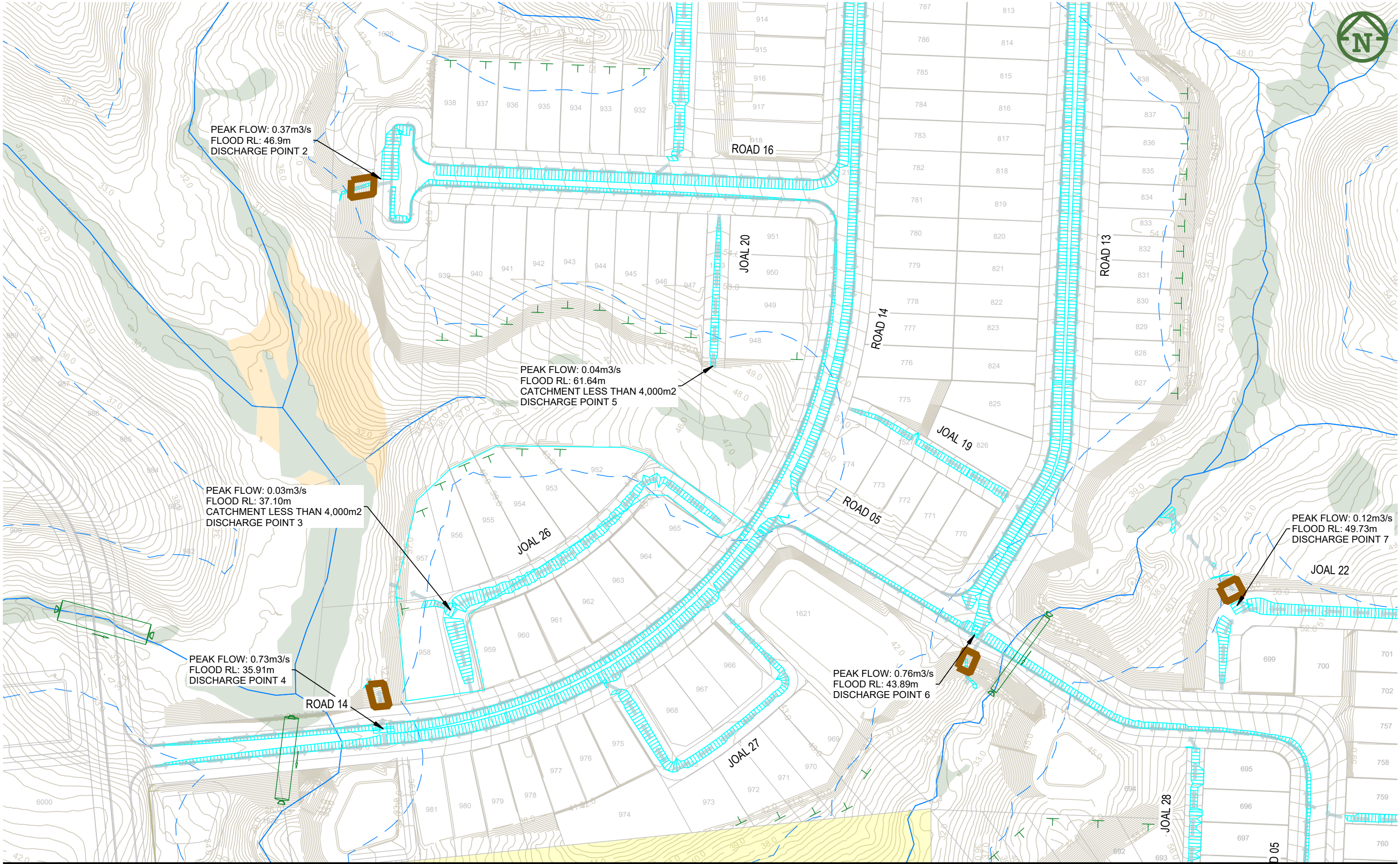
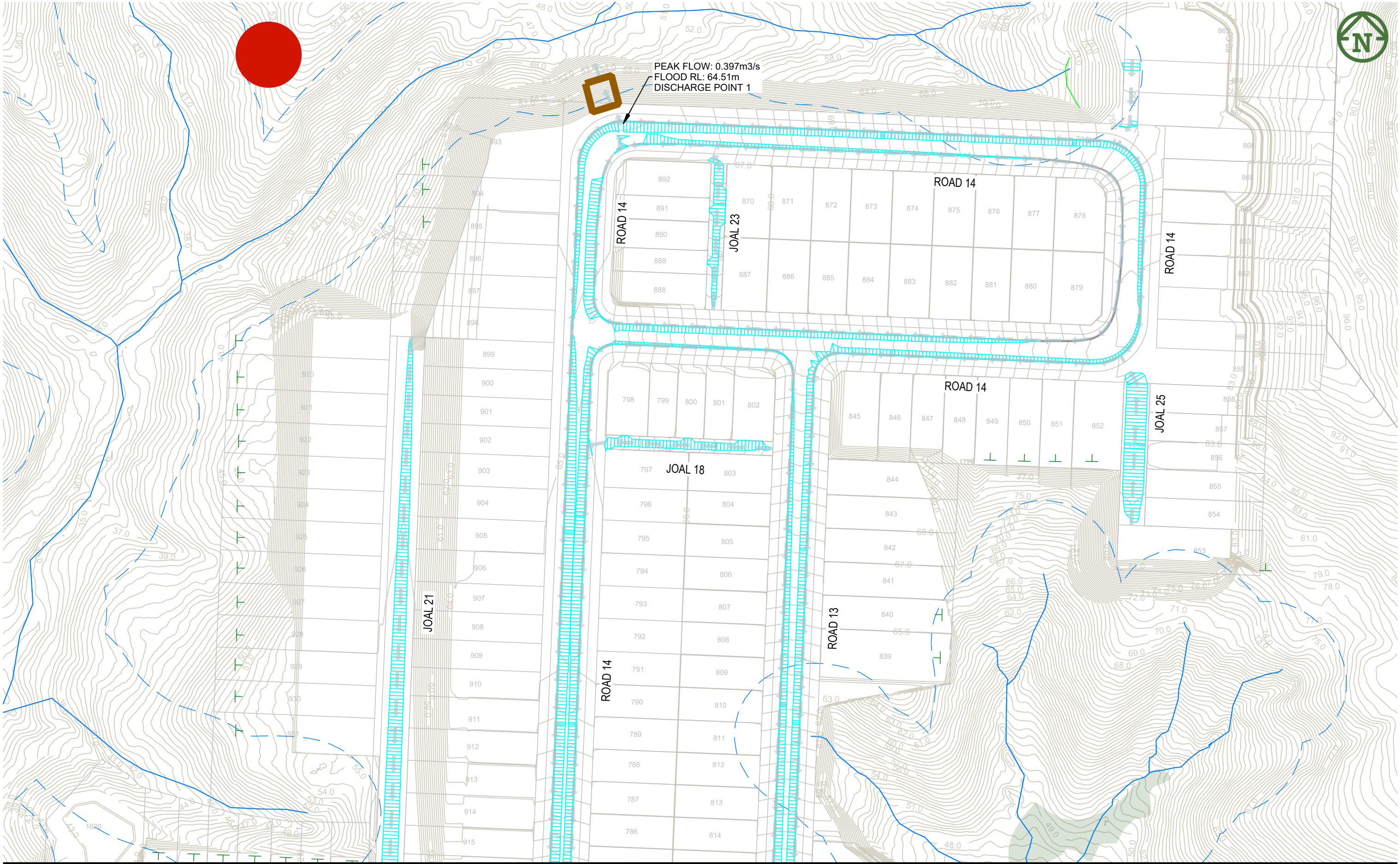






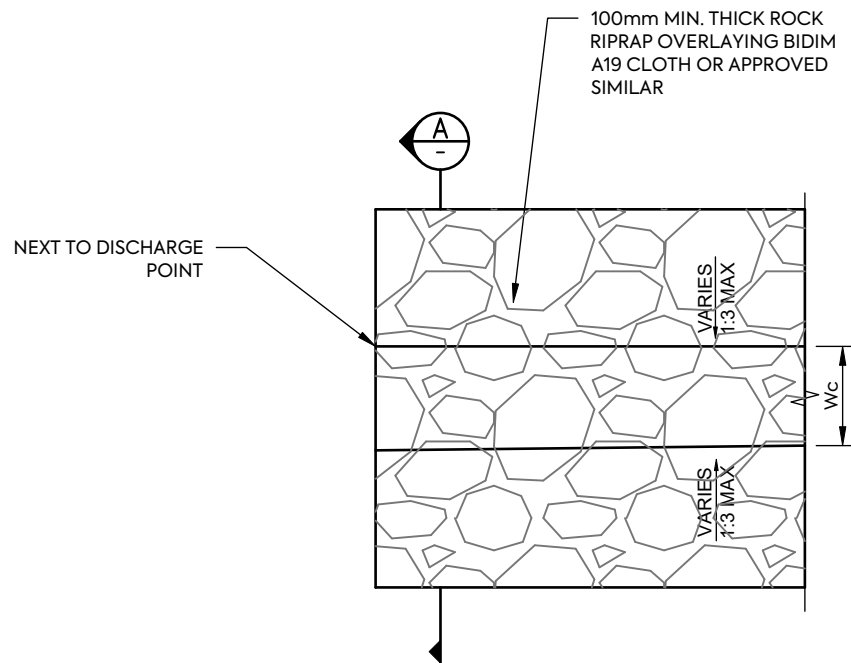




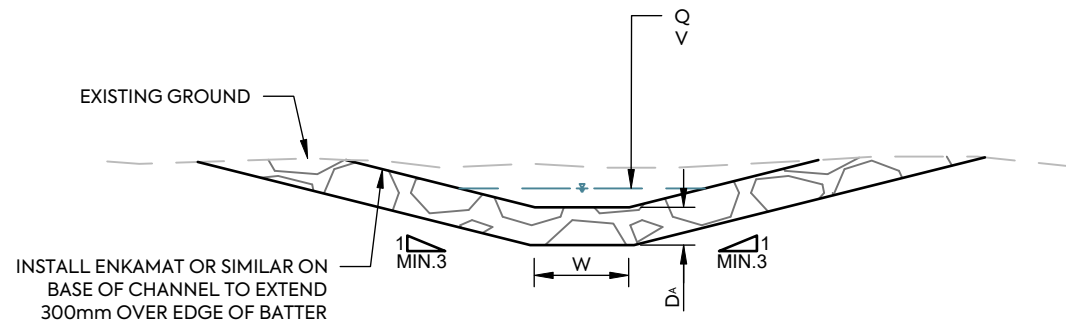


|                                   |  |  |  |                                                                           |  |  |  |                                                                                                                                                     |  |  |  |                                                                                                                                      |  |  |  |
|-----------------------------------|--|--|--|---------------------------------------------------------------------------|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| CLIENT:                           |  |  |  | PROJECT:                                                                  |  |  |  | TITLE:                                                                                                                                              |  |  |  | PURPOSE OF ISSUE:                                                                                                                    |  |  |  |
| VINEWAY LIMITED                   |  |  |  | DELMORE<br>STAGE 2A1, 2A2, 2B1, & 2D<br>53A, 53B & 55 RUSSELL RD<br>OREWA |  |  |  | STORMWATER<br>100 YR OLFP PLAN<br>SHEET 5 OF 5                                                                                                      |  |  |  | RESOURCE CONSENT                                                                                                                     |  |  |  |
| F FOR CONSENT                     |  |  |  | ZW JK 1/07/2025                                                           |  |  |  | SCALE:                                                                                                                                              |  |  |  | DO NOT SCALE                                                                                                                         |  |  |  |
| E FOR CONSENT                     |  |  |  | ZW JK 11/02/2025                                                          |  |  |  | 1:1000 @ A3                                                                                                                                         |  |  |  | DRAWING NO:                                                                                                                          |  |  |  |
| D FOR CONSENT                     |  |  |  | ZW JK 4/02/2025                                                           |  |  |  | 3725-2AB-4605                                                                                                                                       |  |  |  | REV:                                                                                                                                 |  |  |  |
| C FOR CONSENT                     |  |  |  | ZW JK 31/01/2025                                                          |  |  |  | F                                                                                                                                                   |  |  |  |                                                                                                                                      |  |  |  |
| B UPDATED CONTOURS                |  |  |  | TDW JK 16/01/2025                                                         |  |  |  |                                                                                                                                                     |  |  |  |                                                                                                                                      |  |  |  |
| A FIRST ISSUE                     |  |  |  |                                                                           |  |  |  |                                                                                                                                                     |  |  |  |                                                                                                                                      |  |  |  |
| REV DESCRIPTION                   |  |  |  | DRN BY CHK BY APP BY DATE                                                 |  |  |  |                                                                                                                                                     |  |  |  |                                                                                                                                      |  |  |  |
| PLOT DATE Tue Jul 1 10:14:13 2025 |  |  |  | WWW.MCKENZIEANDCO.CO.NZ                                                   |  |  |  | THIS DRAWING IS SOLELY FOR USE BY THE CLIENT ON THIS PROJECT ONLY. NO LIABILITY IS ACCEPTED IN ITS USE BY ANY OTHER ENTITY OR FOR ANY OTHER PURPOSE |  |  |  | c:\12d\5\data\mckfs01\3725-2 Delmore Stage 2_5201\06000. Engineering Design\6400. 12d\Stage 2AB Plotting\12dmodel Stage 2AB Plotting |  |  |  |





TYPICAL DISCHARGE CHANNEL DETAIL - PLAN  
SCALE: 1:40 @ A3



SECTION A  
SCALE: 1:40 @ A3

### DISCHARGE POINT DIMENSIONS

| DISCHARGE          | FLOOD FLOW<br>(m3/s) | FLOOD VELOCITY<br>(m/s) | CHANNEL<br>BED<br>WIDTH<br>Wb | GRADE<br>(SLOPE)<br>'%' | CHANNEL<br>SIDE<br>SLOPE | RIPRAP<br>DIAMETER<br>'d's' (m) | RIPRAP<br>THICKNESS<br>'D'A' (m) |
|--------------------|----------------------|-------------------------|-------------------------------|-------------------------|--------------------------|---------------------------------|----------------------------------|
| DISCHARGE POINT 1  | 0.397                | 3.12                    | 0.5                           | 21.651                  | 1 IN 3                   | 0.33                            | 0.67                             |
| DISCHARGE POINT 2  | 0.37                 | 3.261                   | 0.5                           | 25                      | 1 IN 3                   | 0.36                            | 0.72                             |
| DISCHARGE POINT 3  | 0.03                 | 1.623                   | 0.5                           | 30                      | 1 IN 3                   | 0.37                            | 0.74                             |
| DISCHARGE POINT 4  | 0.73                 | OVERTOP AT CULVERT 9    |                               |                         |                          |                                 |                                  |
| DISCHARGE POINT 5  | 0.04                 | 1.412                   | 0.5                           | 15                      | 1 IN 3                   | 0.27                            | 0.53                             |
| DISCHARGE POINT 6  | 0.76                 | OVERTOP AT CULVERT 8    |                               |                         |                          |                                 |                                  |
| DISCHARGE POINT 7  | 0.12                 | 2.26                    | 0.5                           | 22                      | 1 IN 3                   | 0.33                            | 0.66                             |
| DISCHARGE POINT 8  | 0.25                 | 2.31                    | 0.5                           | 12.89                   | 1 IN 3                   | 0.26                            | 0.52                             |
| DISCHARGE POINT 9  | 0.04                 | 1.609                   | 0.5                           | 22.363                  | 1 IN 3                   | 0.32                            | 0.64                             |
| DISCHARGE POINT 10 | 0.23                 | 2.052                   | 0.5                           | 10                      | 1 IN 3                   | 0.23                            | 0.46                             |

Refer to Engineering Calculations (TR2013/018)



CLIENT:  
VINEWAY LIMITED

PROJECT:  
DELMORE  
STAGE 2A1, 2A2, 2B1 & 2D  
53A, 53B & 55 RUSSELL ROAD  
OREWA

TITLE:  
STORMWATER  
100 YR OLFP  
DISCHARGE POINT DETAIL PLAN

PURPOSE OF ISSUE:  
FOR RESOURCE CONSENT

SCALE:  
AS SHOWN  
DO NOT SCALE

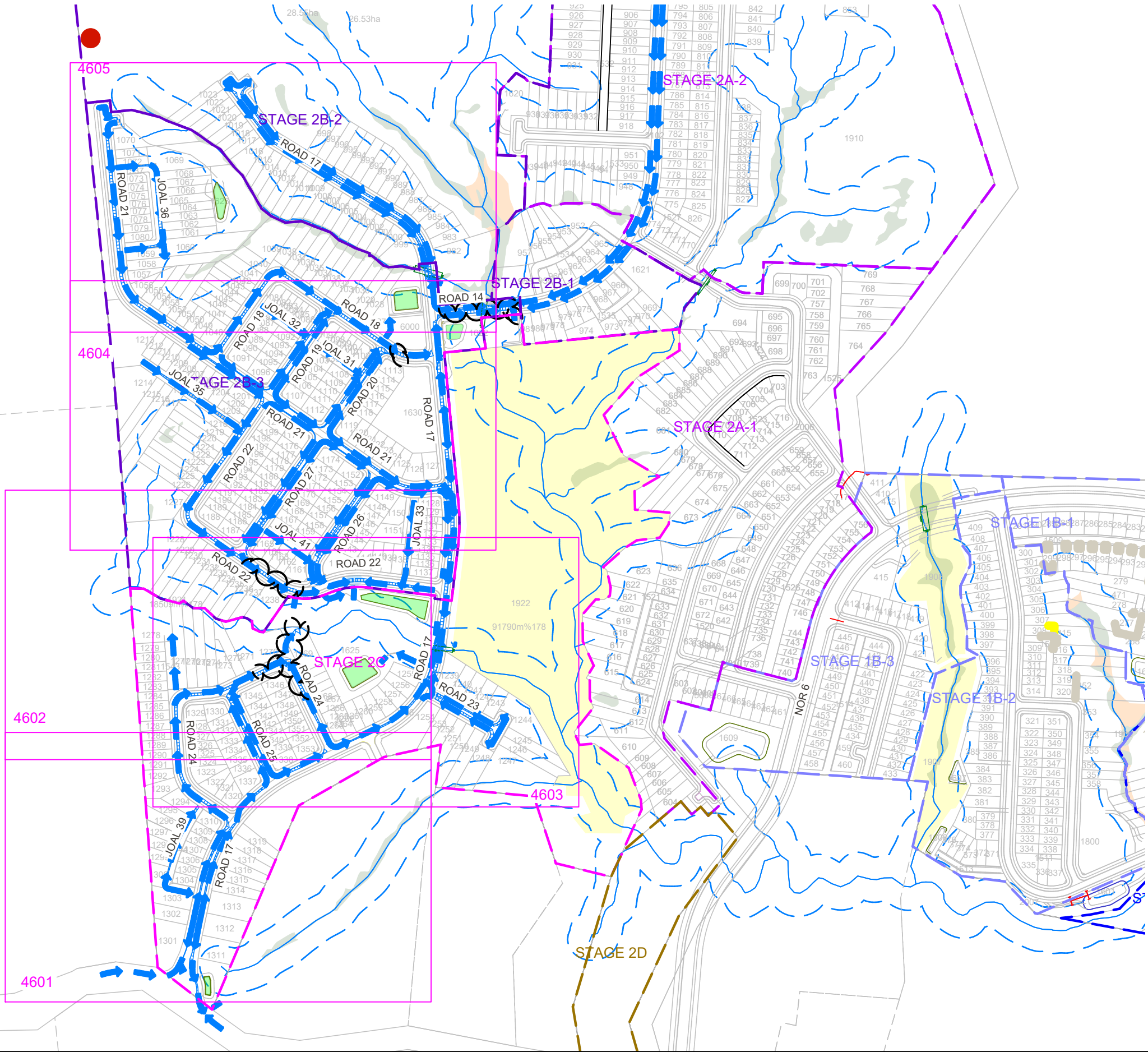
DRAWING NO:  
3725-2AB-4606  
REV:  
A

| REV | DESCRIPTION | DRN BY | CHK BY | APP BY | DATE     |
|-----|-------------|--------|--------|--------|----------|
| A   | FOR CONSENT | ZW     | JK     | JK     | 29/06/25 |





NOTES:  
REFER TO DRAWING 000 FOR GENERAL NOTES



| LEGEND:                                       |  |
|-----------------------------------------------|--|
| STAGE 1A BOUNDARY                             |  |
| STAGE 1B BOUNDARY                             |  |
| STAGE 2A BOUNDARY                             |  |
| STAGE 2B BOUNDARY                             |  |
| STAGE 2C BOUNDARY                             |  |
| STAGE 2D BOUNDARY                             |  |
| PROPOSED STORMWATER                           |  |
| PROPOSED STORMWATER MANHOLE                   |  |
| PROPOSED STORMWATER CATCHPIT                  |  |
| PROPOSED STORMWATER LOT CONNECTION            |  |
| PROPOSED STORMWATER T-BAR                     |  |
| PROPOSED CULVERT                              |  |
| PROPOSED RAINGARDEN                           |  |
| EXISTING STREAM                               |  |
| PROPOSED WASTEWATER                           |  |
| 20m RIPARIAN MARGIN                           |  |
| PROPOSED 100YR OLFP                           |  |
| PROPOSED 100YR OLFP<br>0.4m²/s <DxV < 0.6m²/s |  |
| POND                                          |  |
| COVENANT                                      |  |
| WETLAND                                       |  |
| NEW WETLAND                                   |  |
| ARCHAEOLOGICAL SITE                           |  |

|   |             |    |    |            |
|---|-------------|----|----|------------|
| E | FOR CONSENT | ZW | JK | 1/07/2025  |
| D | FOR CONSENT | DK | JK | 11/02/2025 |
| C | FOR CONSENT | DK | JK | 30/01/2025 |
| B | FOR CONSENT | DK | JK | 31/01/2025 |
| A | FIRST ISSUE | DK | JK | 16/01/2025 |

PLOT DATE Tue Jul 11 14:24:59 2025

WWW.MCKENZIEANDCO.CO.NZ

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MCKENZIE & CO.

CLIENT:

VINEWAY LIMITED

PROJECT:

DELMORE  
STAGE 2B2, 2B3 & 2C  
30 & 32 UPPER OREWA ROAD  
OREWA

TITLE:

STORMWATER  
100 YR OLFP  
OVERALL

PURPOSE OF ISSUE:

RESOURCE CONSENT

SCALE:

1:4000 @A3

DO NOT SCALE

DRAWING NO:

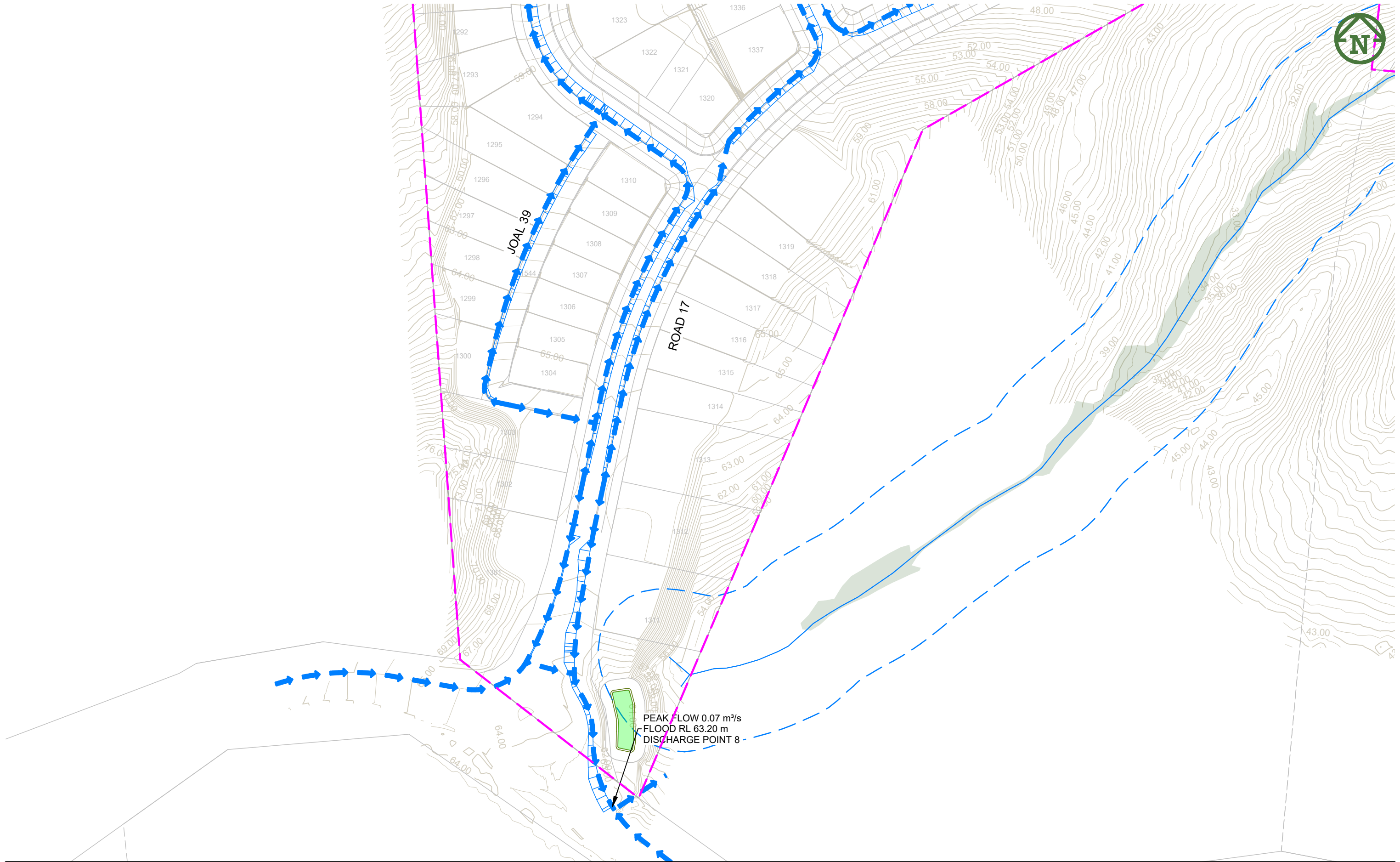
3725-2CDE-4600

REV:

E

c:\12d\5\data\mckf501\3725-2 Delmore Stage 2\_5201\06000. Engineering Design\6400.12d\Stage 2CDE Plotting\12dmodel Stage 2CDE Plotting

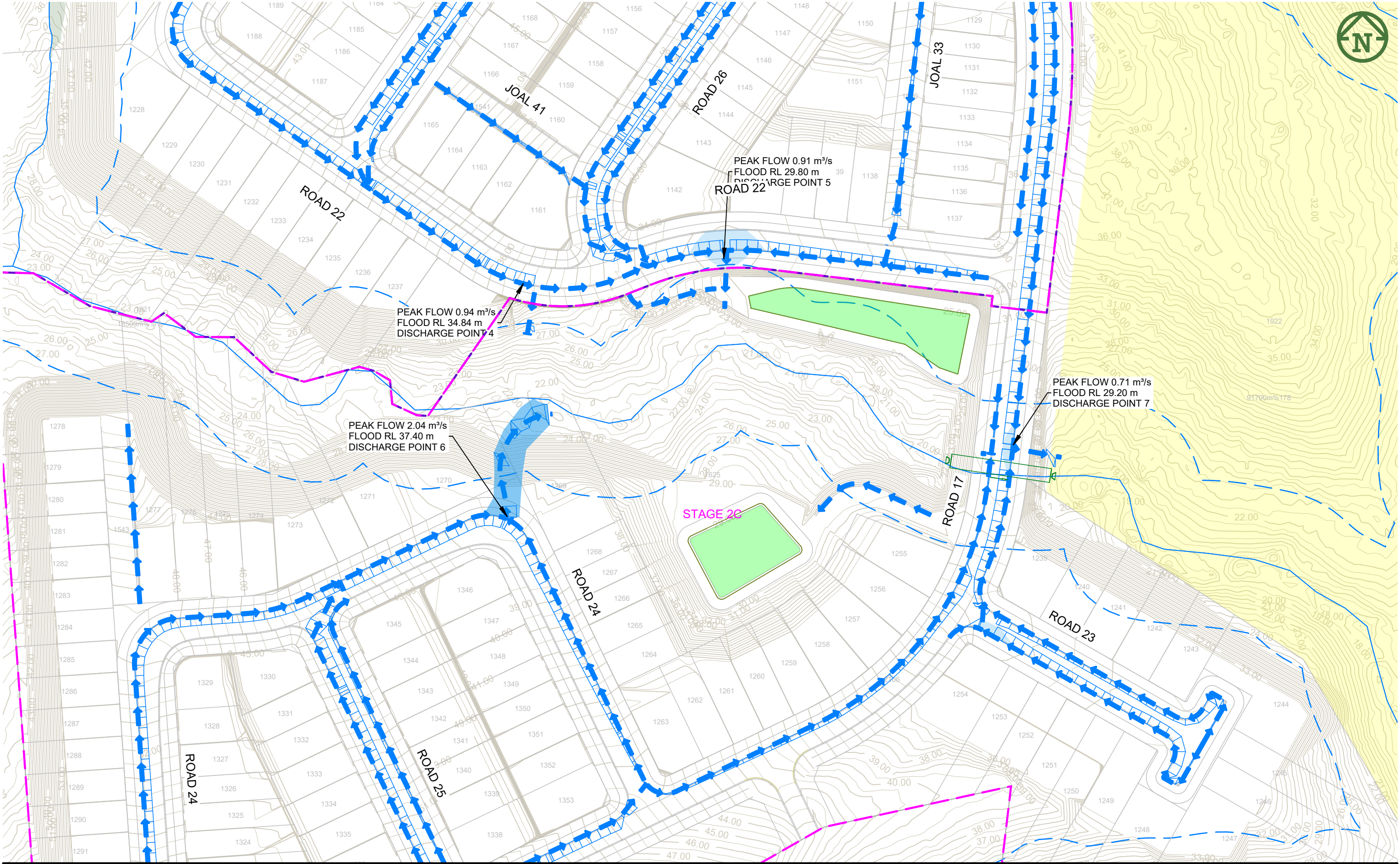




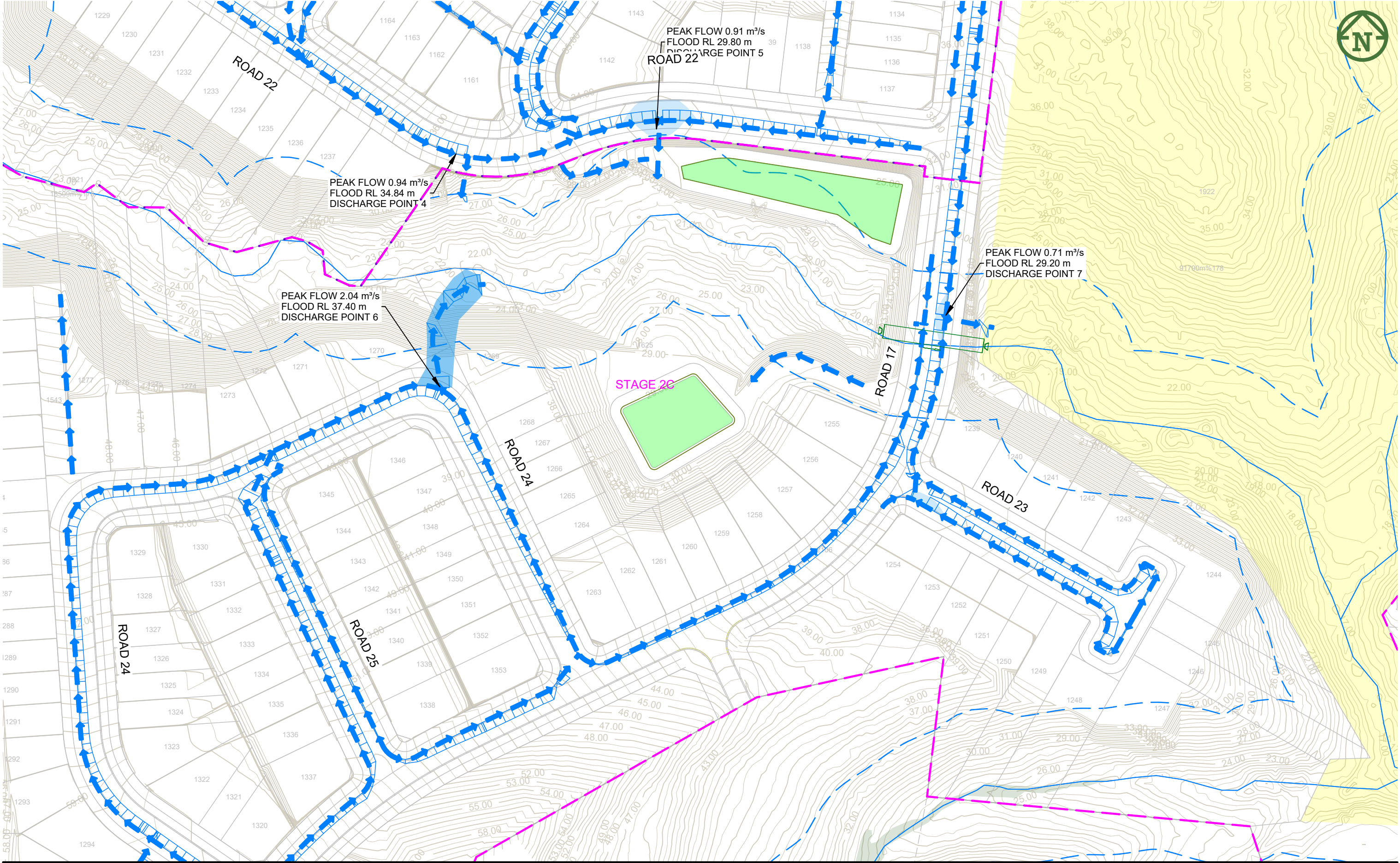
PEAK FLOW 0.07 m³/s  
FLOOD RL 63.20 m  
DISCHARGE POINT 8

|                                                     |             |                         |    |                                                                                                                                                     |        |        |      |                                           |  |  |  |                   |  |  |  |
|-----------------------------------------------------|-------------|-------------------------|----|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|------|-------------------------------------------|--|--|--|-------------------|--|--|--|
| CLIENT:                                             |             |                         |    | PROJECT:                                                                                                                                            |        |        |      | TITLE:                                    |  |  |  | PURPOSE OF ISSUE: |  |  |  |
| VINEWAY LIMITED                                     |             |                         |    | DELMORE<br>STAGE 2B2, 2B3 & 2C<br>31 & 32 UPPER OREWA ROAD<br>OREWA                                                                                 |        |        |      | STORMWATER<br>100 YR OLFP<br>SHEET 1 OF 5 |  |  |  | RESOURCE CONSENT  |  |  |  |
| <div><div></div><div>MCKENZIE &amp; CO.</div></div> |             |                         |    |                                                                                                                                                     |        |        |      |                                           |  |  |  |                   |  |  |  |
| E                                                   | FOR CONSENT | ZW                      | JK | 1/07/2025                                                                                                                                           |        |        |      |                                           |  |  |  |                   |  |  |  |
| D                                                   | FOR CONSENT | DK                      | JK | 11/02/2025                                                                                                                                          |        |        |      |                                           |  |  |  |                   |  |  |  |
| C                                                   | FOR CONSENT | DK                      | JK | 31/01/2025                                                                                                                                          |        |        |      |                                           |  |  |  |                   |  |  |  |
| B                                                   | FOR CONSENT | DK                      | JK | 31/01/2025                                                                                                                                          |        |        |      |                                           |  |  |  |                   |  |  |  |
| A                                                   | FIRST ISSUE | DK                      | JK | 16/01/2025                                                                                                                                          |        |        |      |                                           |  |  |  |                   |  |  |  |
| REV                                                 |             | DESCRIPTION             |    | DRN BY                                                                                                                                              | CHK BY | APP BY | DATE |                                           |  |  |  |                   |  |  |  |
| PLOT DATE Tue Jul 11 14:25:09 2025                  |             | WWW.MCKENZIEANDCO.CO.NZ |    | THIS DRAWING IS SOLELY FOR USE BY THE CLIENT ON THIS PROJECT ONLY. NO LIABILITY IS ACCEPTED IN ITS USE BY ANY OTHER ENTITY OR FOR ANY OTHER PURPOSE |        |        |      |                                           |  |  |  |                   |  |  |  |
|                                                     |             |                         |    | c:\12d5\data\MCKFS01\3725-2 Delmore Stage 2_5201\06000_Engineering Design\6400_12d\Stage 2CDE Plotting\12dmodel Stage 2CDE Plotting                 |        |        |      |                                           |  |  |  |                   |  |  |  |
|                                                     |             |                         |    | 3725-2CDE-4601                                                                                                                                      |        |        |      | E                                         |  |  |  |                   |  |  |  |









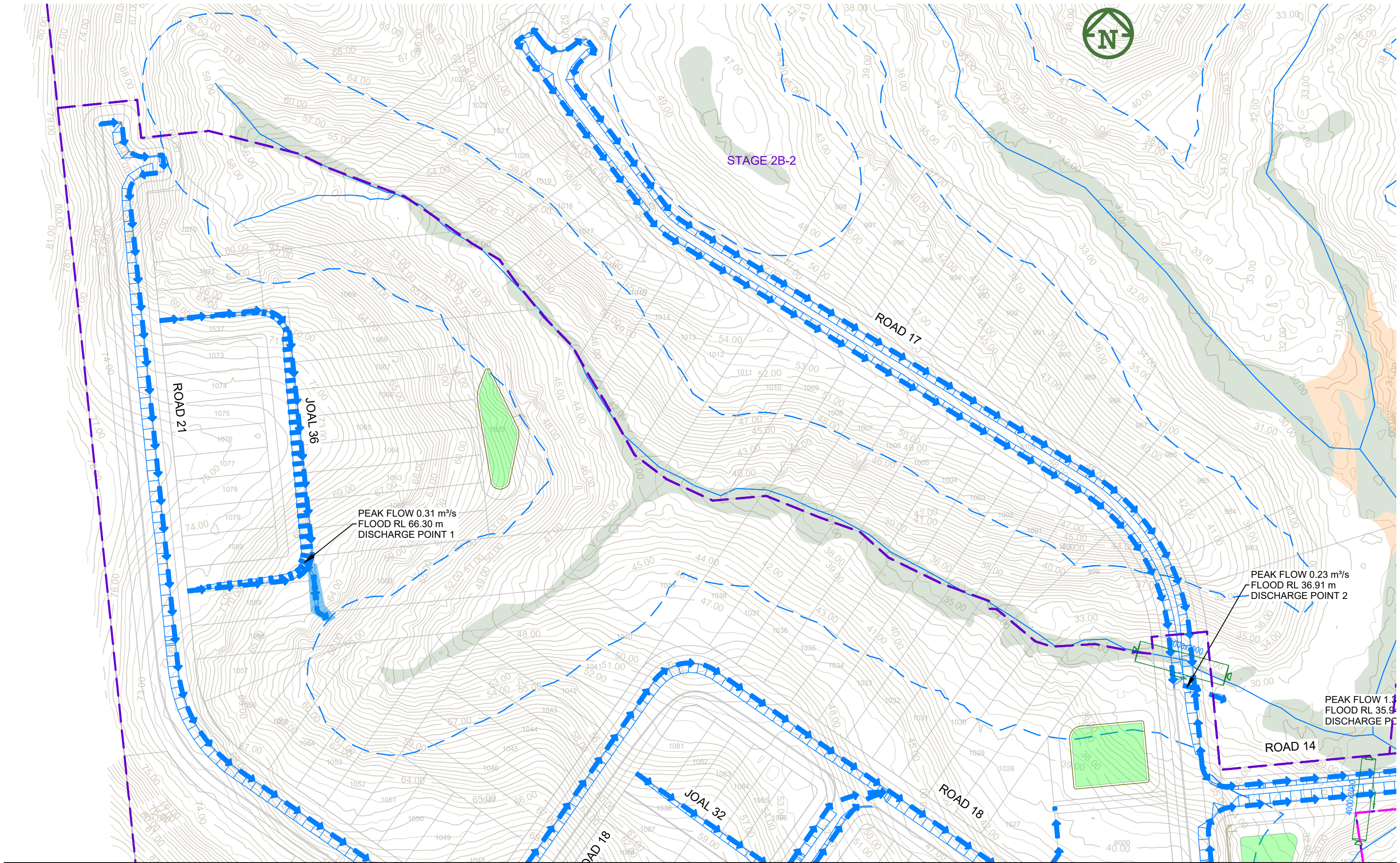




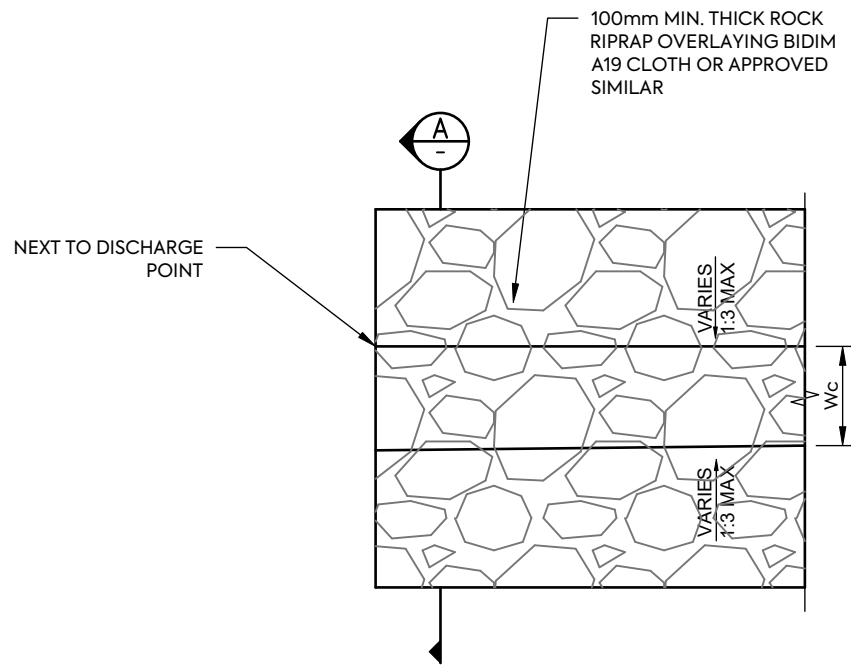
PEAK FLOW 1.30 m³/s  
FLOOD RL 35.94 m  
DISCHARGE POINT 3

|                 |  |  |  |                                                                     |  |  |  |                                           |  |  |  |                   |  |  |  |
|-----------------|--|--|--|---------------------------------------------------------------------|--|--|--|-------------------------------------------|--|--|--|-------------------|--|--|--|
| CLIENT:         |  |  |  | PROJECT:                                                            |  |  |  | TITLE:                                    |  |  |  | PURPOSE OF ISSUE: |  |  |  |
| VINEWAY LIMITED |  |  |  | DELMORE<br>STAGE 2B2, 2B3 & 2C<br>34 & 32 UPPER OREWA ROAD<br>OREWA |  |  |  | STORMWATER<br>100 YR OLFP<br>SHEET 4 OF 5 |  |  |  | RESOURCE CONSENT  |  |  |  |
| REV             |  |  |  | DESCRIPTION                                                         |  |  |  | SCALE:                                    |  |  |  | DRAWING NO:       |  |  |  |
| E               |  |  |  | FOR CONSENT                                                         |  |  |  | 1:1000 @ A3                               |  |  |  | 3725-2CDE-4604    |  |  |  |
| D               |  |  |  | FOR CONSENT                                                         |  |  |  | DO NOT SCALE                              |  |  |  | REV:              |  |  |  |
| C               |  |  |  | FOR CONSENT                                                         |  |  |  | E                                         |  |  |  |                   |  |  |  |
| B               |  |  |  | FOR CONSENT                                                         |  |  |  |                                           |  |  |  |                   |  |  |  |
| A               |  |  |  | FIRST ISSUE                                                         |  |  |  |                                           |  |  |  |                   |  |  |  |
| ZWK             |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |
| DK              |  |  |  | JK                                                                  |  |  |  |                                           |  |  |  |                   |  |  |  |

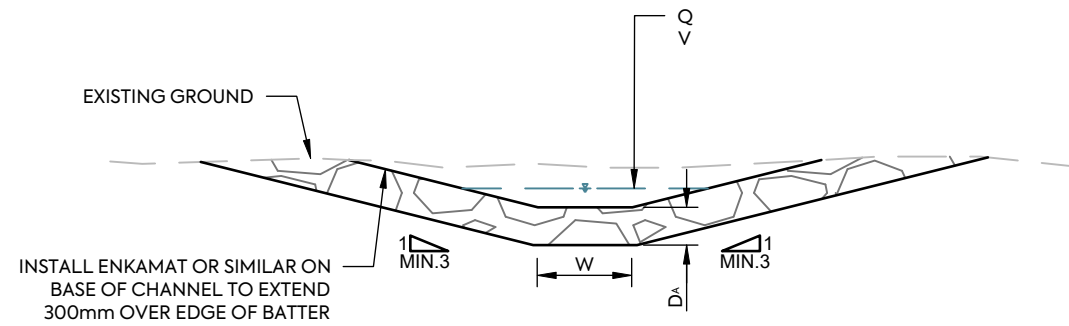








TYPICAL DISCHARGE CHANNEL DETAIL - PLAN  
SCALE: 1:40 @ A3



SECTION A  
SCALE: 1:40 @ A3

## DISCHARGE POINT DIMENSIONS

| DISCHARGE         | FLOOD FLOW<br>(m3/s) | FLOOD VELOCITY<br>(m/s) | CHANNEL<br>BED<br>WIDTH<br>Wb | GRADE<br>(SLOPE)<br>'%' | CHANNEL<br>SIDE<br>SLOPE | RIPRAP<br>DIAMETER<br>'d^s' (m) | RIPRAP<br>THICKNESS<br>'D^A' (m) |
|-------------------|----------------------|-------------------------|-------------------------------|-------------------------|--------------------------|---------------------------------|----------------------------------|
| DISCHARGE POINT 1 | 0.31                 | 4.491                   | 0.5                           | 70                      | 1 IN 3                   | 0.57                            | 1.13                             |
| DISCHARGE POINT 2 | 0.23                 | OVERTOP AT CULVERT 10   |                               |                         |                          |                                 |                                  |
| DISCHARGE POINT 3 | 1.3                  | OVERTOP AT CULVERT 9    |                               |                         |                          |                                 |                                  |
| DISCHARGE POINT 4 | 0.94                 | 4.934                   | 0.5                           | 39                      | 1 IN 3                   | 0.46                            | 0.92                             |
| DISCHARGE POINT 5 | 0.91                 | 3.44                    | 0.5                           | 15                      | 1 IN 3                   | 0.29                            | 0.58                             |
| DISCHARGE POINT 6 | 2.04                 | 3.847                   | 0.5                           | 11.57                   | 1 IN 3                   | 0.26                            | 0.52                             |
| DISCHARGE POINT 7 | 0.71                 | OVERTOP AT 11           |                               |                         |                          |                                 |                                  |
| DISCHARGE POINT 8 | 0.07                 | 1.491                   | 0.5                           | 10.6                    | 1 IN 3                   | 0.23                            | 0.46                             |

Refer to Engineering Calculations (TR2013/018)



CLIENT:  
VINEWAY LIMITED

PROJECT:  
DELMORE  
STAGE 2B2, 2B3 & 2C  
53A, 53B & 55 RUSSELL ROAD  
OREWA

TITLE:  
STORMWATER  
100 YR OLFP  
DISCHARGE POINT DETAIL PLAN

PURPOSE OF ISSUE:  
FOR RESOURCE CONSENT

SCALE:  
AS SHOWN  
DO NOT SCALE

DRAWING NO: 3725-2CDE-4606  
REV: A

| REV | DESCRIPTION | DRN BY | CHK BY | APP BY | DATE     |
|-----|-------------|--------|--------|--------|----------|
| A   | FOR CONSENT | ZW     | JK     | JK     | 29/06/25 |



**Appendix B – Calculations**



## RIPRAP PROTECTION SIZING - TR 2013/018

|              |                               |            |    |      |            |
|--------------|-------------------------------|------------|----|------|------------|
| PROJECT NAME | Delmore Development - STAGE 1 | Created By | ZW | Date | 30/06/2025 |
| PROJECT Nos: | 3725                          | Checked By | JK | Date | 30/06/2025 |

Location: **DISCHARGE POINT 1**

|                                    |               |         |                       |
|------------------------------------|---------------|---------|-----------------------|
| Channel Width ( $W_o$ ):           | <b>0.4</b>    | m       |                       |
| Channel Side Slope:                | <b>1 IN 3</b> |         |                       |
| Slope:                             | <b>12</b>     | %       |                       |
| Flow (Q):                          | <b>0.713</b>  | $m^3/s$ |                       |
| Velocity (V):                      | <b>2.99</b>   | m/s     | Manning's Calculation |
| Depth of flow in channel( $d_c$ ): | <b>0.223</b>  | m       | Manning's Calculation |

### TR 2013/018

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| Froude number ( $F_o$ )= $V/(g \times d_o)^{0.5}$       | = | 2.0215 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.20   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.40   | m |

### RIPRAP DIMENSIONS

|                                |             |   |                                                                                                    |
|--------------------------------|-------------|---|----------------------------------------------------------------------------------------------------|
| Riprap Diameter ( $d_s$ )=     | <b>0.20</b> | m | Note in accordance with TR2013/018 minimum D50 to be 0.15m and minimum RipRap thickness to be 0.3m |
| Thickness of Riprap ( $D_A$ )= | <b>0.40</b> | m |                                                                                                    |
| Total Channel Width=           | <b>1.74</b> | m |                                                                                                    |



## RIPRAP PROTECTION SIZING - TR 2013/018

|                     |                               |            |    |      |            |
|---------------------|-------------------------------|------------|----|------|------------|
| <b>PROJECT NAME</b> | Delmore Development - STAGE 1 | Created By | ZW | Date | 30/06/2025 |
| <b>PROJECT Nos:</b> | 3725                          | Checked By | JK | Date | 30/06/2025 |

|                                                                                                |        |         |                       |
|------------------------------------------------------------------------------------------------|--------|---------|-----------------------|
| <b>Location:</b> <span style="border: 1px solid black; padding: 2px;">DISCHARGE POINT 2</span> |        |         |                       |
| Channel Width ( $W_o$ ):                                                                       | 0.5    | m       |                       |
| Channel Side Slope:                                                                            | 1 IN 3 |         |                       |
| Slope:                                                                                         | 34     | %       |                       |
| Flow (Q):                                                                                      | 1.013  | $m^3/s$ |                       |
| Velocity (V):                                                                                  | 4.784  | m/s     | Manning's Calculation |
| Depth of flow in channel( $d_c$ ):                                                             | 0.195  | m       | Manning's Calculation |

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| <b><u>TR 2013/018</u></b>                               |   |        |   |
| Froude number ( $F_o$ )= $V/(g \times d_o)^{0.5}$       | = | 3.4589 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.43   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.86   | m |

|                                 |             |   |                                                                                                    |
|---------------------------------|-------------|---|----------------------------------------------------------------------------------------------------|
| <b><u>RIPRAP DIMENSIONS</u></b> |             |   |                                                                                                    |
| Riprap Diameter ( $d_s$ )=      | <b>0.43</b> | m | Note in accordance with TR2013/018 minimum D50 to be 0.15m and minimum RipRap thickness to be 0.3m |
| Thickness of Riprap ( $D_A$ )=  | <b>0.86</b> | m |                                                                                                    |
| Total Channel Width=            | <b>1.67</b> | m |                                                                                                    |



## RIPRAP PROTECTION SIZING - TR 2013/018

|              |                               |            |    |      |            |
|--------------|-------------------------------|------------|----|------|------------|
| PROJECT NAME | Delmore Development - STAGE 1 | Created By | ZW | Date | 30/06/2025 |
| PROJECT Nos: | 3725                          | Checked By | JK | Date | 30/06/2025 |

Location: **DISCHARGE POINT 3**

|                                     |               |                   |                       |
|-------------------------------------|---------------|-------------------|-----------------------|
| Channel Width ( $W_o$ ):            | <b>0.5</b>    | m                 |                       |
| Channel Side Slope:                 | <b>1 IN 3</b> |                   |                       |
| Slope:                              | <b>23</b>     | %                 |                       |
| Flow (Q):                           | <b>1.123</b>  | m <sup>3</sup> /s |                       |
| Velocity (V):                       | <b>4.256</b>  | m/s               | Manning's Calculation |
| Depth of flow in channel ( $d_c$ ): | <b>0.225</b>  | m                 | Manning's Calculation |

### TR 2013/018

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| Froude number ( $F_o$ )= $V/(g \times d_o)^{0.5}$       | = | 2.8647 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.36   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.72   | m |

### RIPRAP DIMENSIONS

|                                |             |   |                                                                                                    |
|--------------------------------|-------------|---|----------------------------------------------------------------------------------------------------|
| Riprap Diameter ( $d_s$ )=     | <b>0.36</b> | m | Note in accordance with TR2013/018 minimum D50 to be 0.15m and minimum RipRap thickness to be 0.3m |
| Thickness of Riprap ( $D_A$ )= | <b>0.72</b> | m |                                                                                                    |
| Total Channel Width=           | <b>1.85</b> | m |                                                                                                    |



### DISCHARGE POINT DIMENSIONS

| DISCHARGE         | FLOOD FLOW<br>(m <sup>3</sup> /s) | FLOOD VELOCITY<br>(m/s) | CHANNEL<br>BED<br>WIDTH<br>W <sub>b</sub> | GRADE<br>(SLOPE)<br>'%' | CHANNEL<br>SIDE<br>SLOPE | RIPRAP<br>DIAMETER<br>'d^s' (m) | RIPRAP<br>THICKNESS<br>'D^A' (m) |
|-------------------|-----------------------------------|-------------------------|-------------------------------------------|-------------------------|--------------------------|---------------------------------|----------------------------------|
| DISCHARGE POINT 1 | 0.713                             | 2.99                    | 0.4                                       | 12                      | 1 IN 3                   | 0.20                            | 0.40                             |
| DISCHARGE POINT 2 | 1.013                             | 4.784                   | 0.5                                       | 34                      | 1 IN 3                   | 0.43                            | 0.86                             |
| DISCHARGE POINT 3 | 1.123                             | 4.256                   | 0.5                                       | 23                      | 1 IN 3                   | 0.36                            | 0.72                             |
| DISCHARGE POINT 4 | 0.951                             | OVER TOP AT CULVERT 5   |                                           |                         |                          |                                 |                                  |
| DISCHARGE POINT 5 | 0.674                             | OVER TOP AT CULVERT 4   |                                           |                         |                          |                                 |                                  |
| DISCHARGE POINT 6 | 0.412                             | OVER TOP AT CULVERT 2   |                                           |                         |                          |                                 |                                  |
| DISCHARGE POINT 7 | 1.984                             | OVER TOP AT CULVERT 3   |                                           |                         |                          |                                 |                                  |
| DISCHARGE POINT 8 | 0.03                              | OVER TOP AT CULVERT 12  |                                           |                         |                          |                                 |                                  |

Refer to Engineering Calculations (TR2013/018)



## RIPRAP PROTECTION SIZING - TR 2013/018

|                     |                                                  |            |    |      |            |
|---------------------|--------------------------------------------------|------------|----|------|------------|
| <b>PROJECT NAME</b> | Delmore Development - STAGE 2A-1,<br>2A-2 & 2B-1 | Created By | ZW | Date | 30/06/2025 |
| <b>PROJECT Nos:</b> | 3725                                             | Checked By | JK | Date | 30/06/2025 |

|                                                                                                |        |                   |                       |
|------------------------------------------------------------------------------------------------|--------|-------------------|-----------------------|
| <b>Location:</b> <span style="border: 1px solid black; padding: 2px;">DISCHARGE POINT 1</span> |        |                   |                       |
| Channel Width ( $W_o$ ):                                                                       | 0.5    | m                 |                       |
| Channel Side Slope:                                                                            | 1 IN 3 |                   |                       |
| Slope:                                                                                         | 21.651 | %                 |                       |
| Flow (Q):                                                                                      | 0.397  | m <sup>3</sup> /s |                       |
| Velocity (V):                                                                                  | 3.12   | m/s               | Manning's Calculation |
| Depth of flow in channel( $d_c$ ):                                                             | 0.139  | m                 | Manning's Calculation |

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| <b><u>TR 2013/018</u></b>                               |   |        |   |
| Froude number ( $F_o$ )= $V/(g \times d_p)^{0.5}$       | = | 2.6719 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.33   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.67   | m |

|                                 |      |   |                                                      |
|---------------------------------|------|---|------------------------------------------------------|
| <b><u>RIPRAP DIMENSIONS</u></b> |      |   |                                                      |
| Riprap Diameter ( $d_s$ )=      | 0.33 | m | Note in accordance with TR2013/018 minimum D50 to be |
| Thickness of Riprap ( $D_A$ )=  | 0.67 | m | 0.15m and minimum RipRap thickness to be 0.3m        |
| Total Channel Width=            | 1.33 | m |                                                      |



## RIPRAP PROTECTION SIZING - TR 2013/018

|              |                                                  |            |    |      |            |
|--------------|--------------------------------------------------|------------|----|------|------------|
| PROJECT NAME | Delmore Development - STAGE 2A-1,<br>2A-2 & 2B-1 | Created By | ZW | Date | 30/06/2025 |
| PROJECT Nos: | 3725                                             | Checked By | JK | Date | 30/06/2025 |

Location: **DISCHARGE POINT 2**

|                                    |        |                   |                       |
|------------------------------------|--------|-------------------|-----------------------|
| Channel Width ( $W_o$ ):           | 0.5    | m                 |                       |
| Channel Side Slope:                | 1 IN 3 |                   |                       |
| Slope:                             | 25     | %                 |                       |
| Flow (Q):                          | 0.37   | m <sup>3</sup> /s |                       |
| Velocity (V):                      | 3.261  | m/s               | Manning's Calculation |
| Depth of flow in channel( $d_c$ ): | 0.13   | m                 | Manning's Calculation |

### TR 2013/018

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| Froude number ( $F_o$ )= $V/(g \times d_p)^{0.5}$       | = | 2.8877 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.36   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.72   | m |

### RIPRAP DIMENSIONS

|                                |      |   |                                                      |
|--------------------------------|------|---|------------------------------------------------------|
| Riprap Diameter ( $d_s$ )=     | 0.36 | m | Note in accordance with TR2013/018 minimum D50 to be |
| Thickness of Riprap ( $D_A$ )= | 0.72 | m | 0.15m and minimum RipRap thickness to be 0.3m        |
| Total Channel Width=           | 1.28 | m |                                                      |



## RIPRAP PROTECTION SIZING - TR 2013/018

|              |                                               |            |    |      |            |
|--------------|-----------------------------------------------|------------|----|------|------------|
| PROJECT NAME | Delmore Development - STAGE 2A-1, 2A-2 & 2B-1 | Created By | ZW | Date | 30/06/2025 |
| PROJECT Nos: | 3725                                          | Checked By | JK | Date | 30/06/2025 |

Location: **DISCHARGE POINT 3**

|                                     |               |                   |                       |
|-------------------------------------|---------------|-------------------|-----------------------|
| Channel Width ( $W_o$ ):            | <b>0.5</b>    | m                 |                       |
| Channel Side Slope:                 | <b>1 IN 3</b> |                   |                       |
| Slope:                              | <b>30</b>     | %                 |                       |
| Flow (Q):                           | <b>0.03</b>   | m <sup>3</sup> /s |                       |
| Velocity (V):                       | <b>1.623</b>  | m/s               | Manning's Calculation |
| Depth of flow in channel ( $d_c$ ): | <b>0.031</b>  | m                 | Manning's Calculation |

### TR 2013/018

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| Froude number ( $F_o$ )= $V/(g \times d_o)^{0.5}$       | = | 2.9431 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.37   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.74   | m |

### RIPRAP DIMENSIONS

|                                |             |   |                                                                                                    |
|--------------------------------|-------------|---|----------------------------------------------------------------------------------------------------|
| Riprap Diameter ( $d_s$ )=     | <b>0.37</b> | m | Note in accordance with TR2013/018 minimum D50 to be 0.15m and minimum RipRap thickness to be 0.3m |
| Thickness of Riprap ( $D_A$ )= | <b>0.74</b> | m |                                                                                                    |
| Total Channel Width=           | <b>0.69</b> | m |                                                                                                    |

## RIPRAP PROTECTION SIZING - TR 2013/018

|              |                                                  |            |    |      |            |
|--------------|--------------------------------------------------|------------|----|------|------------|
| PROJECT NAME | Delmore Development - STAGE 2A-1,<br>2A-2 & 2B-1 | Created By | ZW | Date | 30/06/2025 |
| PROJECT Nos: | 3725                                             | Checked By | JK | Date | 30/06/2025 |

Location: **DISCHARGE POINT 5**

|                                     |        |                   |
|-------------------------------------|--------|-------------------|
| Channel Width ( $W_o$ ):            | 0.5    | m                 |
| Channel Side Slope:                 | 1 IN 3 |                   |
| Slope:                              | 15     | %                 |
| Flow (Q):                           | 0.04   | m <sup>3</sup> /s |
| Velocity (V):                       | 1.412  | m/s               |
| Depth of flow in channel ( $d_c$ ): | 0.045  | m                 |

Manning's Calculation

### TR 2013/018

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| Froude number ( $F_o$ )= $V/(g \times d_p)^{0.5}$       | = | 2.1252 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.27   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.53   | m |

### RIPRAP DIMENSIONS

|                                |      |   |                                                                                                    |
|--------------------------------|------|---|----------------------------------------------------------------------------------------------------|
| Riprap Diameter ( $d_s$ )=     | 0.27 | m | Note in accordance with TR2013/018 minimum D50 to be 0.15m and minimum RipRap thickness to be 0.3m |
| Thickness of Riprap ( $D_A$ )= | 0.53 | m |                                                                                                    |
| Total Channel Width=           | 0.77 | m |                                                                                                    |



## RIPRAP PROTECTION SIZING - TR 2013/018

|                     |                                               |            |    |      |            |
|---------------------|-----------------------------------------------|------------|----|------|------------|
| <b>PROJECT NAME</b> | Delmore Development - STAGE 2A-1, 2A-2 & 2B-1 | Created By | ZW | Date | 30/06/2025 |
| <b>PROJECT Nos:</b> | 3725                                          | Checked By | JK | Date | 30/06/2025 |

|                                                                                                |        |         |                       |
|------------------------------------------------------------------------------------------------|--------|---------|-----------------------|
| <b>Location:</b> <span style="border: 1px solid black; padding: 2px;">DISCHARGE POINT 7</span> |        |         |                       |
| Channel Width ( $W_o$ ):                                                                       | 0.5    | m       |                       |
| Channel Side Slope:                                                                            | 1 IN 3 |         |                       |
| Slope:                                                                                         | 22     | %       |                       |
| Flow (Q):                                                                                      | 0.12   | $m^3/s$ |                       |
| Velocity (V):                                                                                  | 2.26   | m/s     | Manning's Calculation |
| Depth of flow in channel( $d_c$ ):                                                             | 0.074  | m       | Manning's Calculation |

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| <b><u>TR 2013/018</u></b>                               |   |        |   |
| Froude number ( $F_o$ )= $V/(g \times d_o)^{0.5}$       | = | 2.6525 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.33   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.66   | m |

|                                 |      |   |                                                                                                    |
|---------------------------------|------|---|----------------------------------------------------------------------------------------------------|
| <b><u>RIPRAP DIMENSIONS</u></b> |      |   |                                                                                                    |
| Riprap Diameter ( $d_s$ )=      | 0.33 | m | Note in accordance with TR2013/018 minimum D50 to be 0.15m and minimum RipRap thickness to be 0.3m |
| Thickness of Riprap ( $D_A$ )=  | 0.66 | m |                                                                                                    |
| Total Channel Width=            | 0.94 | m |                                                                                                    |

## RIPRAP PROTECTION SIZING - TR 2013/018

|              |                                                  |            |    |      |            |
|--------------|--------------------------------------------------|------------|----|------|------------|
| PROJECT NAME | Delmore Development - STAGE 2A-1, 2A-2<br>& 2B-1 | Created By | ZW | Date | 30/06/2025 |
| PROJECT Nos: | 3725                                             | Checked By | JK | Date | 30/06/2025 |

Location: **DISCHARGE POINT 7**

|                                    |               |                   |                       |
|------------------------------------|---------------|-------------------|-----------------------|
| Channel Width ( $W_o$ ):           | <b>0.5</b>    | m                 |                       |
| Channel Side Slope:                | <b>1 IN 3</b> |                   |                       |
| Slope:                             | <b>12.89</b>  | %                 |                       |
| Flow (Q):                          | <b>0.25</b>   | m <sup>3</sup> /s |                       |
| Velocity (V):                      | <b>2.31</b>   | m/s               | Manning's Calculation |
| Depth of flow in channel( $d_c$ ): | <b>0.124</b>  | m                 | Manning's Calculation |

### TR 2013/018

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| Froude number ( $F_o$ )= $V/(g \times d_p)^{0.5}$       | = | 2.0944 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.26   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.52   | m |

### RIPRAP DIMENSIONS

|                                |             |   |                                                      |
|--------------------------------|-------------|---|------------------------------------------------------|
| Riprap Diameter ( $d_s$ )=     | <b>0.26</b> | m | Note in accordance with TR2013/018 minimum D50 to be |
| Thickness of Riprap ( $D_A$ )= | <b>0.52</b> | m | 0.15m and minimum RipRap thickness to be 0.3m        |
| Total Channel Width=           | <b>1.24</b> | m |                                                      |



## RIPRAP PROTECTION SIZING - TR 2013/018

|                     |                                               |            |    |      |            |
|---------------------|-----------------------------------------------|------------|----|------|------------|
| <b>PROJECT NAME</b> | Delmore Development - STAGE 2A-1, 2A-2 & 2B-1 | Created By | ZW | Date | 30/06/2025 |
| <b>PROJECT Nos:</b> | 3725                                          | Checked By | JK | Date | 30/06/2025 |

|                                                                                                                  |        |         |                       |
|------------------------------------------------------------------------------------------------------------------|--------|---------|-----------------------|
| <b>Location:</b> <span style="border: 1px solid black; padding: 2px 10px; color: blue;">DISCHARGE POINT 9</span> |        |         |                       |
| Channel Width ( $W_o$ ):                                                                                         | 0.5    | m       |                       |
| Channel Side Slope:                                                                                              | 1 IN 3 |         |                       |
| Slope:                                                                                                           | 22.363 | %       |                       |
| Flow (Q):                                                                                                        | 0.04   | $m^3/s$ |                       |
| Velocity (V):                                                                                                    | 1.609  | $m/s$   | Manning's Calculation |
| Depth of flow in channel( $d_c$ ):                                                                               | 0.04   | m       | Manning's Calculation |

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| <b><u>TR 2013/018</u></b>                               |   |        |   |
| Froude number ( $F_o$ )= $V/(g \times d_o)^{0.5}$       | = | 2.5686 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.32   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.64   | m |

|                                 |      |   |                                                      |
|---------------------------------|------|---|------------------------------------------------------|
| <b><u>RIPRAP DIMENSIONS</u></b> |      |   |                                                      |
| Riprap Diameter ( $d_s$ )=      | 0.32 | m | Note in accordance with TR2013/018 minimum D50 to be |
| Thickness of Riprap ( $D_A$ )=  | 0.64 | m | 0.15m and minimum RipRap thickness to be 0.3m        |
| Total Channel Width=            | 0.74 | m |                                                      |

## RIPRAP PROTECTION SIZING - TR 2013/018

|              |                                               |            |    |      |            |
|--------------|-----------------------------------------------|------------|----|------|------------|
| PROJECT NAME | Delmore Development - STAGE 2A-1, 2A-2 & 2B-1 | Created By | ZW | Date | 30/06/2025 |
| PROJECT Nos: | 3725                                          | Checked By | JK | Date | 30/06/2025 |

Location: **DISCHARGE POINT 10**

|                                    |        |                   |                       |
|------------------------------------|--------|-------------------|-----------------------|
| Channel Width ( $W_o$ ):           | 0.5    | m                 |                       |
| Channel Side Slope:                | 1 IN 3 |                   |                       |
| Slope:                             | 10     | %                 |                       |
| Flow (Q):                          | 0.23   | m <sup>3</sup> /s |                       |
| Velocity (V):                      | 2.052  | m/s               | Manning's Calculation |
| Depth of flow in channel( $d_c$ ): | 0.127  | m                 | Manning's Calculation |

### TR 2013/018

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| Froude number ( $F_o$ )= $V/(g \times d_p)^{0.5}$       | = | 1.8384 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.23   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.46   | m |

### RIPRAP DIMENSIONS

|                                |      |   |                                                                                                    |
|--------------------------------|------|---|----------------------------------------------------------------------------------------------------|
| Riprap Diameter ( $d_s$ )=     | 0.23 | m | Note in accordance with TR2013/018 minimum D50 to be 0.15m and minimum RipRap thickness to be 0.3m |
| Thickness of Riprap ( $D_A$ )= | 0.46 | m |                                                                                                    |
| Total Channel Width=           | 1.26 | m |                                                                                                    |



## DISCHARGE POINT DIMENSIONS

| DISCHARGE          | FLOOD FLOW<br>(m <sup>3</sup> /s) | FLOOD VELOCITY<br>(m/s) | CHANNEL<br>BED<br>WIDTH<br>W <sub>b</sub> | GRADE<br>(SLOPE)<br>'%' | CHANNEL<br>SIDE<br>SLOPE | RIPRAP<br>DIAMETER<br>'d^s' (m) | RIPRAP<br>THICKNESS<br>'D^A' (m) |
|--------------------|-----------------------------------|-------------------------|-------------------------------------------|-------------------------|--------------------------|---------------------------------|----------------------------------|
| DISCHARGE POINT 1  | 0.397                             | 3.12                    | 0.5                                       | 21.651                  | 1 IN 3                   | 0.33                            | 0.67                             |
| DISCHARGE POINT 2  | 0.37                              | 3.261                   | 0.5                                       | 25                      | 1 IN 3                   | 0.36                            | 0.72                             |
| DISCHARGE POINT 3  | 0.03                              | 1.623                   | 0.5                                       | 30                      | 1 IN 3                   | 0.37                            | 0.74                             |
| DISCHARGE POINT 4  | 0.73                              | OVERTOP AT CULVERT 9    |                                           |                         |                          |                                 |                                  |
| DISCHARGE POINT 5  | 0.04                              | 1.412                   | 0.5                                       | 15                      | 1 IN 3                   | 0.27                            | 0.53                             |
| DISCHARGE POINT 6  | 0.76                              | OVERTOP AT CULVERT 8    |                                           |                         |                          |                                 |                                  |
| DISCHARGE POINT 7  | 0.12                              | 2.26                    | 0.5                                       | 22                      | 1 IN 3                   | 0.33                            | 0.66                             |
| DISCHARGE POINT 8  | 0.25                              | 2.31                    | 0.5                                       | 12.89                   | 1 IN 3                   | 0.26                            | 0.52                             |
| DISCHARGE POINT 9  | 0.04                              | 1.609                   | 0.5                                       | 22.363                  | 1 IN 3                   | 0.32                            | 0.64                             |
| DISCHARGE POINT 10 | 0.23                              | 2.052                   | 0.5                                       | 10                      | 1 IN 3                   | 0.23                            | 0.46                             |

Refer to Engineering Calculations (TR2013/018)

## RIPRAP PROTECTION SIZING - TR 2013/018

|                     |                                                |            |    |      |            |
|---------------------|------------------------------------------------|------------|----|------|------------|
| <b>PROJECT NAME</b> | Delmore Development - STAGE 2B-2,<br>2B-3 & 2C | Created By | ZW | Date | 30/06/2025 |
| <b>PROJECT Nos:</b> | 3725                                           | Checked By | JK | Date | 30/06/2025 |

|                                                                                                |        |         |                       |
|------------------------------------------------------------------------------------------------|--------|---------|-----------------------|
| <b>Location:</b> <span style="border: 1px solid black; padding: 2px;">DISCHARGE POINT 1</span> |        |         |                       |
| Channel Width ( $W_o$ ):                                                                       | 0.5    | m       |                       |
| Channel Side Slope:                                                                            | 1 IN 3 |         |                       |
| Slope:                                                                                         | 70     | %       |                       |
| Flow (Q):                                                                                      | 0.31   | $m^3/s$ |                       |
| Velocity (V):                                                                                  | 4.491  | m/s     | Manning's Calculation |
| Depth of flow in channel( $d_c$ ):                                                             | 0.1    | m       | Manning's Calculation |

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| <b><u>TR 2013/018</u></b>                               |   |        |   |
| Froude number ( $F_o$ )= $V/(g \times d_p)^{0.5}$       | = | 4.5343 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.57   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 1.13   | m |

|                                 |      |   |                                                      |
|---------------------------------|------|---|------------------------------------------------------|
| <b><u>RIPRAP DIMENSIONS</u></b> |      |   |                                                      |
| Riprap Diameter ( $d_s$ )=      | 0.57 | m | Note in accordance with TR2013/018 minimum D50 to be |
| Thickness of Riprap ( $D_A$ )=  | 1.13 | m | 0.15m and minimum RipRap thickness to be 0.3m        |
| Total Channel Width=            | 0.57 | m |                                                      |



## RIPRAP PROTECTION SIZING - TR 2013/018

|                     |                                                |            |    |      |            |
|---------------------|------------------------------------------------|------------|----|------|------------|
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| <b>PROJECT Nos:</b> | 3725                                           | Checked By | JK | Date | 30/06/2025 |

|                                                                                                                 |        |         |                       |
|-----------------------------------------------------------------------------------------------------------------|--------|---------|-----------------------|
| <b>Location:</b> <span style="border: 1px solid black; padding: 2px 5px; color: blue;">DISCHARGE POINT 4</span> |        |         |                       |
| Channel Width ( $W_o$ ):                                                                                        | 0.5    | m       |                       |
| Channel Side Slope:                                                                                             | 1 IN 3 |         |                       |
| Slope:                                                                                                          | 39     | %       |                       |
| Flow (Q):                                                                                                       | 0.94   | $m^3/s$ |                       |
| Velocity (V):                                                                                                   | 4.934  | $m/s$   | Manning's Calculation |
| Depth of flow in channel( $d_c$ ):                                                                              | 0.182  | m       | Manning's Calculation |

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| <b><u>TR 2013/018</u></b>                               |   |        |   |
| Froude number ( $F_o$ )= $V/(g \times d_p)^{0.5}$       | = | 3.6926 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.46   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.92   | m |

|                                 |      |   |                                                                                                    |
|---------------------------------|------|---|----------------------------------------------------------------------------------------------------|
| <b><u>RIPRAP DIMENSIONS</u></b> |      |   |                                                                                                    |
| Riprap Diameter ( $d_s$ )=      | 0.46 | m | Note in accordance with TR2013/018 minimum D50 to be 0.15m and minimum RipRap thickness to be 0.3m |
| Thickness of Riprap ( $D_A$ )=  | 0.92 | m |                                                                                                    |
| Total Channel Width=            | 1.59 | m |                                                                                                    |

## RIPRAP PROTECTION SIZING - TR 2013/018

|              |                                             |            |    |      |            |
|--------------|---------------------------------------------|------------|----|------|------------|
| PROJECT NAME | Delmore Development - STAGE 2B-2, 2B-3 & 2C | Created By | ZW | Date | 30/06/2025 |
| PROJECT Nos: | 3725                                        | Checked By | JK | Date | 30/06/2025 |

Location: **DISCHARGE POINT 5**

|                                     |        |                   |                       |
|-------------------------------------|--------|-------------------|-----------------------|
| Channel Width ( $W_o$ ):            | 0.5    | m                 |                       |
| Channel Side Slope:                 | 1 IN 3 |                   |                       |
| Slope:                              | 15     | %                 |                       |
| Flow (Q):                           | 0.91   | m <sup>3</sup> /s |                       |
| Velocity (V):                       | 3.44   | m/s               | Manning's Calculation |
| Depth of flow in channel ( $d_c$ ): | 0.225  | m                 | Manning's Calculation |

### TR 2013/018

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| Froude number ( $F_o$ )= $V/(g \times d_o)^{0.5}$       | = | 2.3154 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.29   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.58   | m |

### RIPRAP DIMENSIONS

|                                |      |   |                                                                                                    |
|--------------------------------|------|---|----------------------------------------------------------------------------------------------------|
| Riprap Diameter ( $d_s$ )=     | 0.29 | m | Note in accordance with TR2013/018 minimum D50 to be 0.15m and minimum RipRap thickness to be 0.3m |
| Thickness of Riprap ( $D_A$ )= | 0.58 | m |                                                                                                    |
| Total Channel Width=           | 1.85 | m |                                                                                                    |



## RIPRAP PROTECTION SIZING - TR 2013/018

|                     |                                                |            |    |      |            |
|---------------------|------------------------------------------------|------------|----|------|------------|
| <b>PROJECT NAME</b> | Delmore Development - STAGE 2B-2, 2B-3<br>& 2C | Created By | ZW | Date | 30/06/2025 |
| <b>PROJECT Nos:</b> | 3725                                           | Checked By | JK | Date | 30/06/2025 |

|                                                                                                                  |                                                                         |         |                       |
|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|---------|-----------------------|
| <b>Location:</b> <span style="border: 1px solid black; padding: 2px 10px; color: blue;">DISCHARGE POINT 6</span> |                                                                         |         |                       |
| Channel Width ( $W_o$ ):                                                                                         | <span style="border: 1px solid black; padding: 2px 10px;">0.5</span>    | m       |                       |
| Channel Side Slope:                                                                                              | <span style="border: 1px solid black; padding: 2px 10px;">1 IN 3</span> |         |                       |
| Slope:                                                                                                           | <span style="border: 1px solid black; padding: 2px 10px;">11.57</span>  | %       |                       |
| Flow (Q):                                                                                                        | <span style="border: 1px solid black; padding: 2px 10px;">2.04</span>   | $m^3/s$ |                       |
| Velocity (V):                                                                                                    | <span style="border: 1px solid black; padding: 2px 10px;">3.847</span>  | $m/s$   | Manning's Calculation |
| Depth of flow in channel( $d_c$ ):                                                                               | <span style="border: 1px solid black; padding: 2px 10px;">0.345</span>  | m       | Manning's Calculation |

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| <b><u>TR 2013/018</u></b>                               |   |        |   |
| Froude number ( $F_o$ )= $V/(g \times d_o)^{0.5}$       | = | 2.0911 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.26   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.52   | m |

|                                 |             |   |                                                      |
|---------------------------------|-------------|---|------------------------------------------------------|
| <b><u>RIPRAP DIMENSIONS</u></b> |             |   |                                                      |
| Riprap Diameter ( $d_s$ )=      | <b>0.26</b> | m | Note in accordance with TR2013/018 minimum D50 to be |
| Thickness of Riprap ( $D_A$ )=  | <b>0.52</b> | m | 0.15m and minimum RipRap thickness to be 0.3m        |
| Total Channel Width=            | <b>2.57</b> | m |                                                      |

## RIPRAP PROTECTION SIZING - TR 2013/018

|                     |                                             |            |    |      |            |
|---------------------|---------------------------------------------|------------|----|------|------------|
| <b>PROJECT NAME</b> | Delmore Development - STAGE 2B-2, 2B-3 & 2C | Created By | ZW | Date | 30/06/2025 |
| <b>PROJECT Nos:</b> | 3725                                        | Checked By | JK | Date | 30/06/2025 |

|                                                                                                |        |         |                       |
|------------------------------------------------------------------------------------------------|--------|---------|-----------------------|
| <b>Location:</b> <span style="border: 1px solid black; padding: 2px;">DISCHARGE POINT 8</span> |        |         |                       |
| Channel Width ( $W_o$ ):                                                                       | 0.5    | m       |                       |
| Channel Side Slope:                                                                            | 1 IN 3 |         |                       |
| Slope:                                                                                         | 10.6   | %       |                       |
| Flow (Q):                                                                                      | 0.07   | $m^3/s$ |                       |
| Velocity (V):                                                                                  | 1.491  | m/s     | Manning's Calculation |
| Depth of flow in channel ( $d_c$ ):                                                            | 0.067  | m       | Manning's Calculation |

|                                                         |   |        |   |
|---------------------------------------------------------|---|--------|---|
| <b><u>TR 2013/018</u></b>                               |   |        |   |
| Froude number ( $F_o$ )= $V/(g \times d_o)^{0.5}$       | = | 1.8391 |   |
| Riprap Diameter ( $d_s$ )= $0.25 \times W_o \times F_o$ | = | 0.23   | m |
| Thickness of Riprap ( $D_A$ )= $2 \times d_s$           | = | 0.46   | m |

|                                 |             |   |                                                                                                    |
|---------------------------------|-------------|---|----------------------------------------------------------------------------------------------------|
| <b><u>RIPRAP DIMENSIONS</u></b> |             |   |                                                                                                    |
| Riprap Diameter ( $d_s$ )=      | <b>0.23</b> | m | Note in accordance with TR2013/018 minimum D50 to be 0.15m and minimum RipRap thickness to be 0.3m |
| Thickness of Riprap ( $D_A$ )=  | <b>0.46</b> | m |                                                                                                    |
| Total Channel Width=            | <b>0.90</b> | m |                                                                                                    |