

|                  |            |
|------------------|------------|
| Proposal number: | E/1331/19  |
| Date:            | 01/07/2019 |

|           |                       |
|-----------|-----------------------|
| Job Name: | Burndell Road, Yapton |
| Author:   | AC                    |

| Site Elevations (m) |                |      |
|---------------------|----------------|------|
| Ground Level AOD    | Max            | 7.02 |
|                     | Min            | 6.80 |
| Tank Level          | Top            | 5.98 |
|                     | Bottom         | 4.35 |
| Membrane Level      | Base           | 2.30 |
| Cover Depth, z      | Max, $z_{max}$ | 1.04 |
|                     | Min, $z_{min}$ | 0.83 |

| Soil/Fill Characteristics                 |       |
|-------------------------------------------|-------|
| $\gamma_{soil}$ (kNm <sup>-3</sup> )      | 19.00 |
| $\phi$ (°)                                | 34.00 |
| $\gamma_{tank}$ (kNm <sup>-3</sup> )      | 0.55  |
| $\gamma_{wet\ sand}$ (kNm <sup>-3</sup> ) | 19.00 |

## VERTICAL

| Area Due To Spread Of Point Load, A (m <sup>2</sup> ) |  |       |
|-------------------------------------------------------|--|-------|
| Spread angle (degrees)                                |  | 26.00 |
| A ( $z_{max}$ )                                       |  | 1.47  |
| A ( $z_{min}$ )                                       |  | 1.01  |

| Load Area (m.m) |      |
|-----------------|------|
| 0.20            | 0.20 |

|                                         |       |                   |
|-----------------------------------------|-------|-------------------|
| Loading Case (Din 1072)                 |       | 9.90              |
| Surcharge, q                            | 10.00 | kNm <sup>-2</sup> |
| Cover Fill, c<br>Max/Min [ $\gamma.z$ ] | 19.76 | kNm <sup>-2</sup> |
|                                         | 15.68 | kNm <sup>-2</sup> |
| Point, w                                | 10.00 | kN                |

| Factors, $\lambda$ |      |
|--------------------|------|
| Surcharge          | 1.50 |
| Cover              | 1.35 |
| Point              | 1.50 |

| Factored Vertical Loading, (kNm <sup>-2</sup> ) |       |
|-------------------------------------------------|-------|
| Surcharge [ $q_d=q.\lambda$ ]                   | 15.00 |
| Cover [ $c_d=c.\lambda$ ]                       | 26.68 |
|                                                 | 21.16 |
| Point [ $w_d=(w/A).\lambda$ ]                   | 10.17 |
|                                                 | 14.86 |

| Design Vertical Loading, $\sigma_{v,d}$ |       |                   |
|-----------------------------------------|-------|-------------------|
| $\sigma_{v,d}(z_{max})$                 | 51.85 | kNm <sup>-2</sup> |
| $\sigma_{v,d}(z_{min})$                 | 51.02 |                   |

## LATERAL

| Reference Depth |      |
|-----------------|------|
| h (m)           | 2.47 |

|                                 |      |
|---------------------------------|------|
| $\phi$ (rad)                    | 0.59 |
| $k_a [1-\sin\phi / 1+\sin\phi]$ | 0.28 |

|                         |       |                   |
|-------------------------|-------|-------------------|
| Loading Case (Din 1072) |       | 9.90              |
| Surcharge, q            | 10.00 | kNm <sup>-2</sup> |
| Cover, c [ $\gamma.h$ ] | 46.84 | kNm <sup>-2</sup> |

| Factors, $\lambda$ |      |
|--------------------|------|
| Lateral            | 1.35 |
| Variable           | 1.50 |

| Factored Lateral Loading, (kNm <sup>-2</sup> ) |       |
|------------------------------------------------|-------|
| Surcharge [ $q_d=k_a.q.\lambda$ ]              | 4.24  |
| Cover Fill [ $c_d=k_a.c.\lambda$ ]             | 17.88 |

| Design Lateral Loading, $\sigma_{l,d}$ |       |                   |
|----------------------------------------|-------|-------------------|
| $\sigma_{l,d}(z_{max})$                | 22.12 | kNm <sup>-2</sup> |

| UPLIFT                                                     |       |                         |       |
|------------------------------------------------------------|-------|-------------------------|-------|
| Water table elevation (m)                                  | 6.02  | Depth of tank $D_T$ (m) | 4.72  |
| Water displaced $D_{dw}$ (m)                               | 3.72  | Factors $\lambda$       |       |
|                                                            |       | Permanent Uplift        | 1.0   |
|                                                            |       | Permanent Resist press. | 0.9   |
| Case 1 $D_{dw} < D_T$ TRUE                                 |       |                         |       |
| Design Uplift $\text{kNm}^{-2}$                            |       |                         |       |
| $U_d [D_{dw} \cdot \gamma_w \cdot \lambda]$                | 37.15 | Satisfactory:           | FALSE |
| Design Resisting Pressure $\sigma_{r,d}$                   |       |                         |       |
| Cover Fill $c_d [\gamma \cdot z \cdot \lambda]$            | 14.11 |                         |       |
| Case 2 $D_{dw} > D_T$ FALSE                                |       |                         |       |
| Submerged Cover $z_s$ (m)                                  | -0.79 |                         |       |
| Unsubmerged cover $z_u$ (m)                                | 1.04  |                         |       |
| Design Uplift ( $\text{kNm}^{-2}$ )                        |       |                         |       |
| $U_d [D_T \cdot \gamma_w \cdot \lambda]$                   | 47.15 | Satisfactory:           | TRUE  |
| Design Resisting Pressure ( $\text{kNm}^{-2}$ )            |       |                         |       |
| Submerge cover $c_{d,s} [\gamma' \cdot z_s \cdot \lambda]$ | -6.36 |                         |       |
| Tank blocks                                                | 0.80  |                         |       |
| Wet Sand ballast                                           | 35.06 |                         |       |
| Cover $c_{d,u} [\gamma \cdot z_u \cdot \lambda]$           | 17.78 |                         |       |
| TOTAL                                                      | 47.28 |                         |       |