**Appendix G**
**Vertical Hydraulic Gradient Calculations in Vicinity of B716**
**Hoffmann-La Roche Inc., Nutley, NJ**

| Well ID | Total Depth (feet) | Measurement Date | Groundwater Elevation (feet amsl) | Vertical Hydraulic Gradient | Vertical Hydraulic Gradient |
|---|---|---|---|---|---|
| **Vertical Gradient Between Zone S1 and Zone S2** | | | | | |
| MW-106A | 13 | 10/7/15 | 90.70 | 0.2600 | |
| MW-106B | 34 | 10/7/15 | 96.16 | | |
| MW-99 | 20 | 10/7/15 | 92.29 | 0.003 | |
| MW-99B | 45 | 10/7/15 | 92.36 | | |
| MW-366A | 18 | 10/7/15 | 91.72 | 0.020 | |
| MW-366B | 45 | 10/7/15 | 92.26 | | |
| MW-142 | 26 | 10/7/15 | 92.40 | 0.000 | |
| MW-142B | 45 | 10/7/15 | 92.40 | | |
| MW-143 | 26.5 | 10/7/15 | 92.21 | 0.025 | |
| MW-143B | 50 | 10/7/15 | 92.80 | | |
| MW-304A | 20 | 10/7/15 | 91.27 | 0.024 | |
| MW-304B | 50 | 10/7/15 | 91.98 | | |
| MW-108A | 12 | 10/7/15 | 89.46 | 0.117 | |
| MW-108B | 33 | 10/7/15 | 91.92 | | |
| MW-144A | 16.4 | 10/7/15 | 92.00 | -0.009 | |
| MW-144B | 37 | 10/7/15 | 91.81 | | |
| MW-338A | 20 | 10/7/15 | 88.77 | 0.063 | |
| MW-338B | 50 | 10/7/15 | 90.65 | | |
| MW-367A | 15 | 10/7/15 | 89.17 | 0.093 | |
| MW-367B | 40 | 10/7/15 | 91.50 | | |
| MW-112 | 12 | 10/7/15 | 90.41 | 0.035 | |
| MW-112B | 43 | 10/7/15 | 91.48 | | |
| MW-171A | 35 | 10/7/15 | 86.87 | -0.001 | |
| MW-171B | 50 | 10/7/15 | 86.85 | | |
| MW-339A | 20 | 10/7/15 | 89.68 | 0.032 | |
| MW-339B | 50 | 10/7/15 | 90.63 | | |
| MW-257A | 25 | 10/7/15 | 86.72 | -0.034 | |
| MW-257B | 50 | 10/7/15 | 85.88 | | |
| MW-340A | 20 | 10/7/15 | 87.60 | 0.546 | |
| MW-340B | 50 | 10/7/15 | 103.99 | | |
| MW-145A | 27.5 | 10/7/15 | 78.92 | -0.011 | |
| MW-145B | 37.3 | 10/7/15 | 78.81 | | |
| **Vertical Gradient Between Zone S2 and Zone S3** | | | | | |
| MW-478B | 55 | 10/7/15 | 93.17 | 0.0069 | |
| MW-478C | 90 | 10/7/15 | 93.41 | | |
| MW-55B | 55 | 10/7/15 | 92.91 | 0.003 | |
| MW-55C | 90 | 10/7/15 | 93.01 | | |
| MW-99B | 45 | 10/7/15 | 92.36 | 0.009 | |
| MW-99C | 80 | 10/7/15 | 92.66 | | |
| MW-366B | 45 | 10/7/15 | 92.26 | 0.018 | |
| MW-366C | 85 | 10/7/15 | 93.00 | | |
| MW-142B | 45 | 10/7/15 | 92.40 | 0.033 | |
| MW-142C | 80 | 10/7/15 | 93.56 | | |
| MW-143B | 50 | 10/7/15 | 92.80 | -0.014 | |
| MW-143C | 85 | 10/7/15 | 92.32 | | |
| MW-336B | 28 | 10/7/15 | 99.01 | -0.172 | |
| MW-336C | 70 | 10/7/15 | 91.78 | | |
| MW-304B | 50 | 10/7/15 | 91.98 | 0.022 | |
| MW-304C | 90 | 10/7/15 | 92.86 | | |
| MW-338B | 50 | 10/7/15 | 90.65 | -0.006 | |
| MW-338C | 90 | 10/7/15 | 90.42 | | |
| MW-367-S2 | 50 | 10/7/15 | 91.42 | 0.012 | |
| MW-367-S3 | 80 | 10/7/15 | 91.77 | | |
| MW-367B | 40 | 10/7/15 | 91.50 | 0.037 | |
| MW-367C | 70 | 10/7/15 | 92.60 | | |
| MW-337B | 28 | 10/7/15 | 91.69 | 0.019 | |
| MW-337C | 75 | 10/7/15 | 92.59 | | |
| MW-112B | 43 | 10/7/15 | 91.48 | 0.029 | |
| MW-112C | 80 | 10/7/15 | 92.55 | | |
| MW-171B | 50 | 10/7/15 | 86.85 | 0.063 | |
| MW-171C | 80 | 10/7/15 | 88.74 | | |
| MW-339B | 50 | 10/7/15 | 90.63 | -0.012 | |
| MW-339C | 90 | 10/7/15 | 90.15 | | |
| MW-340B | 50 | 10/7/15 | 103.99 | -0.861 | |
| MW-340C | 90 | 10/7/15 | 69.54 | | |
| MW-145B | 37.3 | 10/7/15 | 78.81 | -0.209 | |
| MW-145C | 90 | 10/7/15 | 67.82 | | |

**Appendix G**
**Vertical Hydraulic Gradient Calculations in Vicinity of B716**
**Hoffmann-La Roche Inc., Nutley, NJ**

| Well ID | Total Depth (feet) | Measurement Date | Groundwater Elevation (feet amsl) | Vertical Hydraulic Gradient | Vertical Hydraulic Gradient |
|---|---|---|---|---|---|
| **Vertical Gradient Between Zone S3 and Zone D1** | | | | | |
| MW-304C | 90 | 10/7/15 | 92.86 | 0.0003 | |
| DW-47A | 125 | 10/7/15 | 92.87 | | |
| MW-99C | 80 | 10/7/15 | 92.66 | 0.006 | |
| DW-51A | 135 | 10/7/15 | 93.01 | | |
| MW-366C | 85 | 10/7/15 | 93.00 | -0.002 | |
| DW-52A | 130 | 10/7/15 | 92.91 | | |
| MW-429C | 70 | 10/7/15 | 92.24 | 0.011 | |
| DW-63A | 186 | 10/7/15 | 93.48 | | |
| MW-142C | 80 | 10/7/15 | 93.56 | 0.005 | |
| DW-53A | 140 | 10/7/15 | 93.85 | | |
| MW-145C | 90 | 10/7/15 | 67.82 | 0.016 | |
| DW-49A | 125 | 10/7/15 | 68.38 | | |
| MW-367C | 70 | 10/7/15 | 92.60 | 0.009 | |
| DW-55A | 130 | 10/7/15 | 93.15 | | |
| MW-337C | 75 | 10/7/15 | 92.59 | 0.008 | |
| DW-25A | 140 | 10/7/15 | 93.09 | | |
| MW-112C | 80 | 10/7/15 | 92.55 | -1.090 | |
| DW-25-D1 | 101 | 10/7/15 | 69.65 | | |
| MW-143C | 85 | 10/7/15 | 92.32 | -0.072 | |
| DW-54A | 150 | 10/7/15 | 87.64 | | |
| **Vertical Gradient Between Zone D1 and Zone D2** | | | | | |
| DW-25-D1 | 101 | 10/7/15 | 69.65 | 0.132 | |
| DW-25B | 225 | 10/7/15 | 86.03 | | |

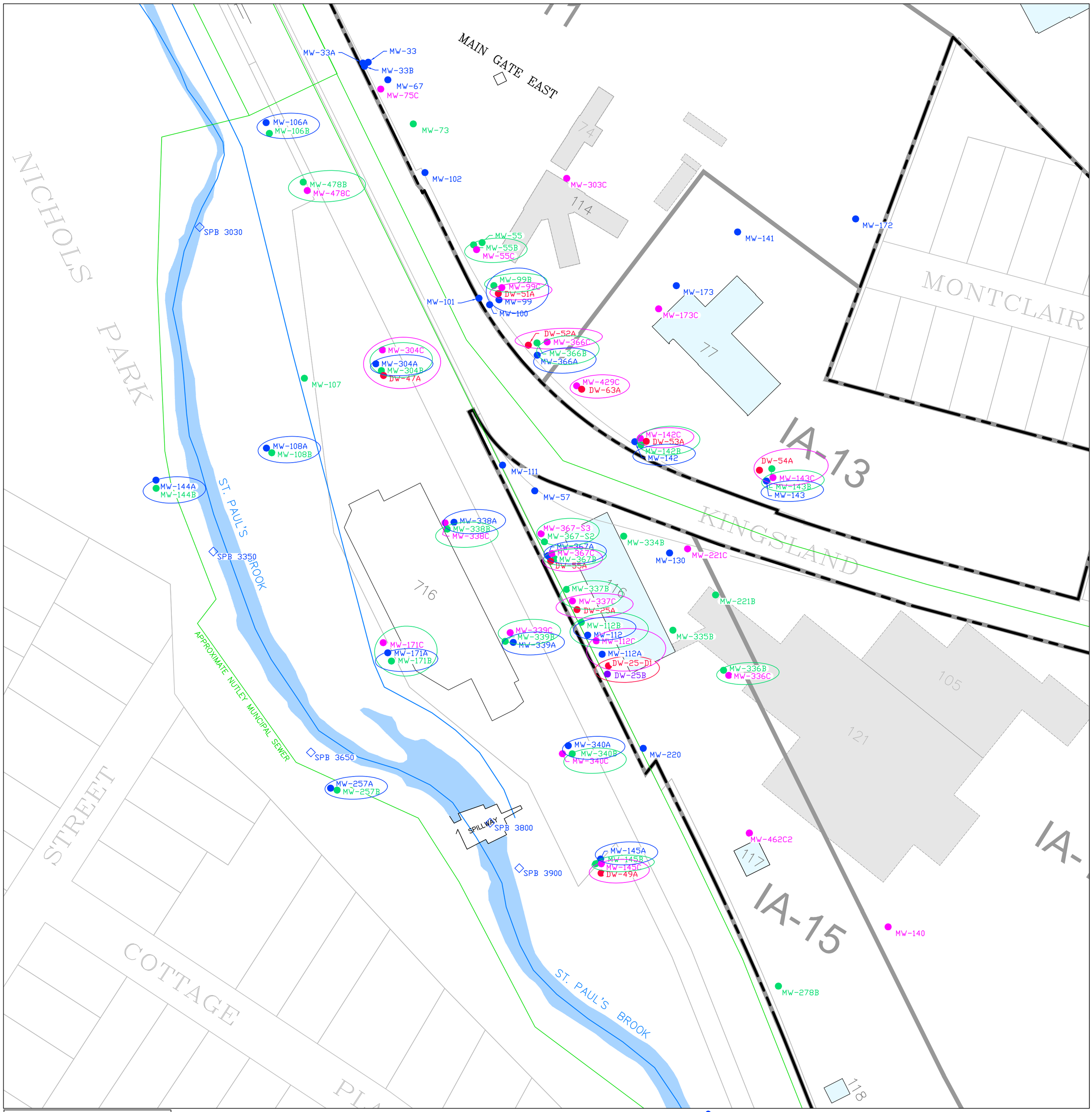
Vertical hydraulic gradients were calculated for each well pair as follows:

$$\frac{\textit{Deep Well Ground Water Elev. (ft) - Shallow Well Ground Water Elev. (ft)}}{\textit{Deep Well Total Depth (ft) - Shallow Well Total Depth (ft)}} = \textit{Vertical Hydraulic Gradient (ft/ft)}$$

Positive values indicate upward gradients and negative values indicate downward gradients

(Todd, D.K., Ground-Water Hydrology, 1980)

| Vertical Hydraulic Gradient Key | |
|---|---|
| Upward Gradient | |
| Downward Gradient | |




NORTH KEY MAP

KEY PLAN

INDICATES AREA OF THIS DRAWING

## LEGEND

- PROPERTY LINE
- DEMOLISHED BUILDING
- EXISTING BUILDING
- MUNICIPAL STORM SEWER (VALLEY DRAIN)
- CLIFTON–ALLWOOD MUNICIPAL SEWER

NOTES:
1. AMSL = ABOVE MEAN SEA LEVEL.
2. BMSL = BELOW MEAN SEA LEVEL.
3. ONLY WELLS IN ZONES S1–D2 ARE SHOWN.

- MW-112 ZONE S1 MONITORING WELL (SCREENED >80' AMSL)
- MW-112B ZONE S2 MONITORING WELL (SCREENED 80'–50' AMSL)
- MW-112C ZONE S3 MONITORING WELL (SCREENED 50'–0' AMSL)
- DW-25A ZONE D1 MONITORING WELL (SCREENED 0'–100' BMSL)
- DW-25B ZONE D2 MONITORING WELL (SCREENED 100'–250' BMSL)
- ZONE S1/S2 WELLS EVALUATED FOR VERTICAL HYDRAULIC GRADIENT
- ZONE S2/S3 WELLS EVALUATED FOR VERTICAL HYDRAULIC GRADIENT
- ZONE S3/D1 WELLS EVALUATED FOR VERTICAL HYDRAULIC GRADIENT
- ZONE D1/D2 WELLS EVALUATED FOR VERTICAL HYDRAULIC GRADIENT

TRC ENVIRONMENTAL CORP.
41 SPRING STREET
NEW PROVIDENCE, NEW JERSEY 07974
908–988–1700

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| 1 | 7/28/16 | MG | SUBMITTED FOR 2016 GWPR ADDENDUM |
| 0 | 4/1/16 | MG | DRAFT ISSUED FOR REVIEW |

DESIGN SUPERVISOR
PROJECT ENGINEER

PROJECT TITLE
NUTLEY SITE
REMEDIATION PROJECT

| INITIATOR | DRAWN BY | CHECKED BY | PROJECT ENGINEER |
|---|---|---|---|
| T. O'MEARA | M. GIAMBATTISTA | L.NUNES | G. CIERPIAL |
| | START DATE 4/1/16 | SUPERVISOR D.NACHMAN | |

THIS DRAWING AND ALL INFORMATION THEREON IS THE PROPERTY OF HOFFMANN–LA ROCHE INC. AND IS CONFIDENTIAL AND MUST NOT BE MADE PUBLIC OR COPIED UNLESS AUTHORIZED BY ROCHE AND IS SUBJECT TO RETURN ON DEMAND.

DRAWING TITLE
APPENDIX G – FIGURE 1
B716 HYDRAULIC GRADIENT
S1–D2 MEASUREMENT LOCATIONS

SCALE 1" = 64'

BLDG. NO. –

PREPARED FOR Hoffmann–La Roche Inc.
340 KINGSLAND STREET NUTLEY, NEW JERSEY 07110–1199

DRAWING NO. NC–STE–S29215–C2527

1

FILE:M:\Cad Files\Vision projects\105009\Site Wide Ground Water RIR\REPORT FIGURES\IRM PERIOD SAMPLING\B716\GWE\Hydraulic Gradient, DATE:7/28/2016 11:58:42 AM