

Supplementary Materials

Table S1. Investment and O&M cost parameters used in SETA for population interval Pop 3 ($\geq 10\,000$ PE)

| Unitary Processes | Investment cost (USD.PE ⁻¹) | | | | | O&M cost (USD.PE ⁻¹ .yr. ⁻¹) | | | |
|---|---|-------|-----------|-----------|-------|---|--------|------|------|
| | k | n | a | b | c | d | e | f | g |
| W1 Septic tank | - | - | - | - | - | 0.42 | 3167.6 | - | - |
| W2 Imhoff tank | - | - | - | - | - | 0.42 | 3167.6 | - | - |
| W3 Primary clarifier | 1.164 | 1.01 | - | - | - | 0.42 | 3167.6 | - | - |
| W4 UASB reactor | 30 | 1 | - | - | - | 0.42 | 3167.6 | - | - |
| W5 Trickling filter (low rate) | 190.4 | 0.935 | - | - | - | 0.83 | 31676 | - | - |
| W6 Trickling filter (medium-high rate) | 46.53 | 1 | - | - | - | 6.2 | 33511 | - | - |
| W7 Activated sludge reactor (extended aeration) | 1.13E+29 | -5.56 | - | - | - | - | - | 30.5 | 0.85 |
| W8 Activated sludge reactor (conventional-high rate aeration) | 46.53 | 1 | - | - | - | 7.87 | 31676 | - | - |
| W9 Combined reactor for nitrification/denitrification | 2584.1 | 0.7 | - | - | - | - | - | 30.5 | 0.85 |
| W10 Anoxic + Aeration tank | 2586 | 0.7 | - | - | - | - | - | 32 | 0.85 |
| W11 Anaerobic pond | 20 | 1 | - | - | - | 0.51 | - | - | - |
| W12 Facultative pond | 25 | 1 | - | - | - | 0.51 | - | - | - |
| W13 Aerated pond | 30 | 1 | - | - | - | 0.6 | - | - | - |
| W14 Settling pond | 7 | 1 | - | - | - | 0.17 | - | - | - |
| W15 Anaerobic + Facultative pond | 42.5 | 1 | - | - | - | 0.41 | - | - | - |
| W16 Anaerobic + Aerated pond | 45 | 1 | - | - | - | 0.54 | - | - | - |
| W17 Facultative pond + Floating macrophytes | 30 | 1 | - | - | - | 1.25 | - | - | - |
| W18 Constructed wetland | - | - | 5.00E-06 | -0.3 | 24939 | 1.25 | - | - | - |
| W19 Secondary clarifier | - | - | 1.50E-04 | 8 | 7622 | - | - | - | - |
| W20 Fine/Micro Stepscreen + chlorine disinfection | 0.06 | 1 | - | - | - | 0.1 | - | - | - |
| W21 Maturation pond | - | - | 5.00E-04 | 35.8 | 4238 | 0.05 | - | - | - |
| W22 Soil infiltration | - | - | - | - | - | 0.1 | - | - | - |
| WS1 Gravity sludge thickener | - | - | 2.70E-04 | 0.7 | 14662 | 0.1 | - | - | - |
| WS2 Chemical sludge stabilization | 0.552 | 1 | - | - | - | 0.1 | - | - | - |
| WS3 Mechanical dewatering | - | - | 1.30E-03 | - 14.7 | 78989 | 0.15 | - | - | - |
| WS4 Drying bed | - | - | 1.50E-04 | 18 | 2853 | 0.08 | - | - | - |
| FS1 Anaerobic pond/tank | - | - | 2.00E-07 | 0.6 | 30000 | - | - | 0.05 | 0.4 |
| FS2 Underground sludge reception tank | - | - | -7.00E-07 | 0.8 | 47635 | - | - | 0.1 | 0.4 |

| Unitary Processes | Investment cost (USD.PE ⁻¹) | | | | | O&M cost (USD.PE ⁻¹ .yr. ⁻¹) | | | |
|---|---|------|----------|------|-------|---|---|------|-----|
| | k | n | a | b | c | d | e | f | g |
| FS3 Drying bed | - | - | 3.00E-07 | 2.6 | 12391 | - | - | 0.05 | 0.4 |
| FS4 Sludge composting hangar | - | - | 1.00E-07 | 1.3 | 26212 | - | - | 0.1 | 0.4 |
| FS5 Chemical sludge stabilization | 1.75E+05 | 0 | - | - | - | - | - | 0.1 | 0.4 |
| FS6 Gravity thickener + mechanical dewatering | 13866 | 0.39 | - | - | - | 0.07 | - | - | - |
| FR1 Anaerobic pond | - | - | 2.00E-07 | 0.6 | 30000 | - | - | 0.02 | 0.4 |
| FR2 Constructed wetland | - | - | 3.00E-06 | -0.3 | 85000 | - | - | 0.01 | 0.4 |

Table S2. Unit area per treatment process and GHG emission/credit parameters used in SETA

| Unitary Processes | Area (m ² /inhab) | GHG Emission debit | | | | | GHG Emission credit | |
|---|------------------------------|--------------------|---------------------------------------|------------------------|-------------------------|-------|---------------------|-----------|
| | | Pop1 - Pop3 | Sc.1: CO ₂ | Sc. 1: CH ₄ | Sc. 1: N ₂ O | Sc. 2 | Sc. 3 | Sc. 1 & 3 |
| W1 Septic tank | 0.02 | | 0 | 2 | 1 | 0 | 0 | 0 |
| W2 Imhoff tank | 0.02 | | 0 | 2 | 1 | 0 | 0 | 0 |
| W3 Primary clarifier | 0.02 | | 0 | 2 | 1 | 0 | 0 | 0 |
| W4 UASB reactor | 0.12 | | 0 | 2 | 1 | 0 | 0 | 0 |
| W5 Trickling filter (low rate) | 0.05 | | 0 | 1 | 1 | 2 | 2 | 0 |
| W6 Trickling filter (medium-high rate) | 0.05 | | 0 | 1 | 1 | 2 | 2 | 0 |
| W7 Activated sludge reactor (extended aeration) | 0.12 | | 0 | 1 | 1 | 2 | 1 | 0 |
| W8 Activated sludge reactor (conventional-high rate aeration) | 0.12 | | 0 | 1 | 1 | 2 | 1 | 0 |
| W9 Combined reactor for nitrification/denitrification | 0.15 | | 0 | 1 | 1 | 2 | 1 | 0 |
| W10 Anoxic + Aeration tank | 0.13 | | 0 | 1 | 1 | 2 | 1 | 0 |
| W11 Anaerobic pond | 0.13 | | 0 | 1 | 1 | 0 | 0 | 0 |
| W12 Facultative pond | 1.50 - 0.90 | | 0 | 1 | 1 | 2 | 0 | 0 |
| W13 Aerated pond | 1.50 - 0.90 | | 0 | 1 | 1 | 2 | 0 | 0 |
| W14 Settling pond | 0.05 | | 0 | 1 | 1 | 0 | 0 | 0 |
| W15 Anaerobic + Facultative pond | 0.88 - 0.55 | | 0 | 1 | 1 | 2 | 0 | 0 |
| W16 Anaerobic + Aerated pond | 0.88 - 0.55 | | 0 | 1 | 1 | 2 | 0 | 0 |
| W17 Facultative pond + Floating macrophytes | 1.50 - 0.90 | | 0 | 1 | 1 | 1 | 1 | 0 |
| W18 Constructed wetland | 0.63 | | 0 | 1 | 1 | 1 | 1 | 2 |
| W19 Secondary clarifier | 0.03 | | <i>(included in aeration process)</i> | | | | | |
| W20 Fine/Micro Stepscreen + chlorine disinfection | < 0.01 | | 0 | 0 | 0 | 1 | 0 | 2 |
| W21 Maturation pond | 0.63 - 0.13 | | 0 | 1 | 1 | 1 | 1 | 2 |
| W22 Soil infiltration | 0.01 | | 0 | 1 | 2 | 0 | 0 | 0 |

| Unitary Processes | Area (m ² /inhab) | GHG Emission debit | | | | | GHG Emission credit | |
|---|---------------------------------|--------------------|--------------------------|---------------------------|----------------------------|-------|---------------------|-----------|
| | | Pop1 - Pop3 | Sc.1: CO ₂ | Sc. 1: CH ₄ | Sc. 1: N ₂ O | Sc. 2 | Sc. 3 | Sc. 1 & 3 |
| WS1 Gravity sludge thickener | 0.01 | 0 | 2 | 1 | 1 | 1 | 0 | 0 |
| WS2 Chemical sludge stabilization | 0.01 | 1 | 1 | 1 | 2 | 2 | 0 | 0 |
| WS3 Mechanical dewatering | < 0.01 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| WS4 Drying bed | 0.04 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| FS1 Anaerobic pond/tank | 0.06-0.03 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| FS2 Underground sludge reception tank | 0.01 - 0.002 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| FS3 Drying bed | 0.04 - 0.01 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| FS4 Sludge composting hangar | 0.02 - 0.01 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| FS5 Chemical sludge stabilization | < 0.01 | 2 | 1 | 1 | 2 | 2 | 0 | 0 |
| FS6 Gravity thickener + mechanical dewatering | < 0.01 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| FR1 Anaerobic pond | 0.06 - 0.03 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| FR2 Constructed wetland | 0.02 - 0.05 | 0 | 1 | 1 | 1 | 1 | 2 | 0 |

Table S3. Overall TA performance for A1 GHG emission/credit parameters

| Individual UP GHG score | Overall solution (TA) score | Description |
|-------------------------|-----------------------------|---|
| 0 | 7-12 | (N) Processes with negligible GHG emissions |
| 1 | 13-18 | (O) Processes with minor GHG emissions |
| 2 | 19-24 | (+) Emissions/Credits with minor to medium significance |
| 3 | 25-30 | (++) Significant emissions/credits |

Table S4. Energy consumption per unit operation used in SETA

| Unitary Processes | Energy use (kWh/m ³) | | |
|---|----------------------------------|------|------|
| | Pop1 | Pop2 | Pop3 |
| W1 Septic tank | 0.00 | 0.00 | 0.00 |
| W2 Imhoff tank | 0.00 | 0.00 | 0.00 |
| W3 Primary clarifier | 0.00 | 0.07 | 0.07 |
| W4 UASB reactor | 0.07 | 0.07 | 0.07 |
| W5 Trickling filter (low rate) | 1.83 | 0.42 | 0.42 |
| W6 Trickling filter (medium-high rate) | 1.46 | 0.34 | 0.34 |
| W7 Activated sludge reactor (extended aeration) | 1.90 | 1.06 | 1.06 |

| | | | |
|---|------|------|------|
| W8 Activated sludge reactor (conventional-high rate aeration) | 1.50 | 0.69 | 0.69 |
| W9 Combined reactor for nitrification/denitrification | 1.90 | 1.06 | 1.06 |
| W10 Anoxic + Aeration tank | 1.90 | 1.06 | 1.06 |
| W11 Anaerobic pond | 0.00 | 0.00 | 0.00 |
| W12 Facultative pond | 0.59 | 0.13 | 0.13 |
| W13 Aerated pond | 1.17 | 0.27 | 0.27 |
| W14 Settling pond | 0.00 | 0.00 | 0.00 |
| W15 Anaerobic + Facultative pond | 0.29 | 0.07 | 0.07 |
| W16 Anaerobic + Aerated pond | 0.59 | 0.13 | 0.13 |
| W17 Facultative pond + Floating macrophytes | 0.29 | 0.13 | 0.13 |
| W18 Constructed wetland | 0.00 | 0.00 | 0.00 |
| W19 Secondary clarifier | 0.22 | 0.15 | 0.15 |
| W20 Fine/Micro Stepscreen + chlorine disinfection | 0.10 | 0.06 | 0.06 |
| W21 Maturation pond | 0.00 | 0.00 | 0.00 |
| W22 Soil infiltration | 0.00 | 0.00 | 0.00 |
| WS1 Gravity sludge thickener | 0.09 | 0.06 | 0.06 |
| WS2 Chemical sludge stabilization | 0.04 | 0.03 | 0.03 |
| WS3 Mechanical dewatering | 0.09 | 0.06 | 0.06 |
| WS4 Drying bed | 0.00 | 0.00 | 0.00 |
| FS1 Anaerobic pond/tank | 0.45 | 0.29 | 0.29 |
| FS2 Underground sludge reception tank | 0.45 | 0.29 | 0.29 |
| FS3 Drying bed | 0.00 | 0.00 | 0.00 |
| FS4 Sludge composting hangar | 0.00 | 0.00 | 0.00 |
| FS5 Chemical sludge stabilization | 0.00 | 0.00 | 0.00 |
| FS6 Gravity thickener + mechanical dewatering | 0.09 | 0.06 | 0.03 |
| FR1 Anaerobic pond | 0.00 | 0.00 | 0.00 |
| FR2 Constructed wetland | 0.00 | 0.00 | 0.00 |