WINNIPEG SEWAGE TREATMENT PROGRAM

SEWPCC

Process Selection Report presentation

Winnipeg

January 24th 2011 - Winnipeg

VEOLIA WATER

Purpose of the meeting

2 immediate purposes :

- Explain the recommandation of the PSR to the Management Team
- Get the agreement of the MT on the recommended process selection

Within the following global objectives :

- Be able to plan SEWPCC Preliminary Design and the required intermediary steps
  - Septage analysis
  - Leachate analysis
  - Sludge analysis
- Be able to plan the Target Cost estimation

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Agenda

I- Basic assumptions definition

II- Pre-selection of the process options

III- Comparison of the pre-selected options

III.1- Technical comparison

III.2- Financial comparison

IV- Pending issues excluded from scoring

V- Recommendation

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I- Basic assumptions definition

- Concerns
  - ❶ Sewage characteristics
  - ❷ Effluent quality requirements (license interpretation)

❶ SEWAGE CHARACTERIZATION

- Methodology

⇨ Use of SEWPCC recorded data between January 2005 – April 2010 for per capita flows and loads calculation

⇨ 2010 population estimation in SEWPCC area = **194,152**

Base line characterisation

⇨ 2031 population projection = **250,000**

⇨ Use of current per capita flows and loads for both the current population and the population growth

Projection

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I- Basic assumptions definition

- Main results

	Units	Flowmeters
Annual average flow	MLD	88
Average dry weather flow	MLD	70
Spring max month	MLD	120
Peak wet weather flow	MLD	403
Peak hourly flow	MLD	415

ANNUAL AVERAGE

	TEMPERATURE		FLOW		LOAD				CONCENTRATION			
			MAX	MIN	TSS	BOD	TKN	TP	TSS	BOD	TKN	TP
	℃	℃	MLD	MLD	Kg/d	Kg/d	Kg/d	Kg/d	mg/l	mg/l	mg/l	mg/l
Average			87.5	87.5	15,912	18,777	3,532	552	182	215	40.4	6.3

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I- Basic assumptions definition

❷ EFFLUENT QUALITY REQUIREMENTS

- Design based on the license requirements with the exception of

	LICENSE			DESIGN ASSUMPTIONS		
TSS	never to exceed	30	mg/l	30-day rolling average	<25	mg/l
$CBOD_5$	never to exceed	25	mg/l	30-day rolling average	<25	mg/l

Because « never to exceed » contrainst ➲
- Higher Capex & Opex
- Low environmental benefit
- Operating difficulties under normal conditions

- In case the license challenge is refused by the Regulator ➲ The impact won't change the ranking of the options as additional capital cost will increase in proportion to current option Capex

↳ bigger current Capex ⇒ bigger financial impact

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II- Pre-selection of the process options

- 3 options built on
  - ❶ Stantec's work
  - ❷ Veolia's experience and knowledge
  - ❸ Validation by an external independant 3rd party

- Option G / 2 : AS/BNR/MJ/ IFAS

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Introduction of a new technology : BAF

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- Option 3 : AS/BNR/BAF(N)/BAF(PDN)
- Option 4 : BAF(NDN)/BAF(PDN)

Because of :

- Significant Capex savings
- Small footprint / short construction duration
- R&D is likely to allow bioP combined with BAF

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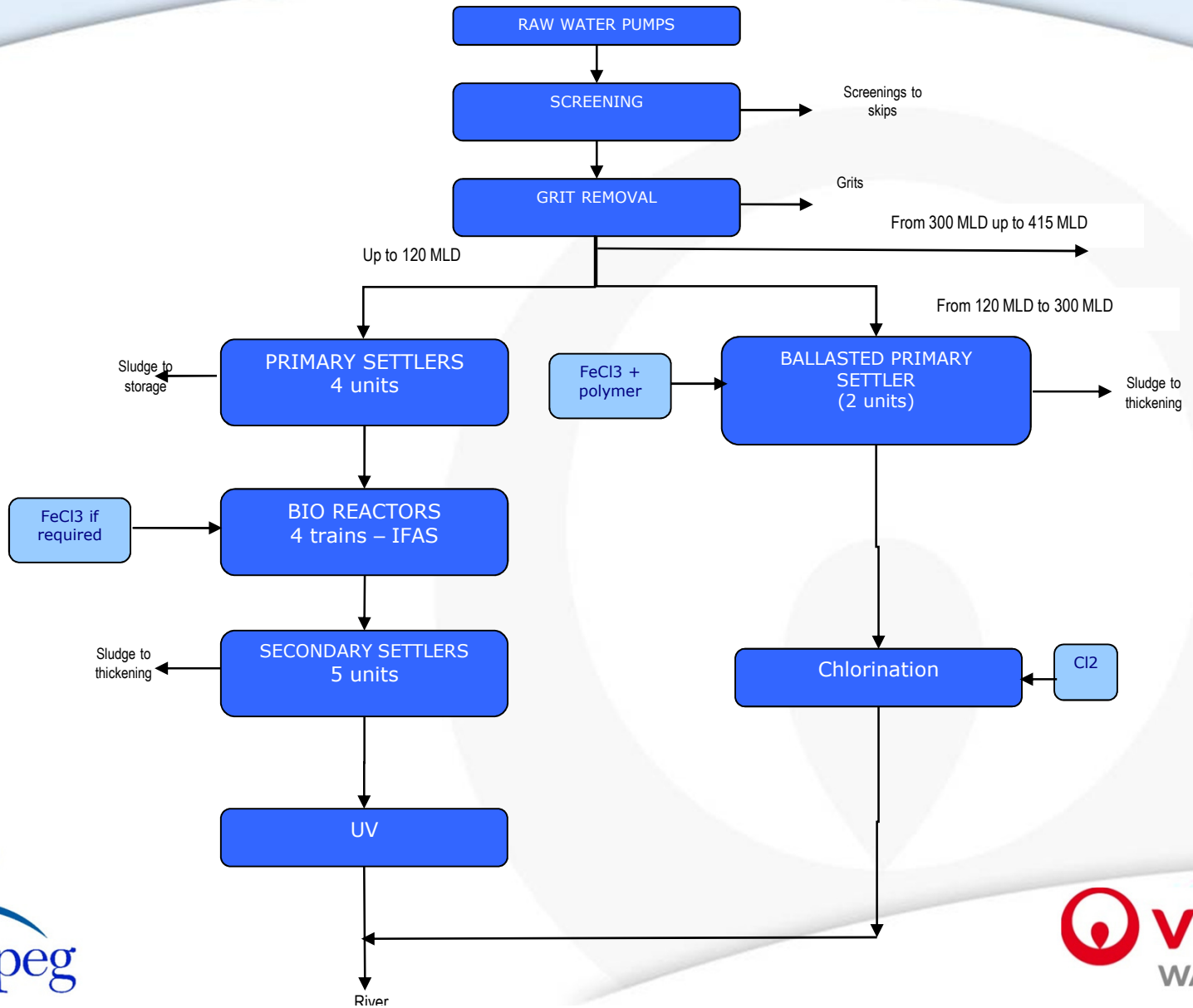
II- Pre-selection of the process options

OPTION 2 : IFAS



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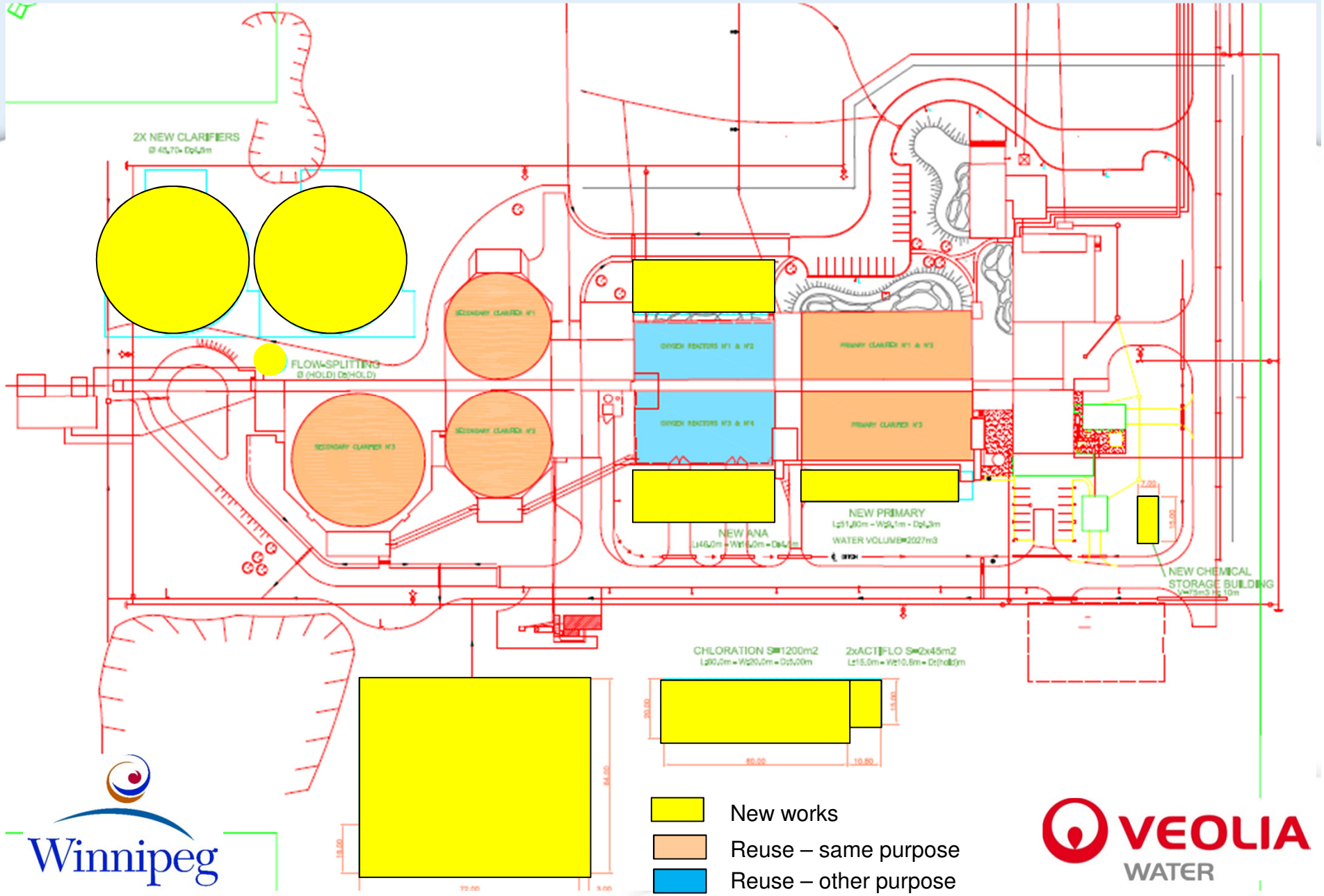

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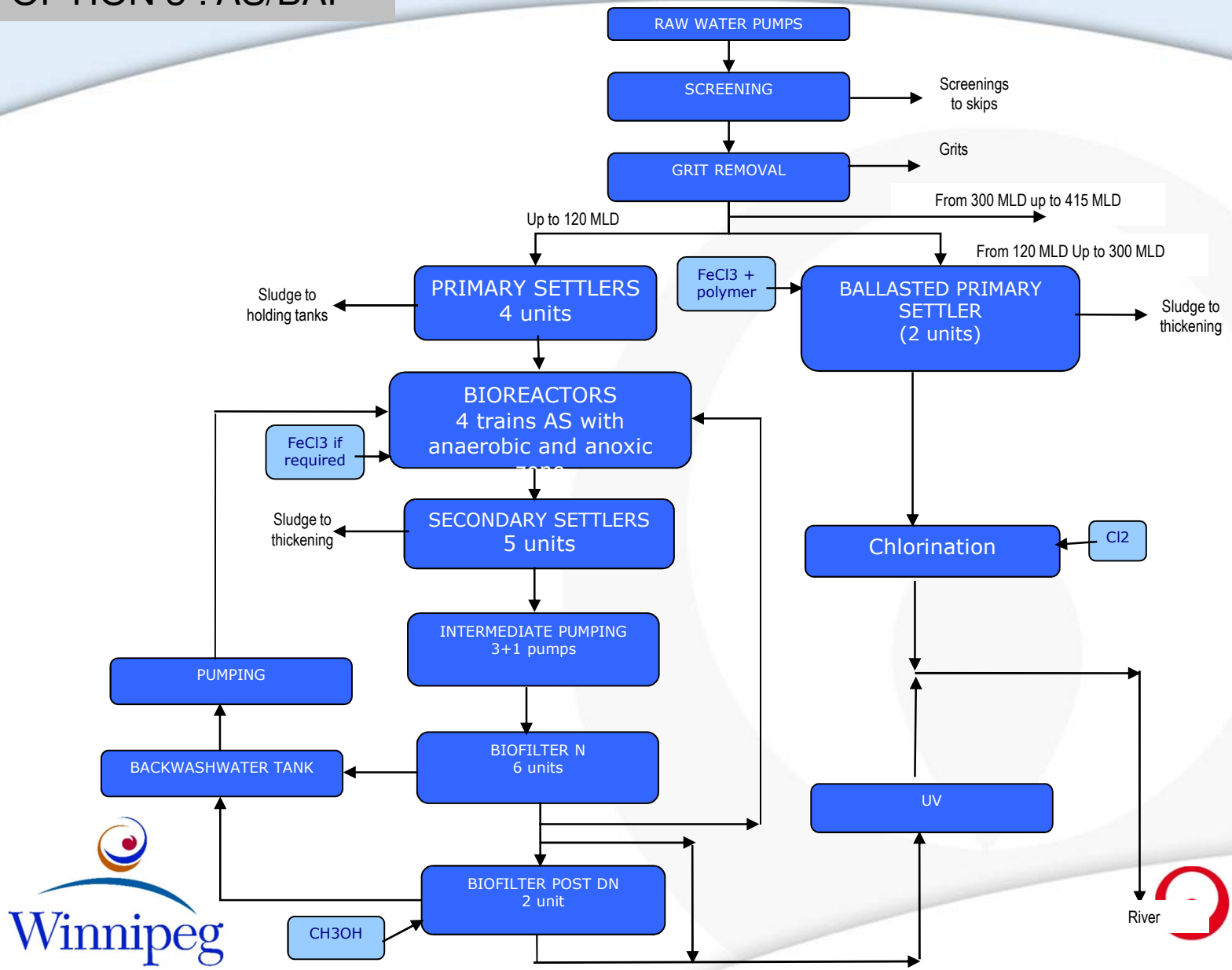
II- Pre-selection of the process options

OPTION 3 : AS/BAF



II- Pre-selection of the process options

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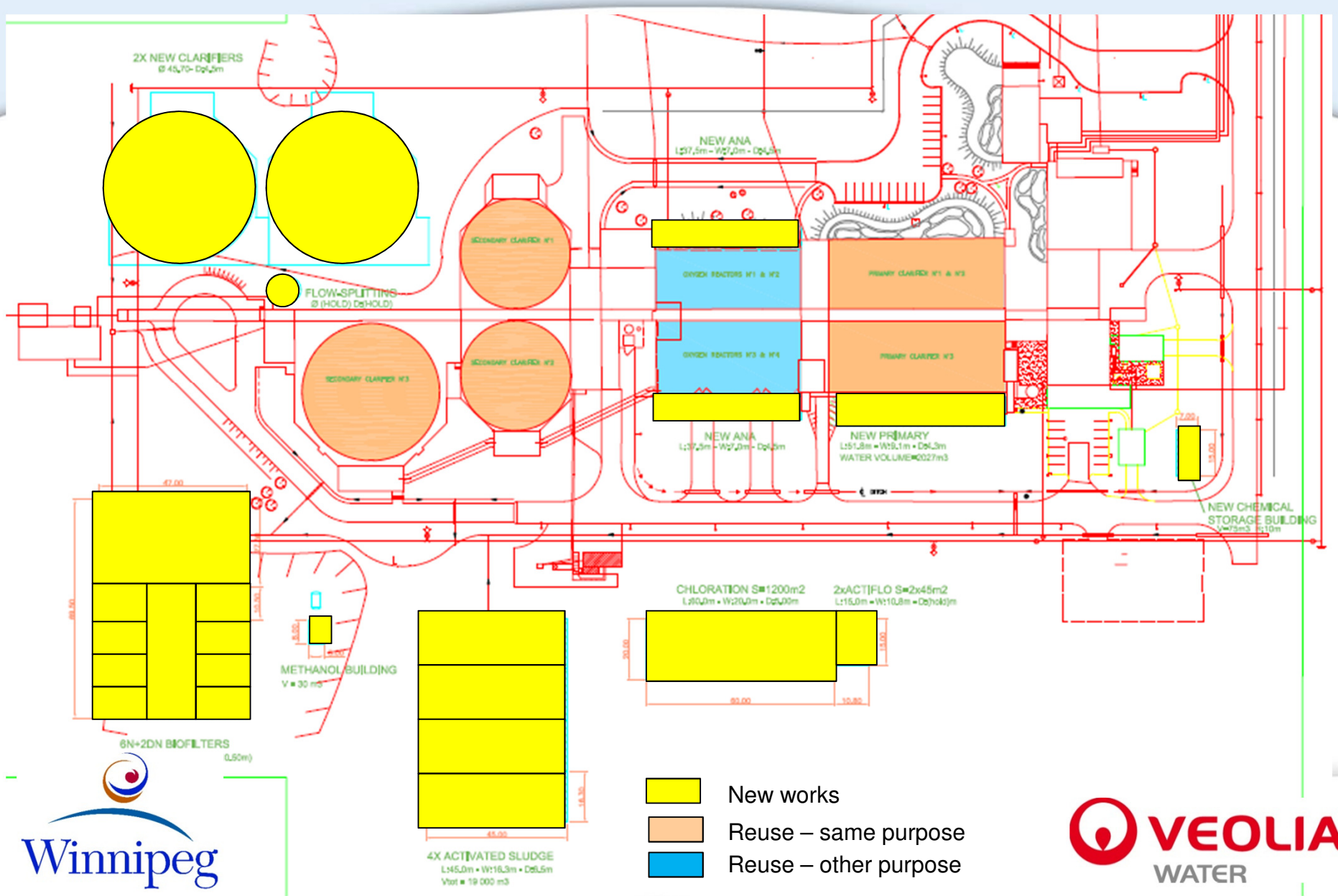

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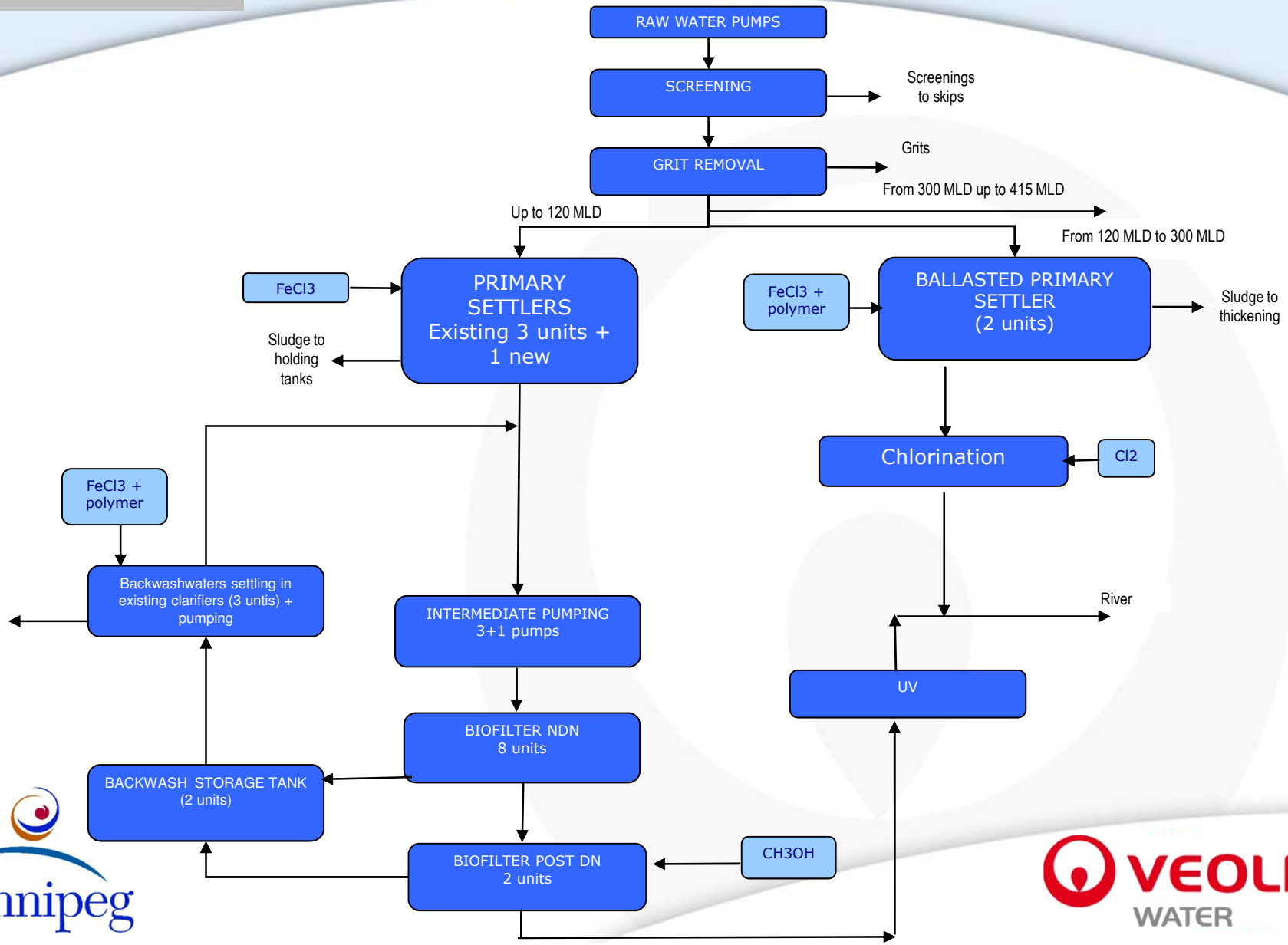
II- Pre-selection of the process options

OPTION 4 : BAF



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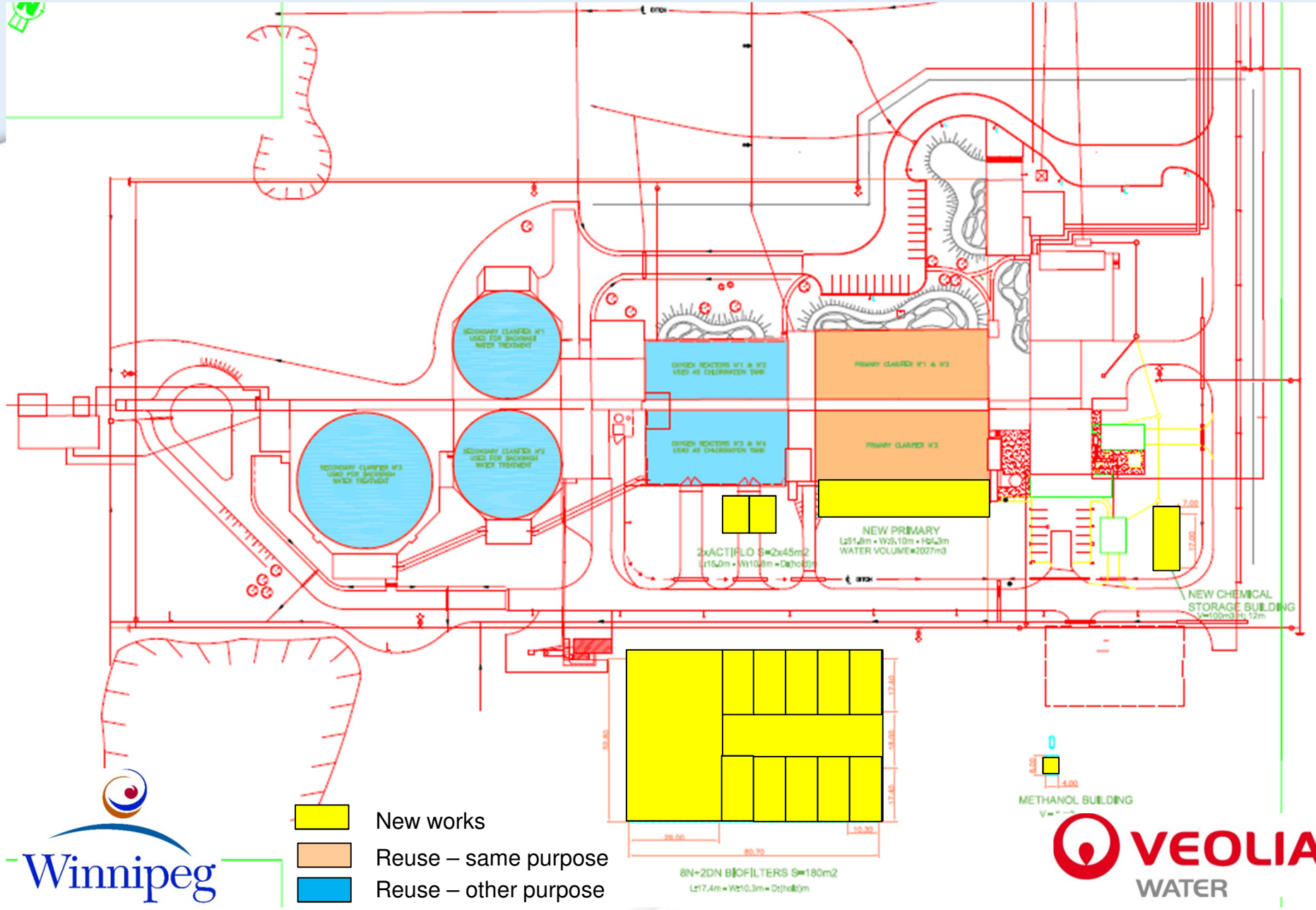
II- Pre-selection of the process options

OPTION 4 : BAF



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II- Pre-selection of the process options

	Advantages	Disadvantages
OPTION 2 : IFAS	BioP removal possible	Big footprint and expensive to cover
	Smaller amount of sludges produced	Potential odours mainly from anoxic/anaerobic tanks
	No real practical limit for influent TSS	Sludge bulking and foaming issue
	Primary clarification without chemicals	Filamentous bacteria issue
	No PDN required	Sensitive to a dilute influent. Can be oversized in these conditions.
	Same process than WEWPCC	Need good operator knowledge
		BioP sludges require proper processing to avoid P returns to the process (aerobic, fast processing, etc…)
		Potential losses of biomass in peak flows (mitigated with secondary bypass in peak flow condition)
		Long construction & commissioning and significant interfaces

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II- Pre-selection of the process options

	Advantages	Disadvantages
OPTION 3 : AS / BAF	BioP removal possible	Sludge bulking issue (less probable than for option 2)
	Smaller amount of sludges produced	Sensitive to the influent's dilution. Can be oversized in these conditions.
	No real practical limit for influent TSS	BioP sludges require proper processing to avoid P returns to the process (aerobic, fast processing, etc…)
	Primary clarification without chemicals	Significant maintenance on M&E
	Full nitrification possible even in cold water	Two processes to operate
	Smaller footprint than option 2	Need excellent operator knowledge
	Robust process: Secondary clarifiers effluent can have some TSS without impacting the final effluent quality because of tertiary filtration	Long construction & commissioning and significant interfaces
	Ability of running with only nitrification	

II- Pre-selection of the process options

	Advantages	Disadvantages
OPTION 4 : BAF	Small footprint	Full bioP removal impossible so far
	Short delay of construction	Primary clarification mandatory with chemicals
	Can be covered easily	Important production of sludges (from coagulant dosage)
	Full nitrification possible even in cold water	Backwash water must be clarified using coagulant
	No secondary clarifier	Methanol dosage required to reach effluent TN objectives (PDN)
	No sludge bulking pb	
	Very rare filamentous bacteria pb with no impact on operation	
	Flexibility in quantity & quality	
	Fully automated and easy operation	
	Low maintenance	
	Ability of running with only nitrification	

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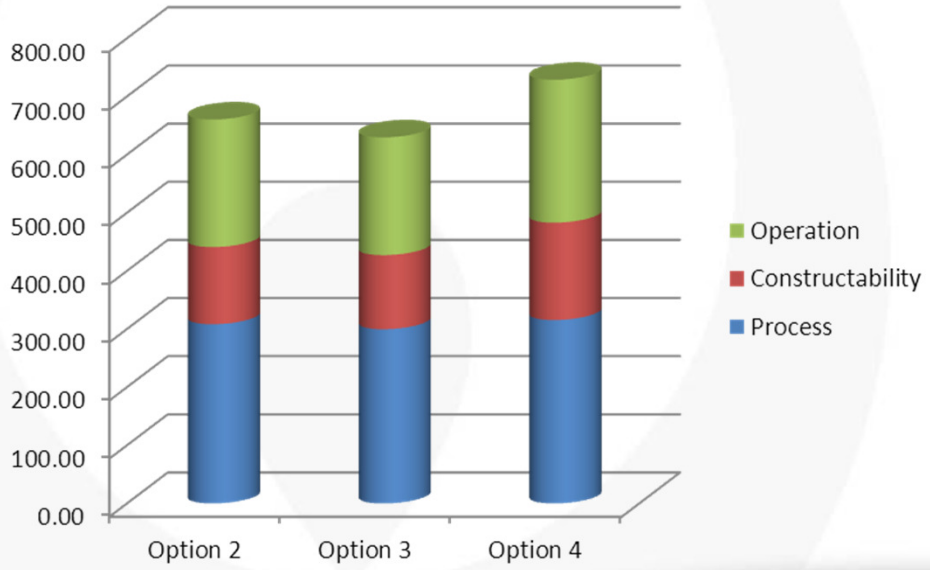
III- Comparison of the process options

III.1- Technical comparison

- 2 dimensions of comparison : ❶ Technical ❷ Financial
- Technical level :
  - **3 categories** : process, constructability & operation / **21 criteria**
  - Weighting and scoring were independant procedures
  - Balanced contribution from CoW and Veolia + EAP pre scoring

➲

	Technical scores
Option 2	660
Option 3	630
Option 4	729



➲ All pre-selected options passed the technical selection

➲ Sensitivity analysis of the technical scoring does not indicate a single compelling option

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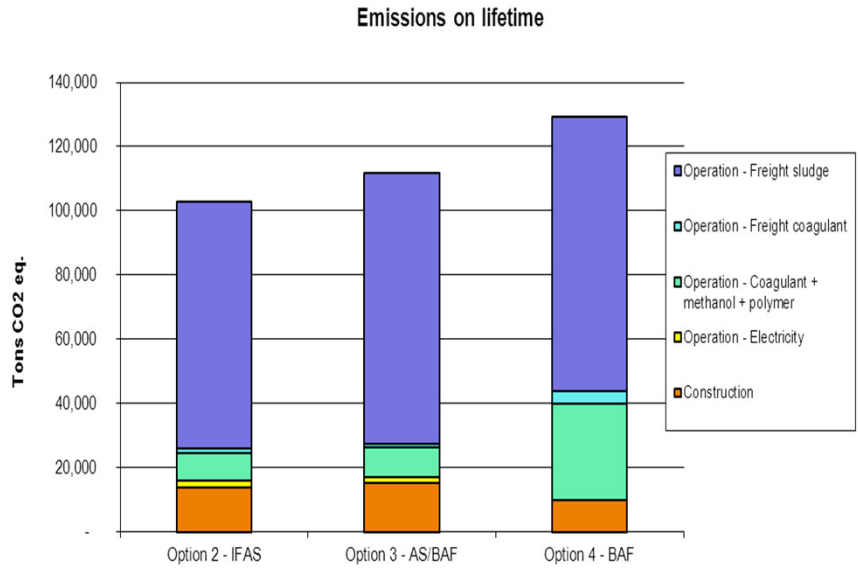
III- Comparison of the process options

III.1- Technical comparison

- Results of the carbon footprint estimate



- Construction impact not significant
- Option 4 higher because of :
  - Chemical usage
  - Higher sludge volume generated

- Mitigation opportunities
  - Freight for sludge can be reduced depending on the biosolid management plan results
  - Leads for reducing the chemicals footprint

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III- Comparison of the process options

III.2- Financial comparison

- Financial dimension :

CAPEX build-up

M&E : benchmark & equipment list

Civil : unit rates & BOQ

Civil works			Source of information
Tank roofing cost */**	1280	$/m2	CoW + validation from Hanscomb
Building cost */**	1920	$/m2	CoW + validation from Hanscomb
Concrete cost for activated sludge	1500	$/m3	CoW + validation from Hanscomb
Concrete cost for clarifiers or settling	1600	$/m3	CoW + validation from Hanscomb
Concrete cost for biofilters and actiflo	1700	$/m3	CoW + validation from Hanscomb

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III- Comparison of the process options

III.2- Financial comparison

- Financial dimension :

CAPEX build-up

M&E : benchmark & equipment list

Civil : unit rates & BOQ

Provisional sums : Rates & update of Stantec's estimates

R&O : Risk & opportunity matrix

RISKS	Occurrence	Amount in M uc		
		Option 2	Option 3	Option 4
Geotechnics	50%	1.8	1.8	0.8
Climate	winter times	1.3	1.4	0.7
Hydraulic profile	50%	1.3		
Asset assessment	50%			0.3

OPPORTUNITIES	Occurrence	Amount in M uc		
		Option 2	Option 3	Option 4
Odour treatment	100%		0.3	2
External works	100%	0.03	0.03	0.1

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Total R&O option 2	4.3 M	uc
Total R&O option 3	2.9 M	uc
Total R&O option 4	-0.3 M	uc

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III- Comparison of the process options

III.2- Financial comparison

- Financial dimension :

CAPEX build-up

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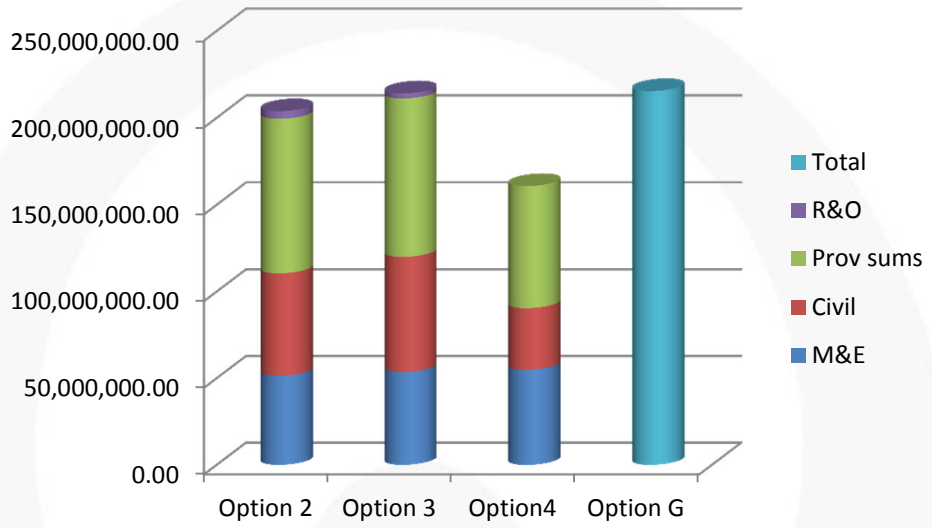

	OPTION 2	OPTION 3	OPTION 4
TOTAL CAPEX PROJECT VALUE uc	**203.8 M**	**214 M**	**160.4 M**
Variance in CAPEX from cheapest option	**27%**	**33%**	**0%**

(without the 10% contingencies for change orders during construction)

Independant Stantec's option G update estimates = **215.4 M CAD**

III- Comparison of the process options

III.2- Financial comparison

OPEX build-up

Elec

Chemicals : op balance & unit costs

Sludge hauling to NEWPCC

UV bulbs : fixed price

Power			Source of information
Electricity cost	0.047	$/kWh	CoW - Eng Dpt
Chemicals			
Ferric chloride cost	328.57	$/m3	CoW - Eng Dpt
Methanol cost	368.25	$/m3	Veolia + CoW - Eng Dpt
Polymer cost	3.89	$/kg	CoW - Eng Dpt
Sludge transportation			
Sludge truck volume	30	m3/load	CoW - Eng Dpt
Sludge truck cost	130.8	$/load	CoW - Eng Dpt
UV bulbs			
Replacement cost	350	$/bulb	CoW - Op Dpt
Life time	8000	hours / bulb	CoW - Op Dpt

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III- Comparison of the process options

III.2- Financial comparison

OPEX build-up

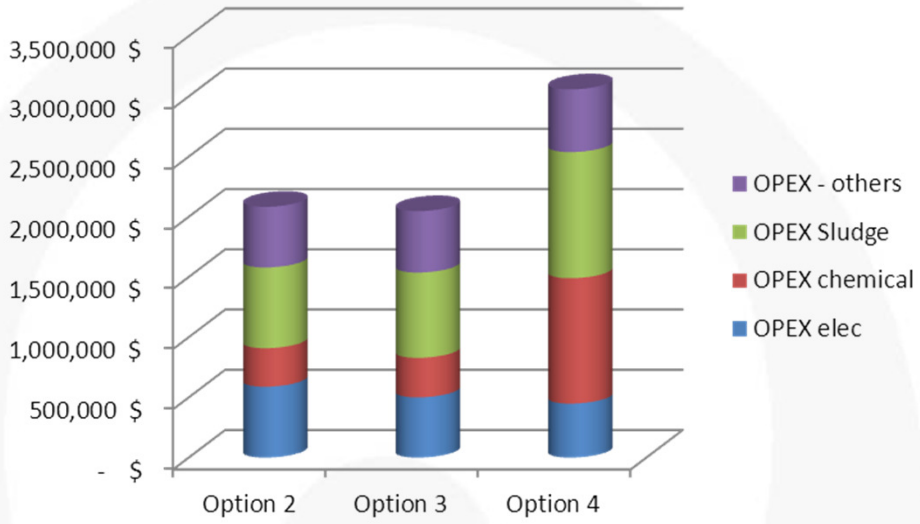
Elec

Chemicals : op balance & unit costs

Sludge hauling to NEWPCC

UV bulbs : fixed price

Maintenance : rate



	OPTION 2	OPTION 3	OPTION 4
TOTAL OPEX PROJECT VALUE (average 2010 - 2031) **uc**	**2.1 M**	**2 M**	**3.1 M**
Variance in OPEX from cheapest option	**2%**	**0%**	**49%**

(based on average OPEX from 2010 to 2031)

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III- Comparison of the process options

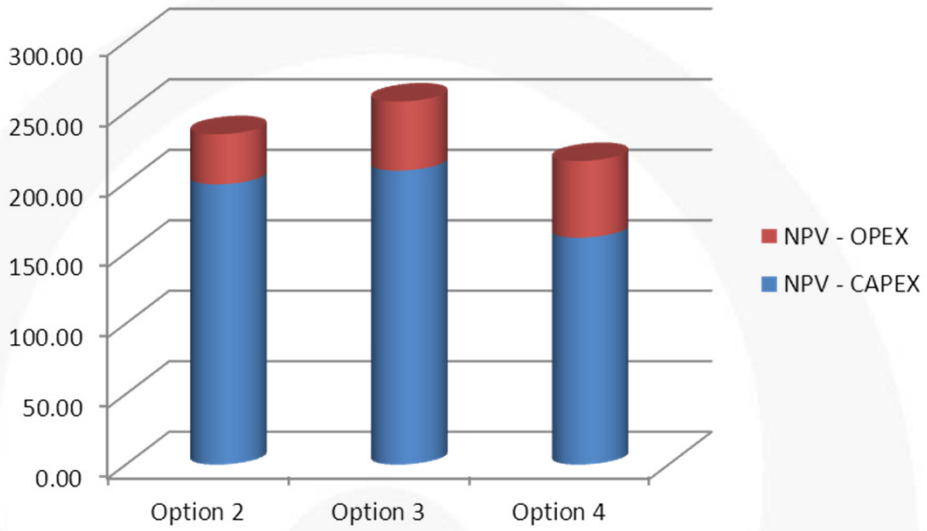
III.2- Financial comparison

NPV

Period : 30 year operation after implementation

Discount rate : 6%

CPI : 2% / year



	OPTION 2	OPTION 3	OPTION 4
WHOLE LIFE COST (Construction + 30 year operation uc NPV with 6% discount rate)	**216.5 M**	**224.7 M**	**200.5 M**
Variance in NPV from cheapest option	**8%**	**12%**	**0%**

(without the 10% contingencies for change orders during construction)

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III- Comparison of the process options

- Global scoring :

Global scores	%
849	94%
812	89%
907	**100%**

- **Based on the scoring, the preferred option is option 4**

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IV- Pending issues excluded from scoring

- Before recommending, the comprehensiveness of the process and its relevancy must be ascertained

  - Possible issue #1 : septage management ⟶ Same impact on all options
  - Possible issue #2 : leachate management ⟶ Same impact on all options
  - Possible issue #3 : sludge treatment ⟶ ?
    - All options produce treatable sludges
    - Volumes of sludges significantly different between the options

➲ May combined cost of main treatment & sludges change the ranking of main treatment options ?

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IV- Pending issues excluded from scoring

- Relevant assumptions :
  - 5 biosolids options reviewed
    - ❶ Pelletization
    - ❷ Thermal oxidation
    - ❸ Composting
    - ❹ Land filling
    - ❺ Land application
  - Sludge Capex : from Stantec's PDR - 2008
  - Sludge Opex : from Stantec's PDR – 2008 for ❶, ❷ and ❸
    from current Opex for ❹ and ❺
  - Sludge production : from PSR
  - Dry solids data : from the CoW and PSR

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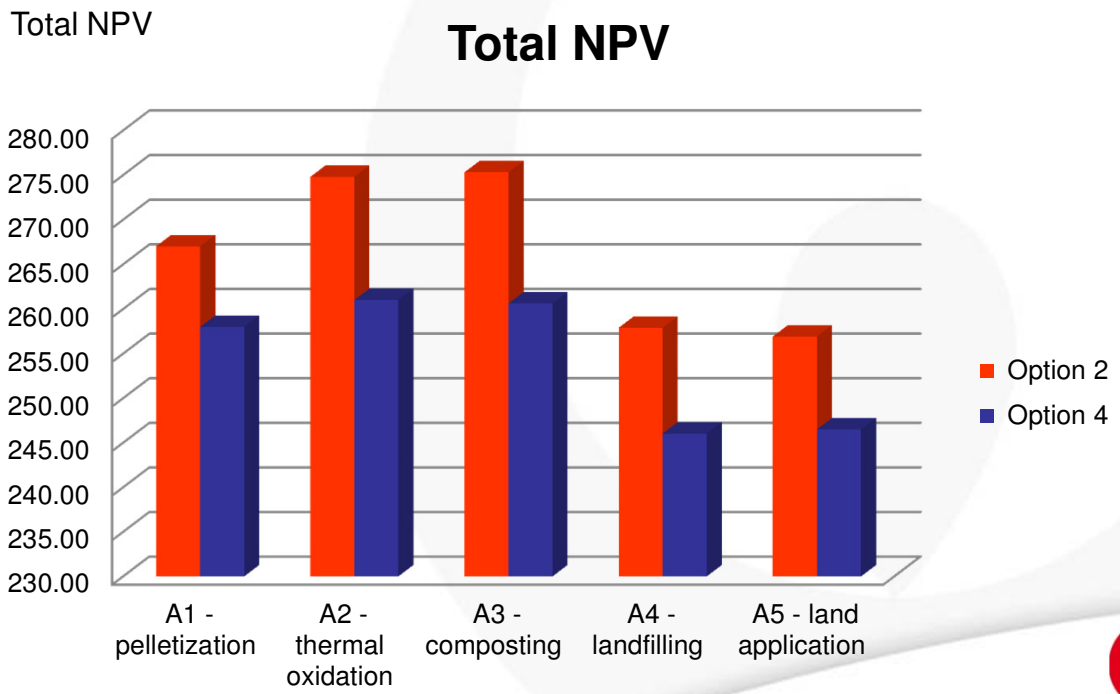
IV- Pending issues excluded from scoring

		Option 2	Option 4	Difference
NPV total	A1 - pelletization	267.03 MCAD	257.99 MCAD	-MCAD 9.04
	A2 - thermal oxidation	274.80 MCAD	261.01 MCAD	-MCAD 13.79
	A3 - composting	275.31 MCAD	260.62 MCAD	-MCAD 14.69
	A4 - landfilling	257.90 MCAD	246.04 MCAD	-MCAD 11.85
	A5 - land application	256.93 MCAD	246.50 MCAD	-MCAD 10.43



IV- Pending issues excluded from scoring

A1 - Pelletization		GLOBAL SCORING
Option 2		859.31
Option 4		**913.05**

A2 - Thermal oxidation		GLOBAL SCORING
Option 2		857.08
Option 4		**918.81**

A3 - Composting		GLOBAL SCORING
Option 2		855.63
Option 4		**920.27**

A4 - Landfilling		GLOBAL SCORING
Option 2		857.21
Option 4		**910.81**

A5 - Land application		GLOBAL SCORING
Option 2		855.90
Option 4		**909.13**

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IV- Pending issues excluded from scoring

- All biosolid options lead to a closer gap between the combined NPV of main treatment and sludge but option 4 is always better
- Biosolid options will not change SEWPCC main treatment rankings
- Treatment decision can be taken without compromising future biosolids options

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V- Recommendation

- **Option 4** is recommended as it has :
  - ✓ the best global score
  - ✓ and the lowest whole life cost

However, there are downsides like :

- ✓ Higher sludge production
- ✓ Higher carbon footprint
- ✓ Higher Opex
- ✓ No full BioP removal

Which can be mitigated by :

- ✓ Green chemicals development
- ✓ Energy recovery capacities
- ✓ Process evolution

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