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**To:** [Greg Blaylock](#)  
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**Subject:** Perc Test Results and Key Trench Depth Determination  
**Date:** Thursday, February 03, 2011 4:46:51 PM  
**Attachments:** [DN-ND-29 Temp-Percolation Test Locations.pdf](#)  
[North Dam Percolation Test Results Final.xls](#)

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Greg

The percolation tests along the key trench footprint of the North Dam have been completed and the test data have been analyzed and reviewed. The test results are presented in the attached spreadsheet as well as the PDF drawing for your information.

Please note that all the drill logs are not yet complete, and will take another few days to be finished as the field lab is running at capacity, with the bottleneck being the moisture content determinations. None-the less, we believe that we have sufficient information to make a call on whether a design modification on the key trench is required.

In determining whether a design modification is required, the following design considerations were taken into consideration:

1. The evaporator pipes must have a constant slope along the base of the key trench and that slope cannot be less than 5% (1:20). The only slope change allowed is at the north and south end where the pipes turn towards the radiators, but still these slopes cannot be less than 5%.
2. The base of the key trench should be at least 1.0 m below the static level observed in the percolation tests in all upstream locations.
3. The inflection point between the north and south evaporator pipe sets must not change.
4. The bottom liner must be below original ground at any point along the dam alignment.

Taking these elements into consideration, and after taking into account the percolation test results, as well as the drill logs completed to date we conclude that NO CHANGE is justified to the current key trench design grades. We have discussed this with our colleagues at EBA and they are in agreement with our conclusion.

Notwithstanding this statement, it should be noted that additional excavation of the central section of the key trench will be required to remove organic material at depth (i.e. the "peat" zone identified on our drawings between chainage 0+90 and 1+05). Exact guidelines pertaining to the extent of this excavation will be provided in the coming days as we obtain the rest of the lab test data to complete the drill logs. In addition, there may be some additional excavation required between chainage 0+60 and 0+80 along the downstream side where the key trench is at its shallowest. A field determination as to the extent of additional excavation will be made once the initial excavation has been completed.

Should you require further explanation of our conclusions we would be happy to convene a conference call tomorrow to discuss the matter.

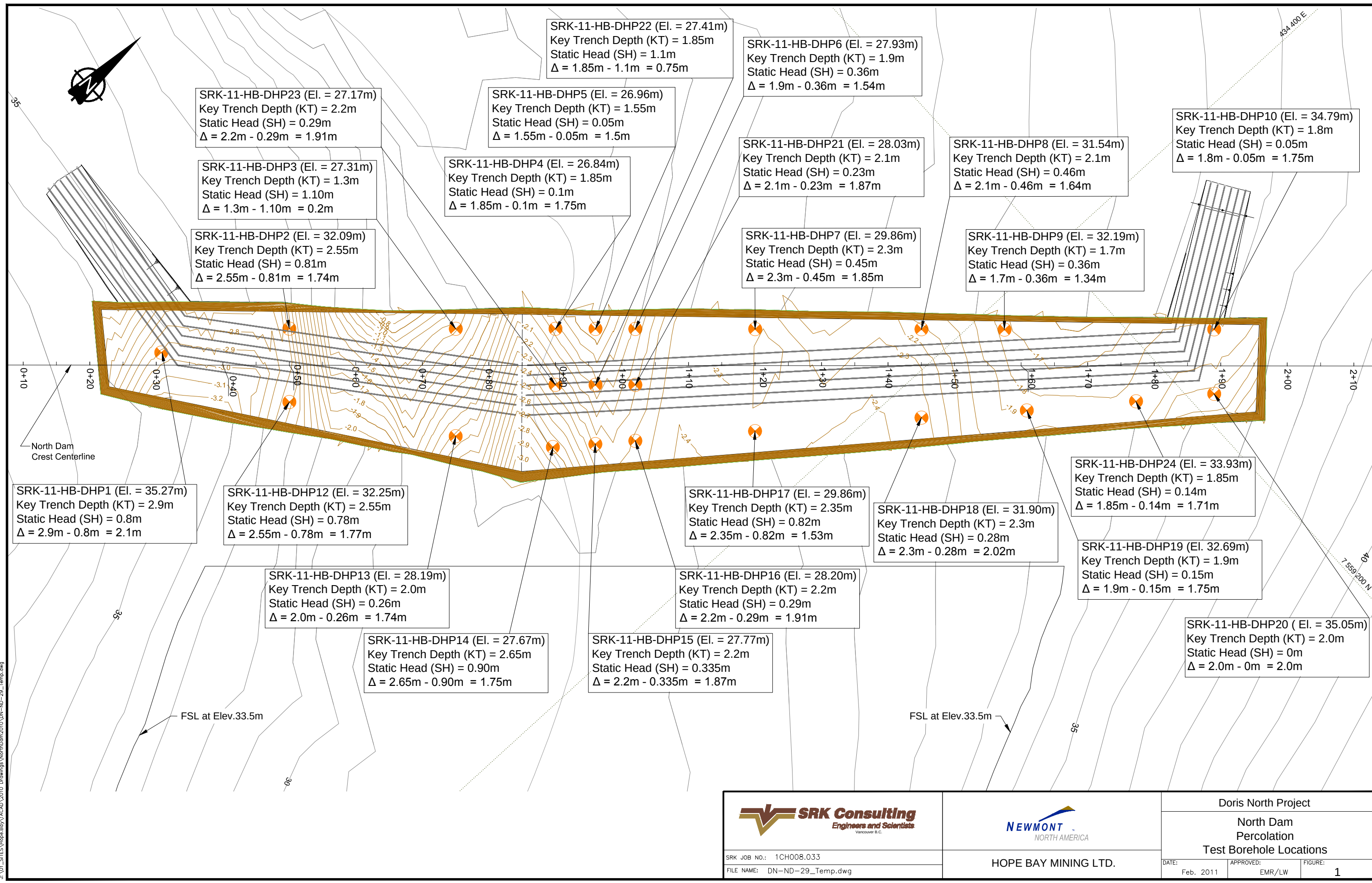
Regards

Maritz

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| BH # | Sta.        | Northing<br>(m) | Easting<br>(m) | Ground<br>Elev. (m) | Date of<br>Reading | Time of<br>Reading | Elapsed<br>Time (min) | Water Drop<br>(m) |  |
|------|-------------|-----------------|----------------|---------------------|--------------------|--------------------|-----------------------|-------------------|--|
| 1    | 0+30        | 7,559,090.0     | 434,321.1      | 35.191              | 30-Jan-11          | 11:35              | 0                     | 0.000             |  |
|      |             |                 |                |                     | 30-Jan-11          | 11:36              | 1                     | -0.200            |  |
|      |             |                 |                |                     | 30-Jan-11          | 11:37              | 2                     | -0.340            |  |
|      |             |                 |                |                     | 30-Jan-11          | 11:40              | 5                     | -0.600            |  |
|      |             |                 |                |                     | 30-Jan-11          | 11:45              | 10                    | -0.690            |  |
|      |             |                 |                |                     | 30-Jan-11          | 11:50              | 15                    | -0.720            |  |
|      |             |                 |                |                     | 30-Jan-11          | 12:05              | 30                    | -0.760            |  |
|      |             |                 |                |                     | 30-Jan-11          | 12:20              | 45                    | -0.800            |  |
|      |             |                 |                |                     | 30-Jan-11          | 12:35              | 60                    | -0.800            |  |
|      |             |                 |                |                     | 30-Jan-11          | 13:00              | 85                    | -0.810            |  |
|      |             |                 |                |                     | 30-Jan-11          | 14:58              | 203                   | -0.800            |  |
| 2    | 0+50        | 7,559,107.0     | 434,331.4      | 32.446              | 30-Jan-11          | 12:20              | 3225                  | ice               |  |
|      |             |                 |                |                     | 30-Jan-11          | 12:13              | 0                     | -0.200            |  |
|      |             |                 |                |                     | 30-Jan-11          | 12:14              | 1                     | -0.480            |  |
|      |             |                 |                |                     | 30-Jan-11          | 12:15              | 2                     | -0.560            |  |
|      |             |                 |                |                     | 30-Jan-11          | 12:18              | 5                     | -0.640            |  |
|      |             |                 |                |                     | 30-Jan-11          | 12:23              | 10                    | -0.720            |  |
|      |             |                 |                |                     | 30-Jan-11          | 12:34              | 21                    | -0.750            |  |
|      |             |                 |                |                     | 30-Jan-11          | 12:43              | 30                    | -0.780            |  |
|      |             |                 |                |                     | 30-Jan-11          | 13:05              | 52                    | -0.810            |  |
|      |             |                 |                |                     | 30-Jan-11          | 15:00              | 167                   | -0.810            |  |
|      |             |                 |                |                     | 30-Jan-11          | 16:10              | 237                   | -0.810            |  |
| 3    | 0+75        | 7,559,126.0     | 434,346.2      | 27.231              | 30-Jan-11          | 17:20              | 3187                  | -0.810            |  |
|      |             |                 |                |                     | 30-Jan-11          | 16:35              | 0                     | 0.000             |  |
|      |             |                 |                |                     | 30-Jan-11          | 16:34              | 1                     | -0.520            |  |
|      |             |                 |                |                     | 30-Jan-11          | 16:35              | 2                     | -0.870            |  |
|      |             |                 |                |                     | 30-Jan-11          | 16:38              | 5                     | -0.930            |  |
|      |             |                 |                |                     | 30-Jan-11          | 16:43              | 10                    | -0.930            |  |
|      |             |                 |                |                     | 30-Jan-11          | 16:48              | 15                    | -0.930            |  |
|      |             |                 |                |                     | 30-Jan-11          | 17:03              | 30                    | -0.930            |  |
|      |             |                 |                |                     | 30-Jan-11          | 17:18              | 45                    | -0.930            |  |
|      |             |                 |                |                     | 30-Jan-11          | 17:31              | 58                    | -0.930            |  |
|      |             |                 |                |                     | 30-Jan-11          | 18:03              | 90                    | -0.930            |  |
| 4    | 0+90        | 7,559,137.0     | 434,356.2      | 26.773              | 30-Jan-11          | 17:20              | 2927                  | -1.100            |  |
|      |             |                 |                |                     | 30-Jan-11          | 16:57              | 0                     | 0.000             |  |
|      |             |                 |                |                     | 30-Jan-11          | 16:58              | 1                     | -0.040            |  |
|      |             |                 |                |                     | 30-Jan-11          | 16:59              | 2                     | -0.060            |  |
|      |             |                 |                |                     | 30-Jan-11          | 17:02              | 5                     | -0.060            |  |
|      |             |                 |                |                     | 30-Jan-11          | 17:07              | 10                    | -0.070            |  |
|      |             |                 |                |                     | 30-Jan-11          | 17:18              | 21                    | -0.080            |  |
|      |             |                 |                |                     | 30-Jan-11          | 17:27              | 30                    | -0.100            |  |
|      |             |                 |                |                     | 30-Jan-11          | 18:01              | 64                    | -0.100            |  |
|      |             |                 |                |                     | 30-Jan-11          | 18:40              | 103                   | -0.100            |  |
|      |             |                 |                |                     | 1-Feb-11           | 17:20              | 2903                  | ice               |  |
| 5    | 0+96        | 7,559,141.0     | 434,362.2      | 27.192              | 30-Jan-11          | 17:47              | 0                     | 0.000             |  |
|      |             |                 |                |                     | 30-Jan-11          | 17:48              | 1                     | -0.010            |  |
|      |             |                 |                |                     | 30-Jan-11          | 17:49              | 2                     | -0.040            |  |
|      |             |                 |                |                     | 30-Jan-11          | 17:57              | 10                    | -0.050            |  |
|      |             |                 |                |                     | 1-Feb-11           | 17:20              | 2853.0                | ice               |  |
|      |             |                 |                |                     | 30-Jan-11          | 12:44              | 0                     | 0.000             |  |
|      |             |                 |                |                     | 31-Jan-11          | 12:45              | 1                     | -0.090            |  |
|      |             |                 |                |                     | 31-Jan-11          | 12:46              | 2                     | -0.230            |  |
|      |             |                 |                |                     | 31-Jan-11          | 12:49              | 5                     | -0.300            |  |
|      |             |                 |                |                     | 31-Jan-11          | 12:54              | 10                    | -0.330            |  |
|      |             |                 |                |                     | 31-Jan-11          | 12:59              | 15                    | -0.360            |  |
| 6    | 1+02        | 7,559,145.0     | 434,366.5      | 27.854              | 31-Jan-11          | 14:05              | 81                    | -0.360            |  |
|      |             |                 |                |                     | 31-Jan-11          | 14:05              | 81                    | -0.360            |  |
|      |             |                 |                |                     | 1-Feb-11           | 17:30              | 1726                  | ice               |  |
|      |             |                 |                |                     | 1-Feb-11           | 12:05              | 0                     | 0.000             |  |
|      |             |                 |                |                     | 1-Feb-11           | 12:06              | 1                     | -0.230            |  |
|      |             |                 |                |                     | 1-Feb-11           | 12:09              | 4                     | -0.300            |  |
|      |             |                 |                |                     | 1-Feb-11           | 12:19              | 14                    | -0.410            |  |
|      |             |                 |                |                     | 1-Feb-11           | 12:41              | 36                    | -0.440            |  |
|      |             |                 |                |                     | 1-Feb-11           | 13:15              | 70                    | -0.440            |  |
|      |             |                 |                |                     | 1-Feb-11           | 17:30              | 325                   | -0.450            |  |
|      |             |                 |                |                     | 31-Jan-11          | 13:27              | 0                     | 0.000             |  |
| 7    | 1+45        | 7,559,177.0     | 434,395.6      | 31.506              | 31-Jan-11          | 13:28              | 1                     | -0.300            |  |
|      |             |                 |                |                     | 31-Jan-11          | 13:29              | 2                     | -0.350            |  |
|      |             |                 |                |                     | 31-Jan-11          | 13:32              | 5                     | -0.380            |  |
|      |             |                 |                |                     | 31-Jan-11          | 13:37              | 10                    | -0.410            |  |
|      |             |                 |                |                     | 31-Jan-11          | 13:42              | 15                    | -0.450            |  |
|      |             |                 |                |                     | 31-Jan-11          | 14:09              | 42                    | -0.460            |  |
|      |             |                 |                |                     | 1-Feb-11           | 17:00              | 1653                  | ice               |  |
|      |             |                 |                |                     | 31-Jan-11          | 13:48              | 0                     | 0.000             |  |
|      |             |                 |                |                     | 31-Jan-11          | 13:49              | 1                     | -0.250            |  |
|      |             |                 |                |                     | 31-Jan-11          | 13:50              | 2                     | -0.300            |  |
|      |             |                 |                |                     | 31-Jan-11          | 13:57              | 9                     | -0.360            |  |
| 8    | 1+65        | 7,559,186.0     | 434,404.0      | 32.069              | 31-Jan-11          | 14:19              | 31                    | -0.360            |  |
|      |             |                 |                |                     | 1-Feb-11           | 16:58              | 1630                  | ice               |  |
|      |             |                 |                |                     | 31-Jan-11          | 13:49              | 0                     | 0.000             |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:50              | 1                     | 0.000             |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:51              | 2                     | 0.000             |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
| 9    | 1+89        | 7,559,210.0     | 434,424.9      | 34.542              | 28-Jan-11          | 13:49              | 0                     | 0.000             |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:50              | 1                     | 0.000             |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:51              | 2                     | 0.000             |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
| 10   | 1+89        | 7,559,210.0     | 434,424.9      | 34.542              | 28-Jan-11          | 13:49              | 0                     | 0.000             |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:50              | 1                     | 0.000             |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:51              | 2                     | 0.000             |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
|      |             |                 |                |                     | 28-Jan-11          | 13:57              | 8                     | -0.050            |  |
| 11   | Not drilled |                 |                |                     | 30-Jan-11          | 10:58              | 0                     | -0.240            |  |
|      |             |                 |                |                     | 30-Jan-11          | 10:57              | 1                     | -0.440            |  |
|      |             |                 |                |                     | 30-Jan-11          | 10:59              | 3                     | -0.510            |  |
|      |             |                 |                |                     | 30-Jan-11          | 11:01              | 5                     | -0.570            |  |
|      |             |                 |                |                     | 30-Jan-11          | 11:07              | 11                    | -0.700            |  |
|      |             |                 |                |                     |                    |                    |                       |                   |  |