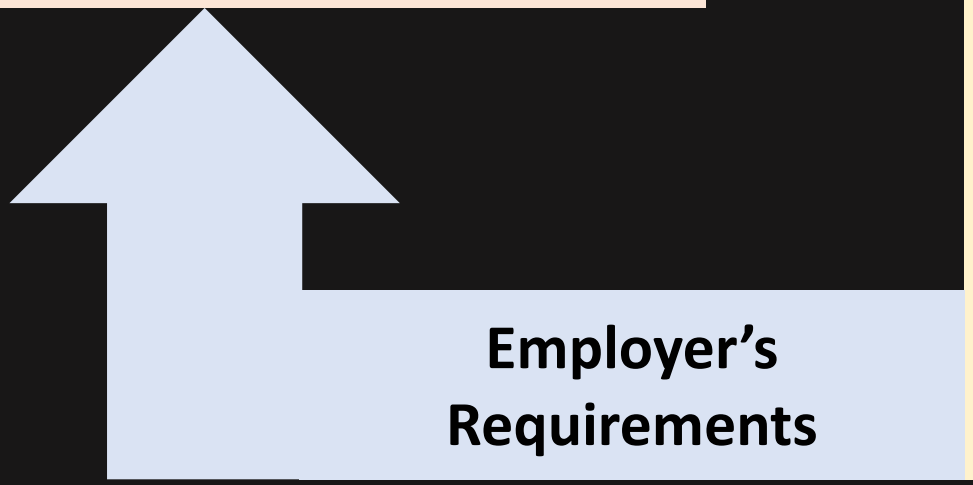


Employer's Requirements

Section 6 Employers Requirements

Purpose and Scope

Supporting Data

Technical Requirements

- Design-Build
- Operation Service

Project Management

Asset Management

Audit Body

Minimum Resources

- People
- Equipment

Social Safeguards

Environmental Safeguards

Employers Requirements from Section 3 to Section 6

Table 3-2 Technical Bid Evaluation Criteria

No.	Requirement Type	Name
1	Functional	Produce Water – Quantity and Quality
2	Functional	Provide for Augmentation
3	Functional	Provide Buildings, Services and Amenities
4	Functional	Hand Back Operations
5	Management	Practise Asset Management
6	Management	Practise Project Management

Extract from Revised Bidding Document

Table 3-3 Technical Evaluation Criteria Key Factors

No.	Criterion		Key Factors
1	Functional Requirement: Produce Water – Quantity and Quality	1	24 MLD capacity is provided
		2	6/12/18/24 incremental supply is provided - quantity
		3	95.9% quantity reliability is achievable
		4	The specified water quality is provided
		5	6/12/18/24 incremental supply is provided – quality
		6	100% quality reliability is achievable
2	Functional Requirement: Provide for Augmentation	1	Allowance for 24 MLD to 48 MLD capacity is provided
		2	Allowance for a Boron reduction from 2.4 mg/l to 1 mg/l is provided
		3	Allowance for the installation of a DAF system is provided
3	Functional Requirement: Provide Buildings, Services and Amenities	1	Buildings are provided and fitted out as specified
		2	Secure Access is provided to site and buildings
		3	Electricity is provided to all the parts of the plant
		4	Other Services and Amenities are provided
4	Functional Requirement: Hand Back Operations	1	NWSDB staff are trained and competent
		2	Assets are in the expected condition at hand back
		3	Systems are in the expected condition at hand back
		4	Adequate spares are provided at hand back
5	Management Requirement: Practise Asset Management	1	Assets design lives are achieved
		2	Supply is matched to demand
		3	Operational efficiency is maximised
		4	1. Incident management is provided 2. Emergency management is provided
		5	Compliance with standards and codes is achieved
6	Management Requirement: Practise Project Management	1	Timelines are met
		2	Budget and costs and managed
		3	Quality is delivered
		4	Audits are undertaken
		5	Social responsibilities are met
		6	Environmental responsibilities are met
		7	Data and documentation are managed
		8	Reports and meeting are managed
		9	Good conduct and professional behaviour are practised

Summary

1. Technical criteria should heed the underlying causes of previous desalination plant failures
2. Ideally single stage qualification criteria should include financial, experience and technical criteria and use all for selection
3. Pre-qualification and one stage should include technical criteria in the second stage and use for selection

‘Most advantageous proposal’

Technical Evaluation
Performance Guarantees

Performance Guarantees

	Performance Measure	Damage
Specified	Water Production Quantity	Payment reduced if water not provided Payment reduced if supply is unreliable
	Water Production Quality	Payment reduced if out of specification Payment reduced if water quality not tested Payment reduced if discharge licence breached
Bid	Energy Usage – SWRO	Payment reduced by 1.5 times excess over cap
	Energy Usage – Other	Payment reduced by 1.5 times excess over cap
	Chemical Usage	Payment capped at bid chemical usage
	Replacement of ultrafilters	Payment only made in accordance with asset replacement fund
	Replacement of cartridge filters	Payment only made in accordance with asset replacement fund

Performance Guarantees (Bid)

Bidders were required to provide:

- designs and
- calculations

to show how the performance guarantees would be achieved

Engineer's Estimate of Energy Usage for a 24 MLD SWRO

Item	Number of Duty Units	Number of Standby Units	Average Power Use	Average Power Use			Maximum Power Use (HP)	Maximum Power Use		
				Total (HP)	% Total	kWh/m3		Total (HP)	% Total	kWh/m3
Desalination Plant Intake Pump Station										
Seawater Intake Pumps	4	1	100	400	7.77	0.249	150	600	9.32	0.373
	4	1	100	400	7.77	0.249	150	600	9.32	0.373
First Stage Gravity Filters										
Gravity Filters - Blowers	2	1	30	24	0.47	0.015	30	24	0.37	0.015
Gravity Filters - Backwash Pumps	2	1	60	48	0.93	0.03	60	48	0.75	0.03
Other Pre-filtration Pretreatment Equipm	4	4	5	20	0.39	0.012	5	20	0.31	0.012
Interim Pumps	4	1	25	100	1.94	0.062	60	240	3.73	0.149
	12	7	120	192	3.73	0.119	155	332	5.16	0.206
Second Stage Pressure Filter										
Pressure Filters - Blowers	2	1	40	32	0.62	0.02	40	32	0.5	0.02
Pressure Filters - Backwash Pumps	2	1	80	64	1.24	0.04	80	64	0.99	0.04
Other Pre-filtration Pretreatment Equipm	4	4	8	32	0.62	0.02	8	40	0.62	0.025
Filtered Water Pumps	4	1	65	260	5.05	0.162	110	440	6.83	0.274
	12	7	193	388	7.53	0.242	238	576	8.94	0.359
Reverse Osmosis System (Single Pass)										
High Pressure RO Feed Pumps	8	0	400	3,200	62.12	1.989	450	3,600	55.9	2.238
ERI Booster Pumps	8	0	25	200	3.88	0.124	30	240	3.73	0.149
	16	0	425	3400	66	2.113	480	3840	59.63	2.387
Product Water Delivery Pumps										
Product Water Delivery Pumps	4	1	40	160	3.11	0.099	60	240	3.73	0.149
	4	1	40	160	3.11	0.099	60	240	3.73	0.149
Solids Handling Facilities										
Waste Discharge Pumps	4	1	2.5	10	0.19	0.006	5	20	0.31	0.012
Retention Tank Discharge Mixers	4	0	20	80	1.55	0.05	20	80	1.24	0.05
	8	1	22.5	90	1.74	0.056	25	100	1.55	0.062
Membrane Cleaning System										
Membrane Cleaning Pumps	2	1	2	4	0.08	0.002	2	4	0.06	0.002
Flush Pumps	2	1	2.5	5	0.1	0.003	2.5	5	0.08	0.003
Mechanical Mixers for Chemical Batch Ta	2	0	0.5	1	0.02	0.001	0.5	1	0.02	0.001
Chemical Cleaning System	2	0	4	8	0.16	0.005	4	8	0.12	0.005
	8	2	9	18	0.36	0.011	9	18	0.28	0.011
Chemical Feed Equipment										
Coagulant Feed System	2	1	5	10	0.19	0.006	20	40	0.62	0.025
Polymer Feed System	2	1	1	2	0.04	0.001	2	4	0.06	0.002
Sulfuric Acid Feed System	2	1	0.1	0.2	0	0	0.8	2	0.025	0.001
Calcium Hypochlorite Feed System	1	1	5	5	0.1	0.003	0.8	1	0.01	0
Sodium Bisulfide Feed System	2	1	1	2	0.04	0.001	4	8	0.12	0.005
Sodium Hydroxide Feed System	2	1	6	5	0.1	0.003	8	16	0.25	0.01
Antiscalant Feed System	2	1	2	4	0.08	0.002	8	16	0.25	0.01
Lime/CO2 Feed System	6	3	2.5	15	0.29	0.009	8	48	0.75	0.03
	19	10	22.6	43.2	0.84	0.025	51.6	135	2.085	0.083
Service Facilities										
HVAC	1	0	60	60	1.16	0.037	100	100	1.55	0.062
Lightning	1	0	80	80	1.55	0.05	100	120	1.86	0.075
Controls and Automation	1	0	50	50	0.97	0.031	80	80	1.24	0.05
Service Air Compressors	5	5	10	50	0.97	0.031	10	50	0.78	0.031
Other Miscellaneous/Contingency			220	220	4.27	0.137	250	250	3.88	0.155
	8	5	420	460	8.92	0.286	540	600	9.31	0.373
Total	**91**	**34**	**1352.1**	**5151.2**	**100**	**3.2**	**1708.6**	**6441**	**100.005**	**4.003**

Performance Guarantee

Energy: SWRO	kWh/m3	2.78	3.40	3.45	2.71 to 2.63	3.23
Energy: Other	kWh/year	963,600	1,399,789	2,715,600	N/A	5,680,032
Total	kWh/m3	2.89	3.61	3.76	N/A	3.88

Engineer's estimate 3.84 kWh/m^3

Summary

1. The demonstrated achievement of performance guarantees should be one of the assessed technical criteria

Technical Evaluation
Employer's Requirements

Employers Requirements from Section 3 to Section 6

Table 3-2 Technical Bid Evaluation Criteria

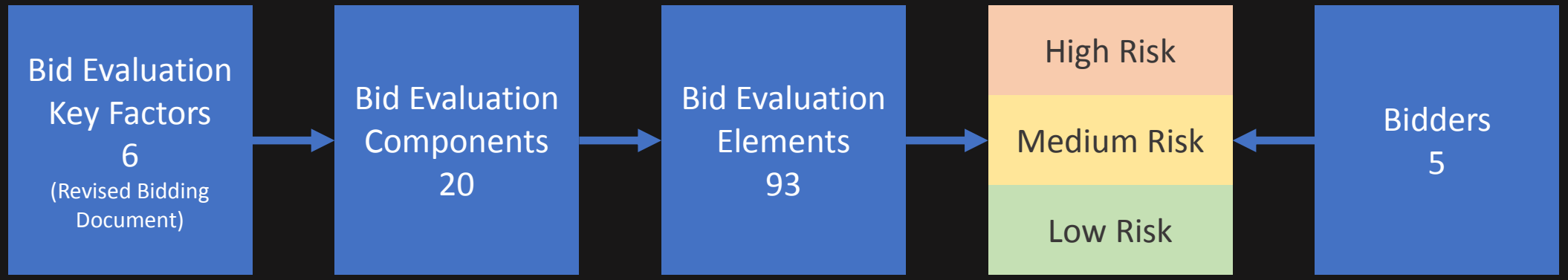
No.	Requirement Type	Name
1	Functional	Produce Water – Quantity and Quality
2	Functional	Provide for Augmentation
3	Functional	Provide Buildings, Services and Amenities
4	Functional	Hand Back Operations
5	Management	Practise Asset Management
6	Management	Practise Project Management

Extract from Revised Bidding Document

Table 3-3 Technical Evaluation Criteria Key Factors

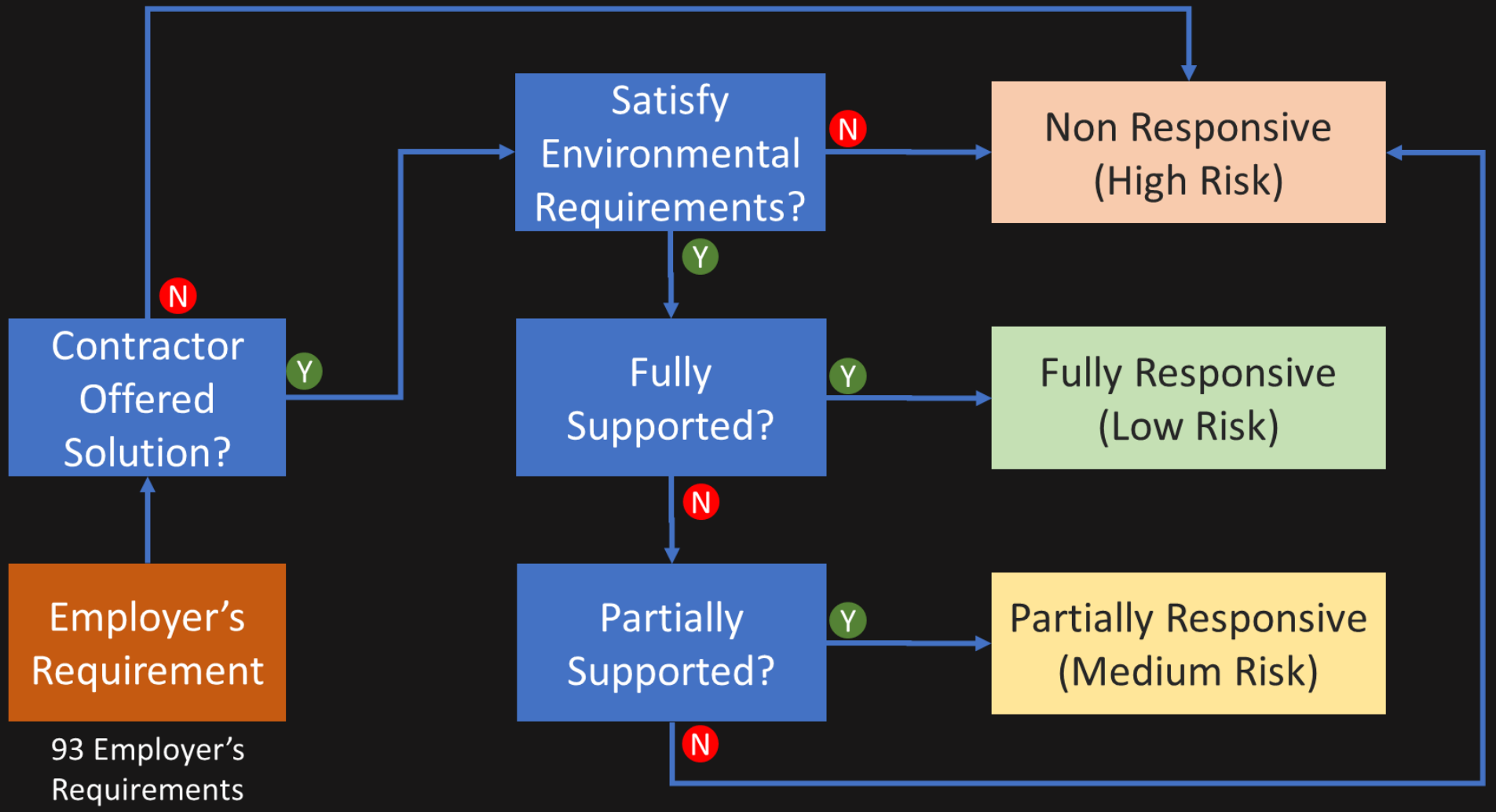
No.	Criterion		Key Factors
1	Functional Requirement: Produce Water – Quantity and Quality	1	24 MLD capacity is provided
		2	6/12/18/24 incremental supply is provided - quantity
		3	95.9% quantity reliability is achievable
		4	The specified water quality is provided
		5	6/12/18/24 incremental supply is provided – quality
		6	100% quality reliability is achievable
2	Functional Requirement: Provide for Augmentation	1	Allowance for 24 MLD to 48 MLD capacity is provided
		2	Allowance for a Boron reduction from 2.4 mg/l to 1 mg/l is provided
		3	Allowance for the installation of a DAF system is provided
3	Functional Requirement: Provide Buildings, Services and Amenities	1	Buildings are provided and fitted out as specified
		2	Secure Access is provided to site and buildings
		3	Electricity is provided to all the parts of the plant
		4	Other Services and Amenities are provided
4	Functional Requirement: Hand Back Operations	1	NWSDB staff are trained and competent
		2	Assets are in the expected condition at hand back
		3	Systems are in the expected condition at hand back
		4	Adequate spares are provided at hand back
5	Management Requirement: Practise Asset Management	1	Assets design lives are achieved
		2	Supply is matched to demand
		3	Operational efficiency is maximised
		4	1. Incident management is provided 2. Emergency management is provided
		5	Compliance with standards and codes is achieved
6	Management Requirement: Practise Project Management	1	Timelines are met
		2	Budget and costs and managed
		3	Quality is delivered
		4	Audits are undertaken
		5	Social responsibilities are met
		6	Environmental responsibilities are met
		7	Data and documentation are managed
		8	Reports and meeting are managed
		9	Good conduct and professional behaviour are practised

Evaluation of Employer's Requirements



Produce Water – Quantity and Quality
Provide for Augmentation
Provide Buildings, Services and Amenities
Hand Back Operations
Practise Asset Management
Practise Project Management

Evaluation of Employer's Requirements



Evaluation of Employer's Requirements

Table 1 Absolute Number of Each Risk Rating

Risk					
Low	77	55	40	40	34
Medium	14	26	35	33	39
High	2	12	18	20	20
Total	93	93	93	93	93

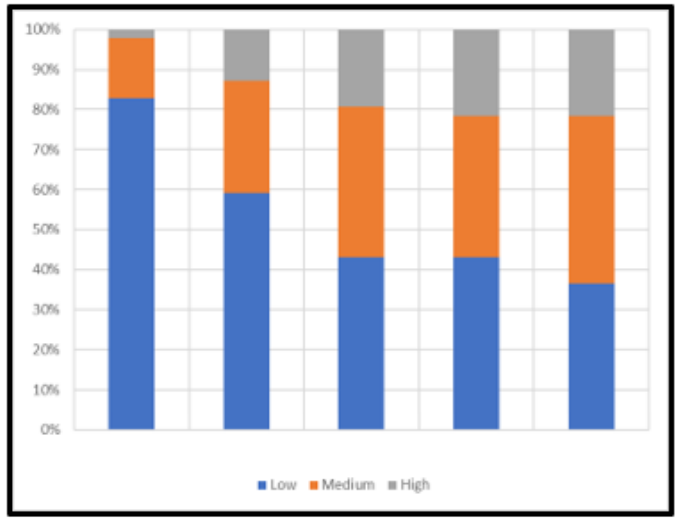


Figure 3 Percentage of Low, Medium and High Risk Evaluation Elements

Evaluation Component Risk Ratings					
Intake and Outfall Works	Low	High	Medium	High	Medium
Treatment Process Selection	Low	Medium	High	Low	Medium
Treatment Plant Works	Low	Medium	High	High	Low
Product Water and Conveyance Works	Low	High	Medium	High	Medium
Operations and Maintenance	Low	High	Medium	Medium	Low
Functional Guarantees	Low	Medium	High	High	Medium
Resources	Medium	Medium	Low	High	Medium
Overall	**Low**	**High**	**High**	**High**	**Medium**

Summary

1. Ideally a technical evaluation should use an objective assessment method (especially when sole source of supply)
2. Each assessment element should be assessed by the same person (who has expertise in that element), and confirmed by a second person
3. A technical evaluation provides a valuable insight into each contractor's proposal and each contractor itself

Evaluation

Financial Evaluation

1. Methodology
2. Real Costs
3. Discounting
4. Comparison of Bids

Real Dollars

Real	Dollars of today
~~Nominal~~	~~Dollars of the day~~

Bidders to price in real dollars
Include an economic adjustment mechanism

Discounting?

Discounting?

Business Case
Bid Evaluation
Cost Recovery

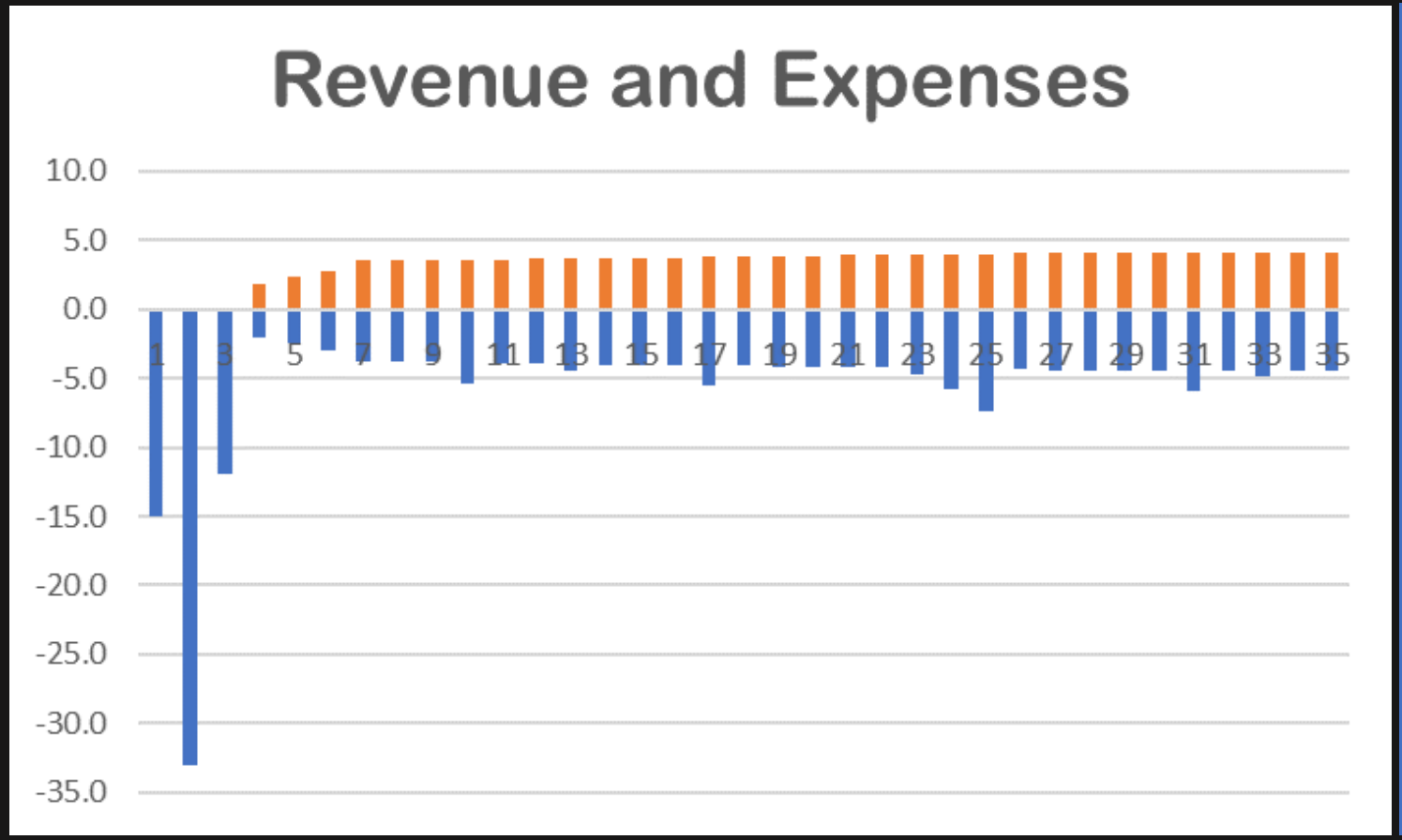
Establishes a foundation for the project against which everything else can measured and be tested

Discounting?

Item	Purpose	Financial Factors	Time Period
Business Case	Determine the preferred option Seek project approval	Forecast growth Capital expenses Operational expenses Discount rate	30 to 50 years
Bid Evaluation	Determine the preferred contractor Seek approval to award	Capital prices Operational prices	Life of contract
Water Pricing	Determine the unit price of water Establish a water tariff	Operational expenses Return on capital Return of capital Taxes	Life of pricing period

Discounting?

Estimates



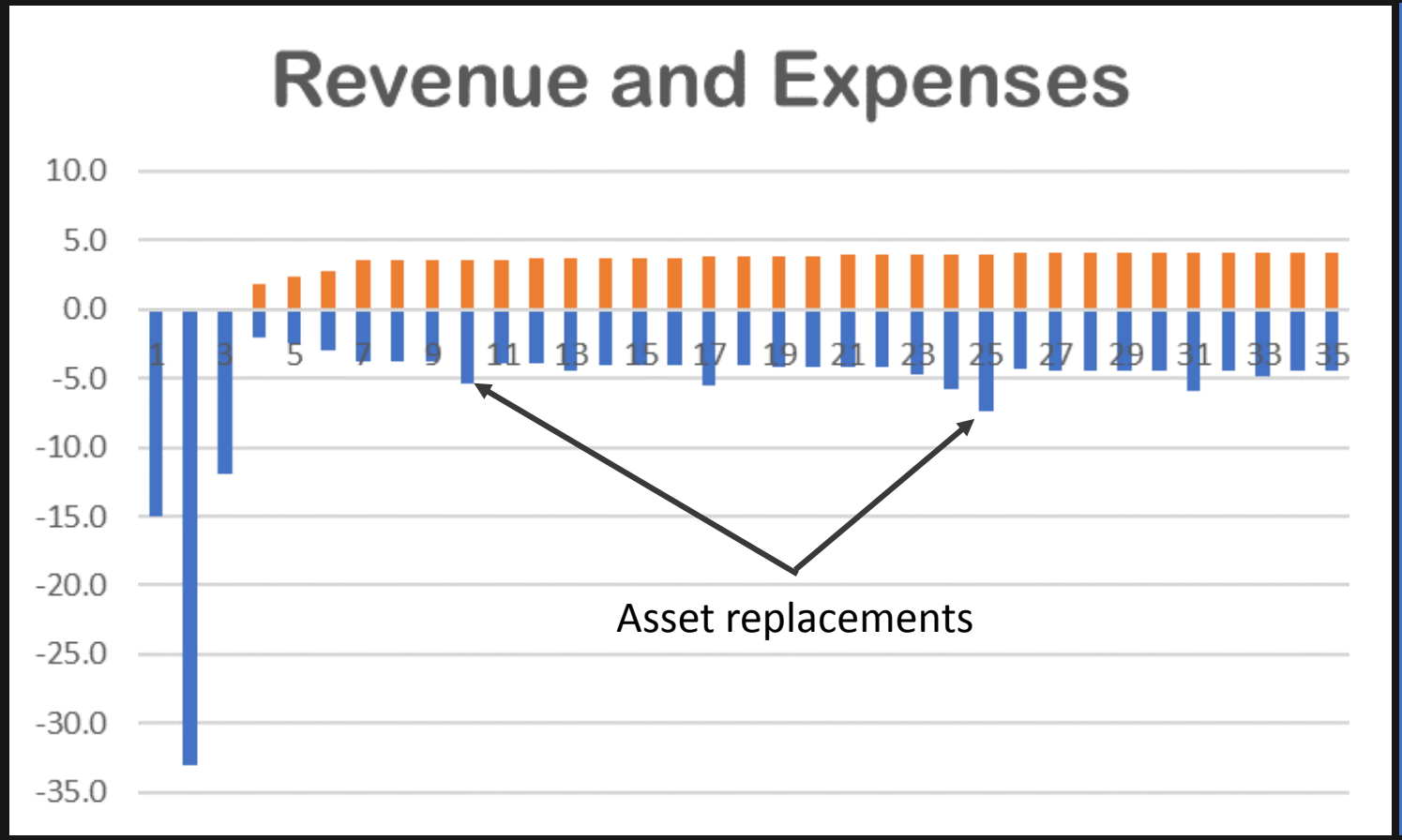
Discount Rate

= Inflation

+ Uncertainty

Discounting – Business Case

Estimates



Discount Rate

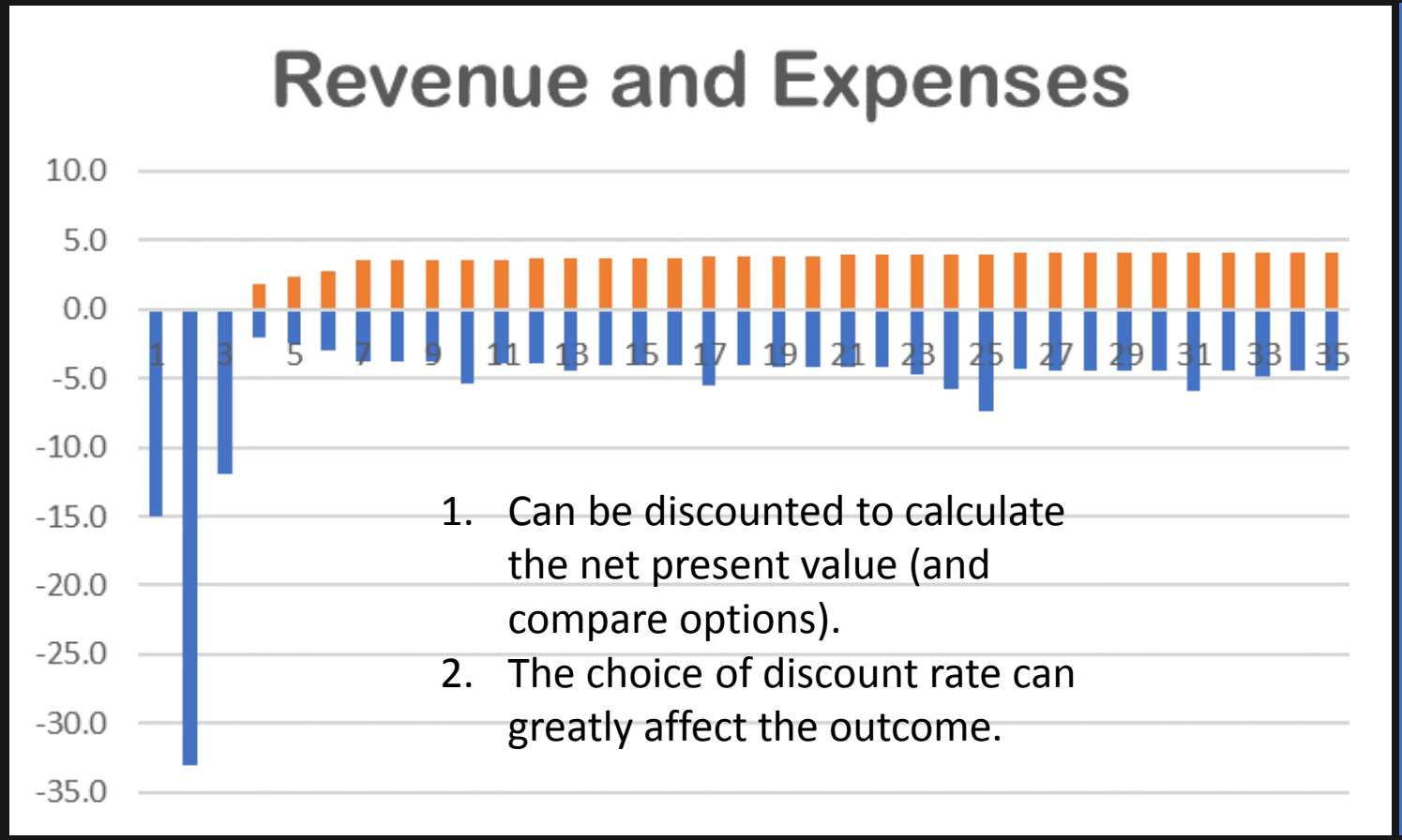
= ~~Inflation~~

+ Uncertainty

- Weighted Average Cost of Capital
- Five percent

Discounting – Business Case

Estimates



Discount Rate

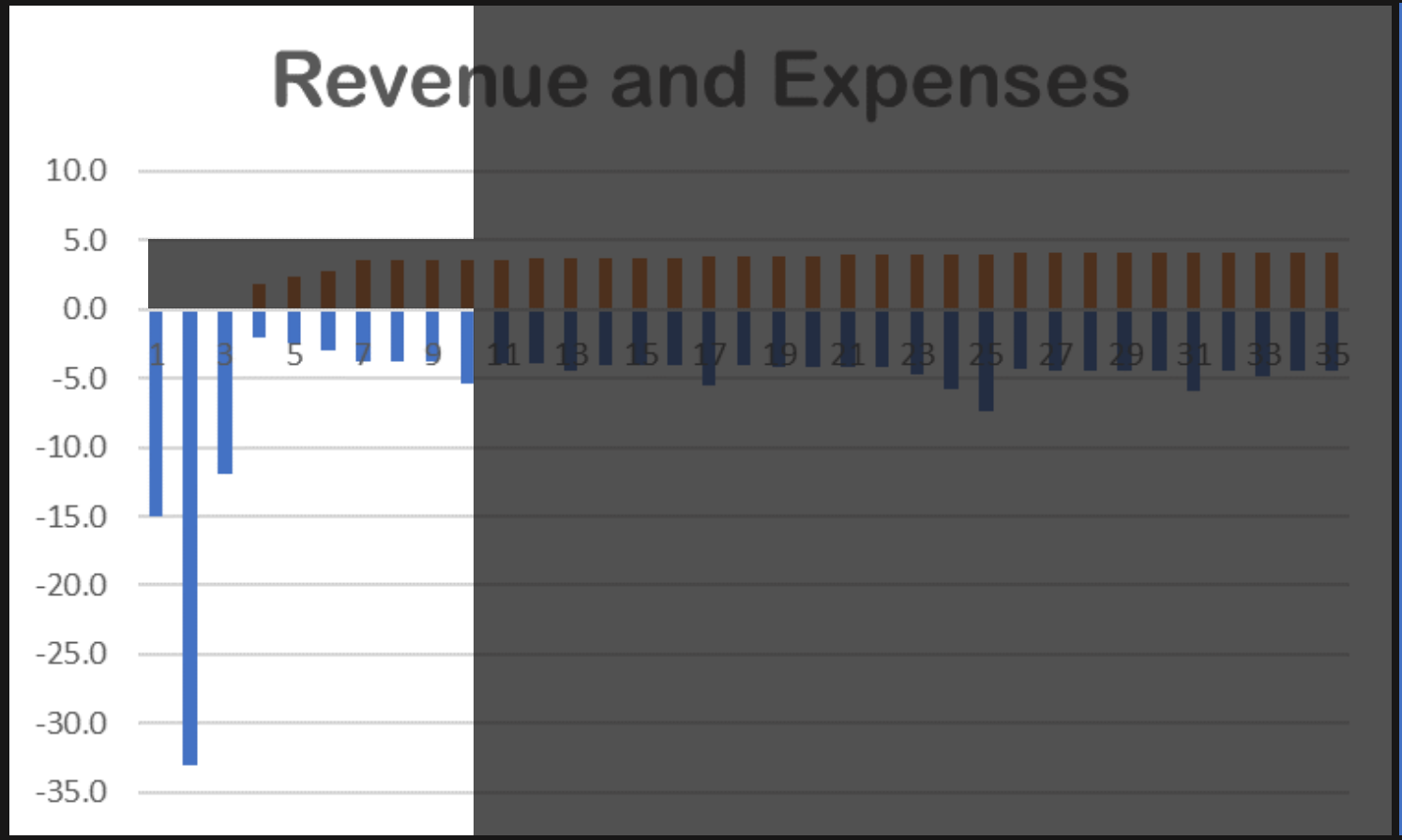
= ~~Inflation~~

+ Uncertainty

- Weighted Average Cost of Capital
- Five percent

Discounting – Bidding

Bid Prices



Discount Rate

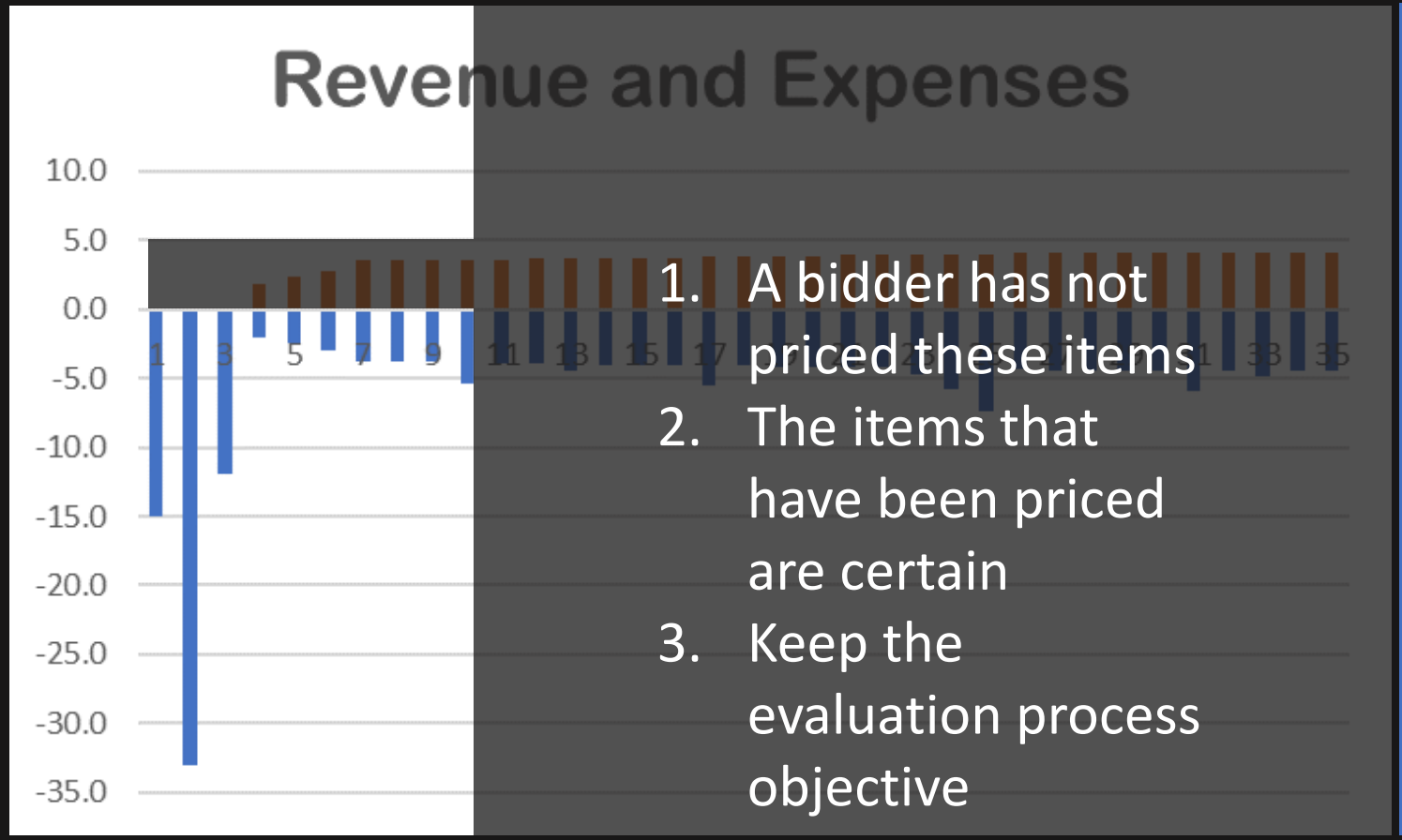
= ~~Inflation~~

+ ~~Uncertainty~~

- ~~Weighted Average Cost of Capital~~
- Zero percent

Discounting - Bidding

Bid Prices



1. A bidder has not priced these items
2. The items that have been priced are certain
3. Keep the evaluation process objective

Discount Rate

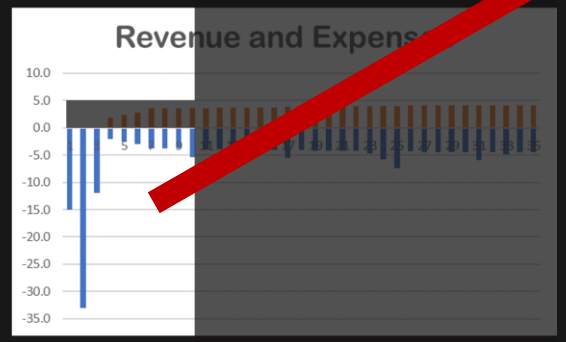
= ~~Inflation~~

+ ~~Uncertainty~~

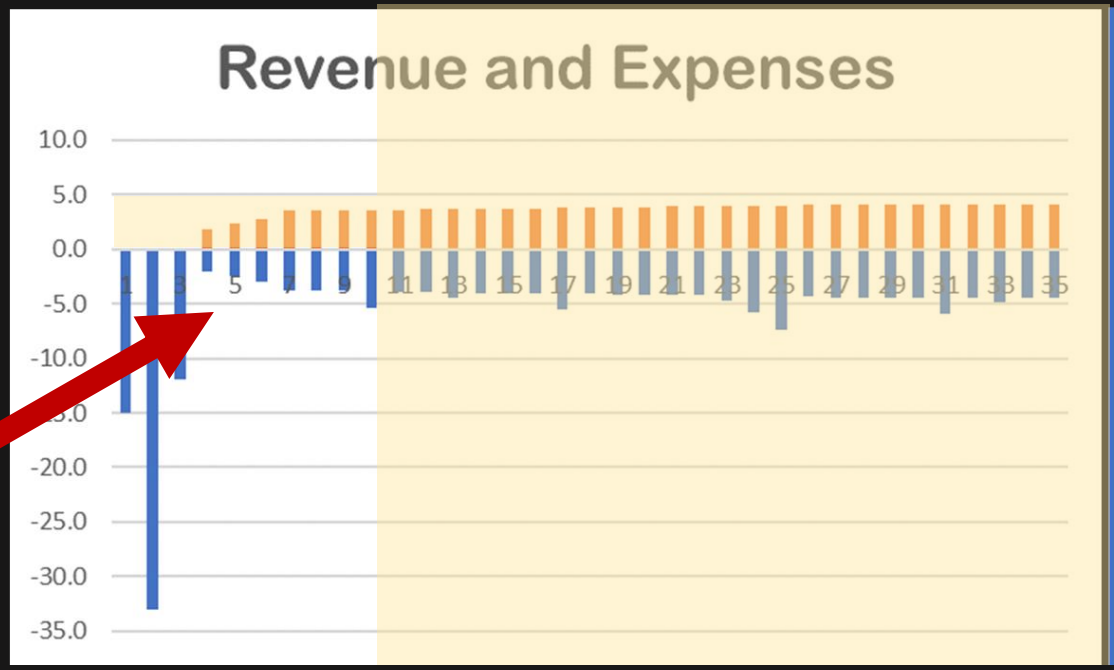
- ~~Weighted Average Cost of Capital~~
- Zero percent

Discounting – Impact of Bid on Business Case (Change in NPV?)

Bid Prices



Estimates



Discount Rate

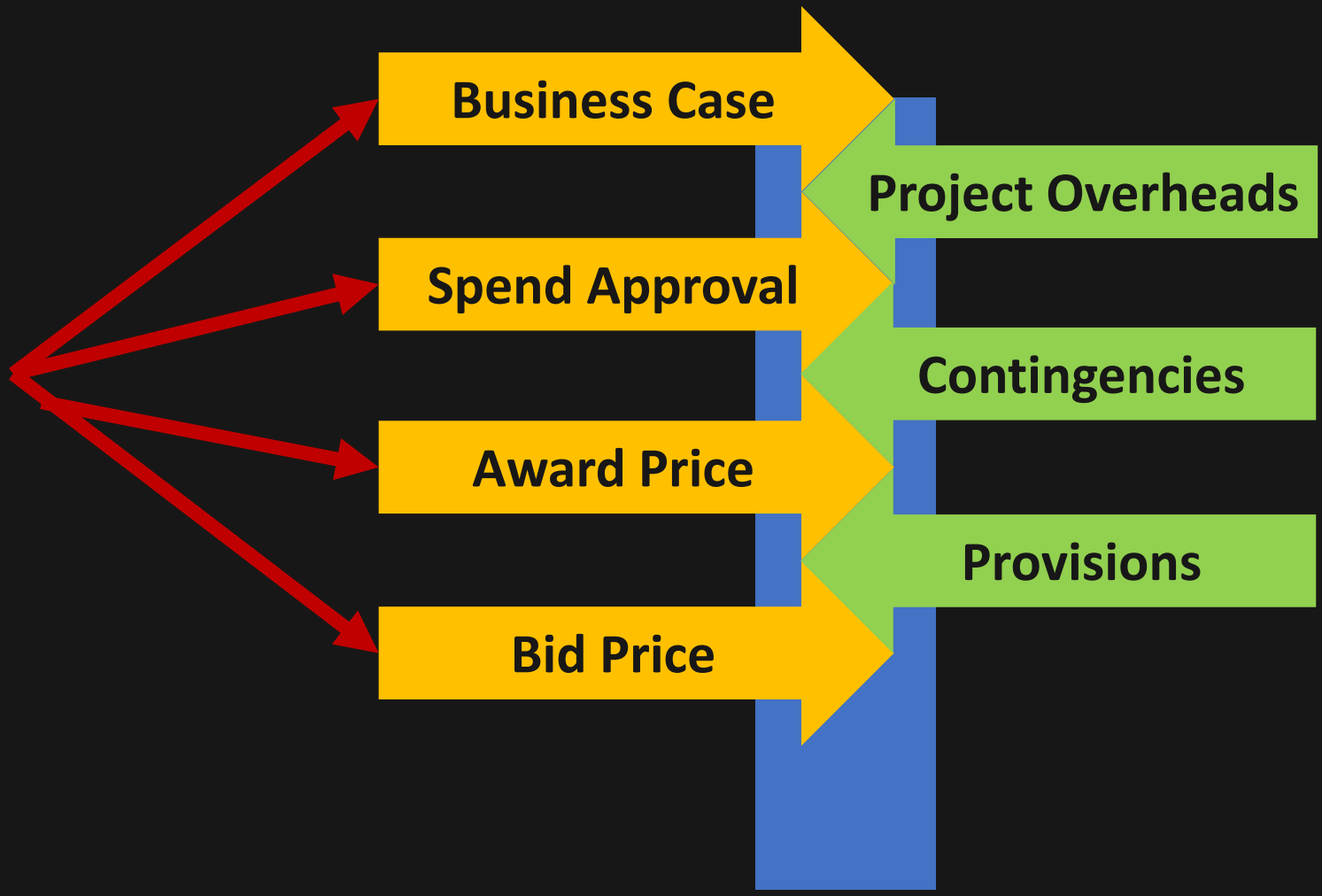
= ~~Inflation~~

+ Uncertainty

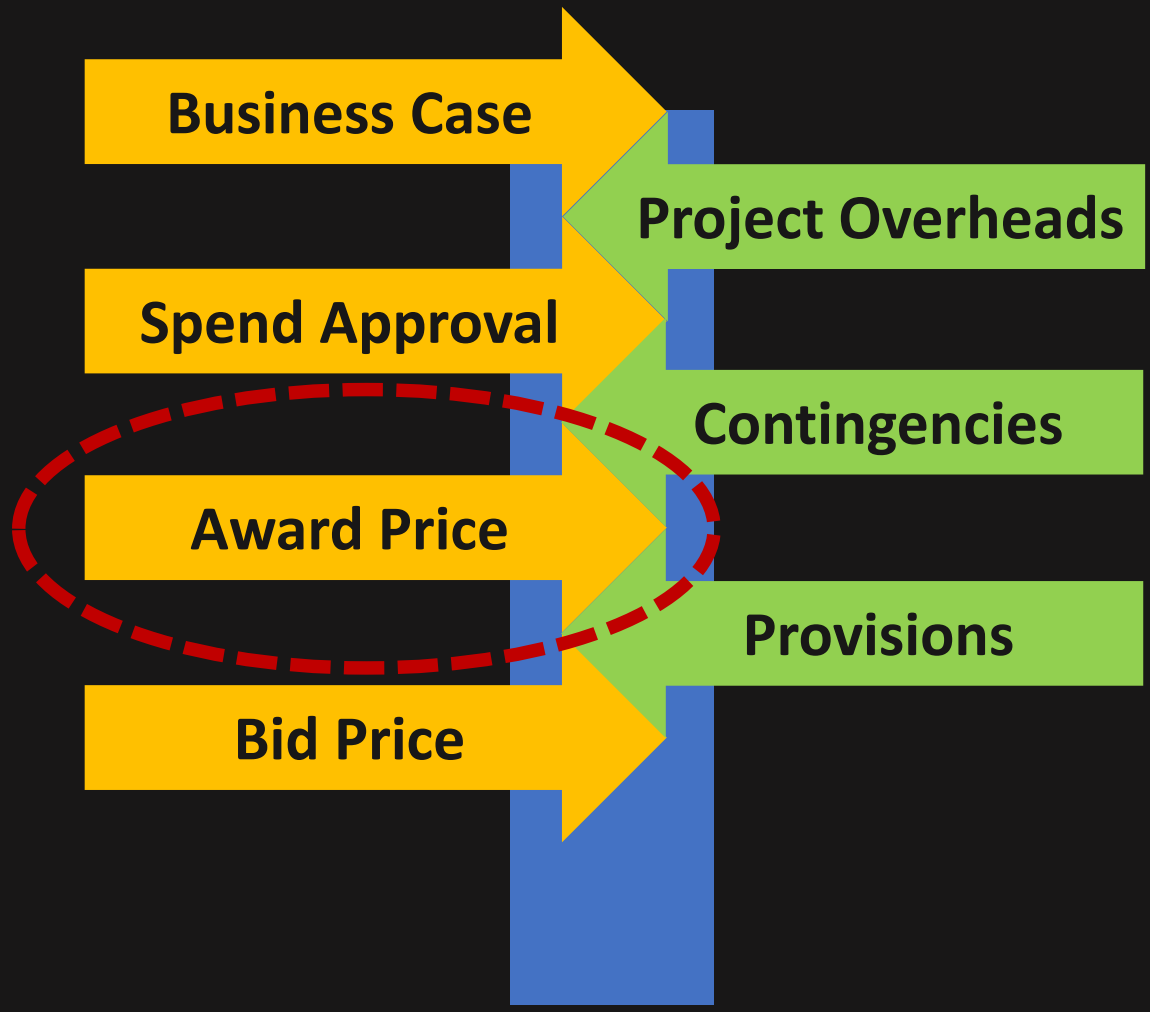
- Weighted Average Cost of Capital
- Five percent

Comparison of Bids

Which do you compare?

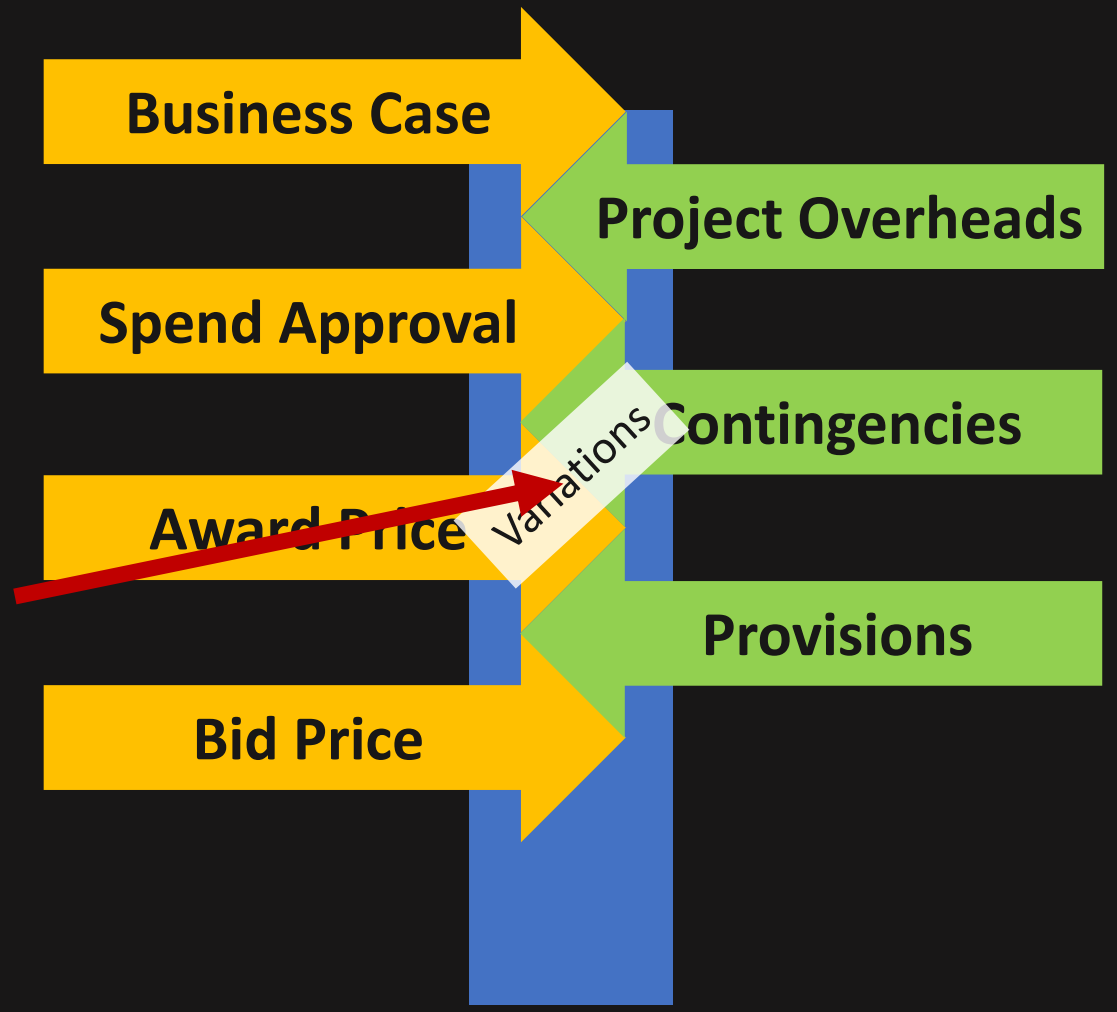


Comparison of Bids



Comparison of Bids

Variations used to include contingencies and adjust the contract price



Summary

1. Ideally a business case should be prepared for each project (for approval and as a financial baseline)
2. A bid price should be the numerical sum of the capital and operational prices submitted by the bidder without amendment (arithmetical adjustment)
3. The award price should be equal to the sum of the bid price plus the estimate for provisions but should exclude contingencies
4. Variations should be used to add contingencies to the contract price

Summary Learned - Summary

Today

Desalination Plant

Procurement

Evaluation

FIDIC Gold Book

Risk Allocation

Lessons

1. 24 Observations
2. Develop into a Knowledge Project
3. Still much to learn about DBO contracts
4. Need to continue to provide guidance and train Project Management Units in:
   a) Procurement,
   b) Bid Evaluation,
   c) DBO Contracts, and
   d) What's Important

Which two countries have the highest installed desalination plant capacity in the world?

Highest: Saudi Arabia

5 million m^3/day

Second Highest: United States of America

2.8 million m^3/day