TECHNICAL NOTE 2009/26

Department of Water, Land and Biodiversity Conservation

GROUNDWATER FLOW MAPPING ACROSS THE MOUNT LOFTY RANGES

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INTRODUCTION

The National Water Initiative funded project: *Improve the knowledge of groundwater flow mechanisms in fractured rock aquifers in the Mount Lofty Ranges, Northern Adelaide Plains, and Kangaroo Island,* aims to improve management of groundwater resources in fractured rock aquifers by increasing the understanding of groundwater flow mechanisms occurring in these systems. Groundwater flow mapping across the Mount Lofty Ranges is one component of the groundwater flow across faults sub project.

The Mount Lofty Ranges provides important surface water and groundwater resources for domestic, industrial and agricultural purposes locally, as well as metropolitan Adelaide's reticulated water supply. As such, water allocation in these areas needs to be actively managed to ensure that current and future uses of these resources are sustainable and that the environment is also recognised as a user of the resource.

Groundwater migration across the Para and Eden-Burnside Faults from the Mount Lofty Ranges to the sedimentary aquifers of the Northern Adelaide Plains, Adelaide Plains and McLaren Vale areas provides a significant amount of recharge to these aquifers. The processes occurring and the spatial extent of these recharge zones are not well understood. In addition, areas of the Mount Lofty Ranges adjacent to the fault are not presently managed as potential areas of recharge.

Mapping of groundwater flow systems along several transects across the Mount Lofty Ranges can assist in defining the spatial extent of these recharge zones by outlining local, intermediate and regional groundwater flow paths.

This technical note presents five groundwater flow transects through the margin of the Mount Lofty Ranges and the methodology used to construct these transects.

METHOD

This investigation took the form of a desktop study. Five east-west transects extending from the eastern margin of the Mount Lofty Ranges (MLR) across the Adelaide Plains (Figure 1), were constructed to identify local, intermediate and regional groundwater flow paths;

1. Wells throughout the MLR were selected from the SAGeodata database. Wells were only selected if they had a water level measured in the last 15 years. The reason for this is that water levels fluctuate significantly over time and comparing historic water levels to present water levels cannot be done accurately. The selected wells were saved in a shapefile format with well attributes.

2. Six east-west transects were drawn across the MLR. ArcMAP™ version 9.2 was used to select wells from the generated shapefile within a 250 m buffer distance of a transect. The position of these wells was then projected vertically onto the generated transect assigning them new x and y coordinates. Using the 25m digital elevation model (DEM) of the MLR a spot height for each well was generated, this presented as an additional field in the attribute table.

3. The attribute table of these wells was exported to a spreadsheet. This file was then loaded into SAgeodata creating a new Group Code, recording all selected wells which were relevant to the investigation.

4. Microsoft Access was used to extract the wells of the Group Code from the database along with the following attributes: ground elevation, latest SWL (standing water level- usually measured from top of casing- TOC) and date, reduced standing water level (RSWL typically mAHD), casing height, production zone from and to (length of screen in the well), aquifer monitored, latest well depth, electrical conductivity (EC) and date of EC measure, date constructed.

5. The Microsoft Access table was exported to a spreadsheet. In addition to these attributes, additional fields were created for the new x and y coordinates generated from ArcMAP. Well unit numbers from the ArcMAP attribute table and the Microsoft access table were manually matched and any duplicates were removed. Additional fields were added to the spreadsheet for: Cumulative Distance (along transect), Production Zone Length, Production Zone Mid-Length (production zone length divided by 2) and Reduced Production Zone Mid-Length (production zone mid length as referenced to mAHD)

6. Once this table had been completed with the appropriate fields, wells with no record of DTW, SWL or depth were removed and the production zone was made equal to maximum depth if unknown. The surveyed elevation data was used over the height generated by DEM for the ground elevation of the well, and corrected eastings and northings from the transect line were used.

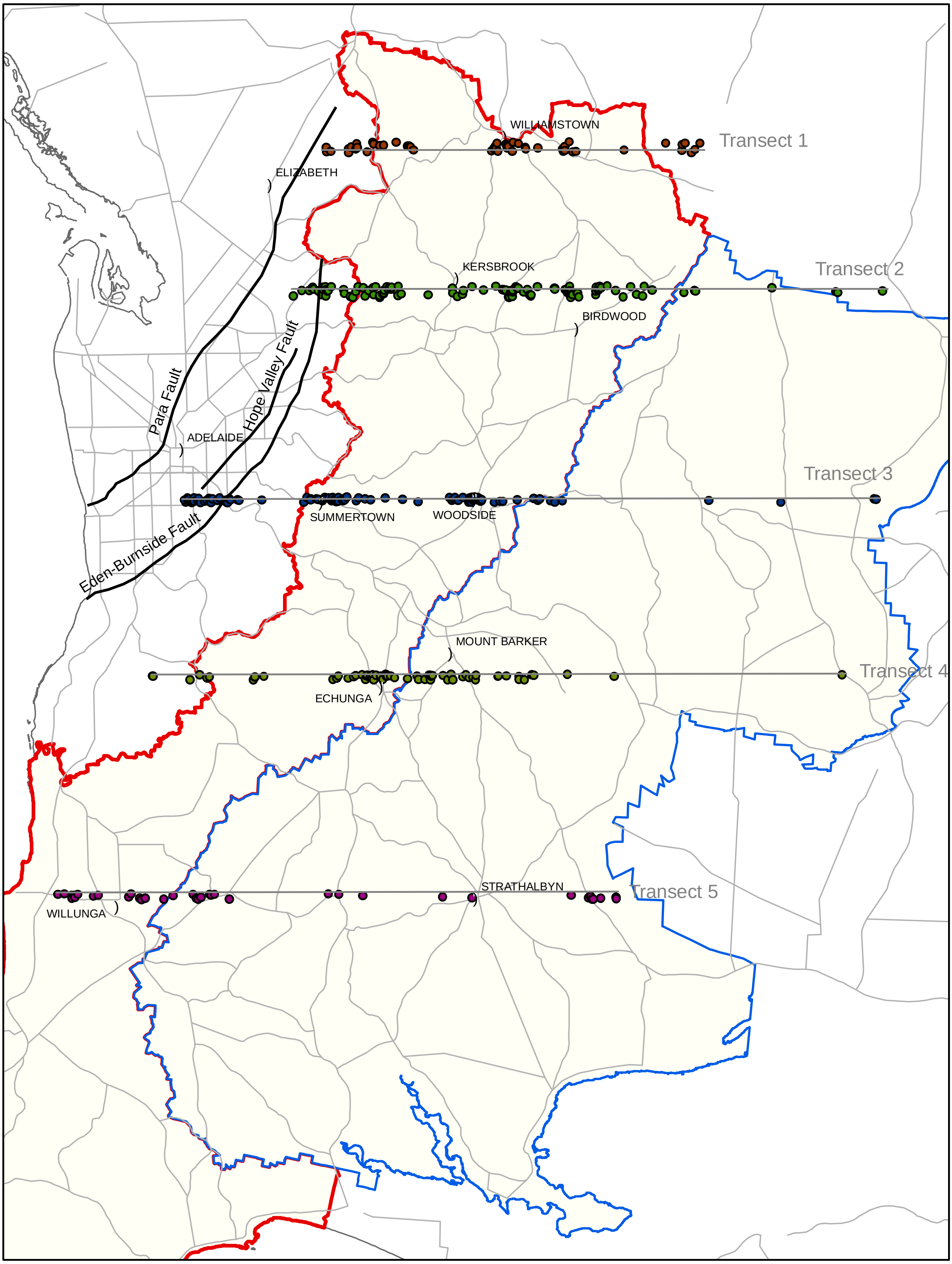
7. A graph was produced with the elevation, RSWL, reduced production mid zone on the vertical axis and the eastings on the horizontal axis. Error bars were used on the reduced production mid-zone series to show the length of the production zone. Each well was labelled at the mid-production zone with its RSWL.

8. The graph was then imported into CorelDRAW, where each element of the graph was digitised.

9. Lines of equal potential at suitable intervals were hand drawn based on the RSWL at the reduced production mid-zone (see Appendix A), these lines are perpendicular to the water

table. Following this, the equipotential lines were digitised onto the figure using the CorelDRAW package.

10. A cross-section of the structural geology along the transect was also completed based on digitised geological maps, which included outcrops, rock types and descriptions, and faults.
11. Details on the strike and dip of the lithology were collected from hard copy geological maps.
12. The geological cross-section was exported into CorelDRAW and the coordinates of the equipotential transect were underlain with the geological cross-section.
13. The structural geology was then digitised into CorelDRAW, and the cross-section was colour coded to represent different geological units.
14. Local, intermediate and regional groundwater flow paths were drawn perpendicular to lines of equal potential from high to low potential.



) Localities
Transect1
Transect2
Transect3
Transect4
Transect5
Major Roads
Eastern Mount Lofty Ranges
Western Mount Lofty Ranges

Figure 1. Groundwater Flow Transects

Produced By: Mt Lofty Ranges Team
Knowledge and Information Division
Department of Water, Land and Biodiversity Conservation
Projection: Transverse Mercator
Datum: Geocentric Datum of Australia 1994
Date: October 2008

0 4 8 12 16 20 km

Government of South Australia
Department of Water, Land and Biodiversity Conservation

M:\Projects_GWM\Mt_Lofty_Ranges\GWFlowmapping\gw_flow_mapping.mxd October 2008 S.Stewart

RESULTS

Figures 2 through 6 depict local, intermediate and regional groundwater flow paths across the Mount Lofty Ranges.

These figures will provide the basis for the sub-program in the NWI project *Groundwater Flow Across Faults*.

Figure 2. Transect 1

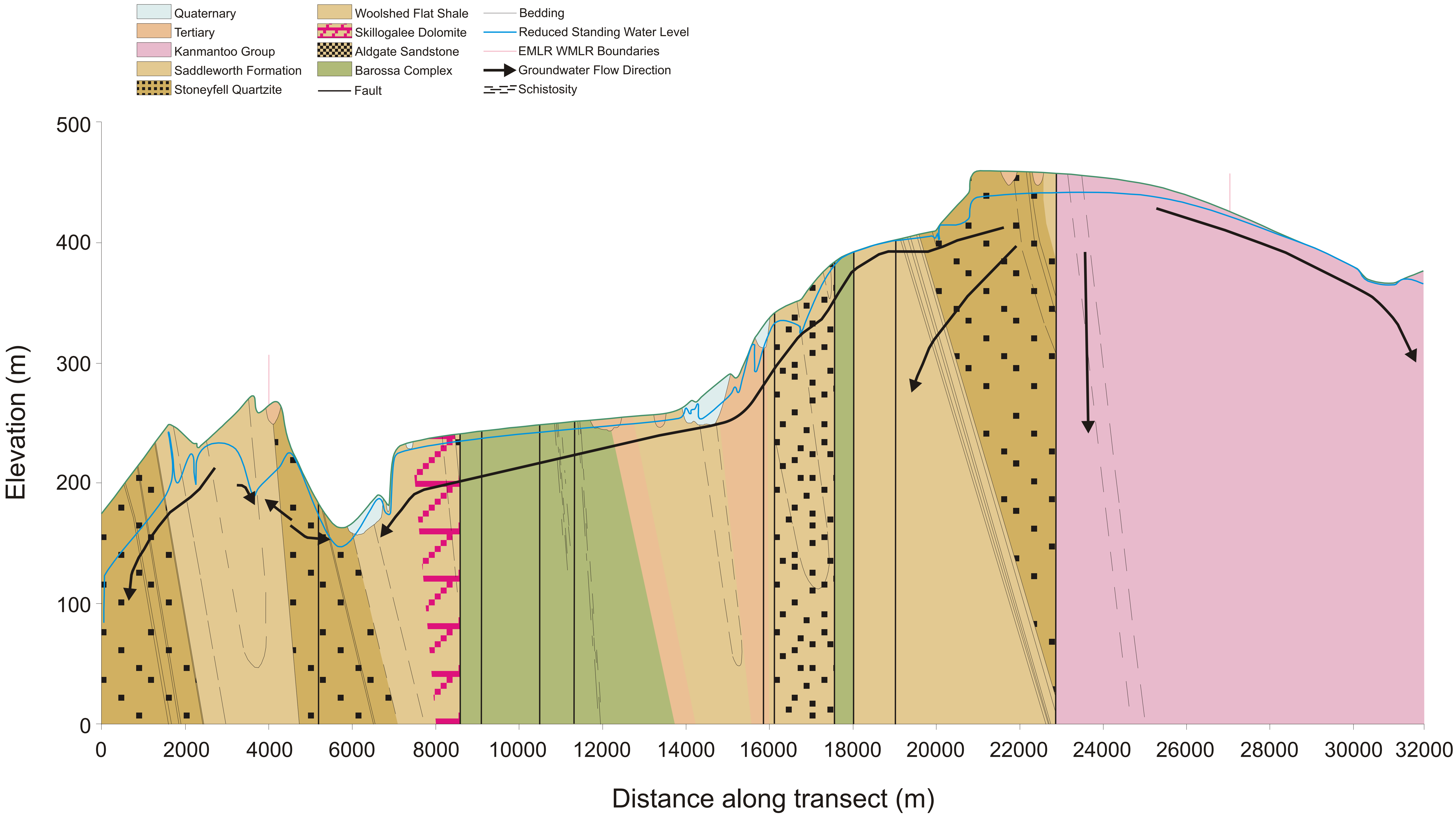


Figure 3. Transect 2

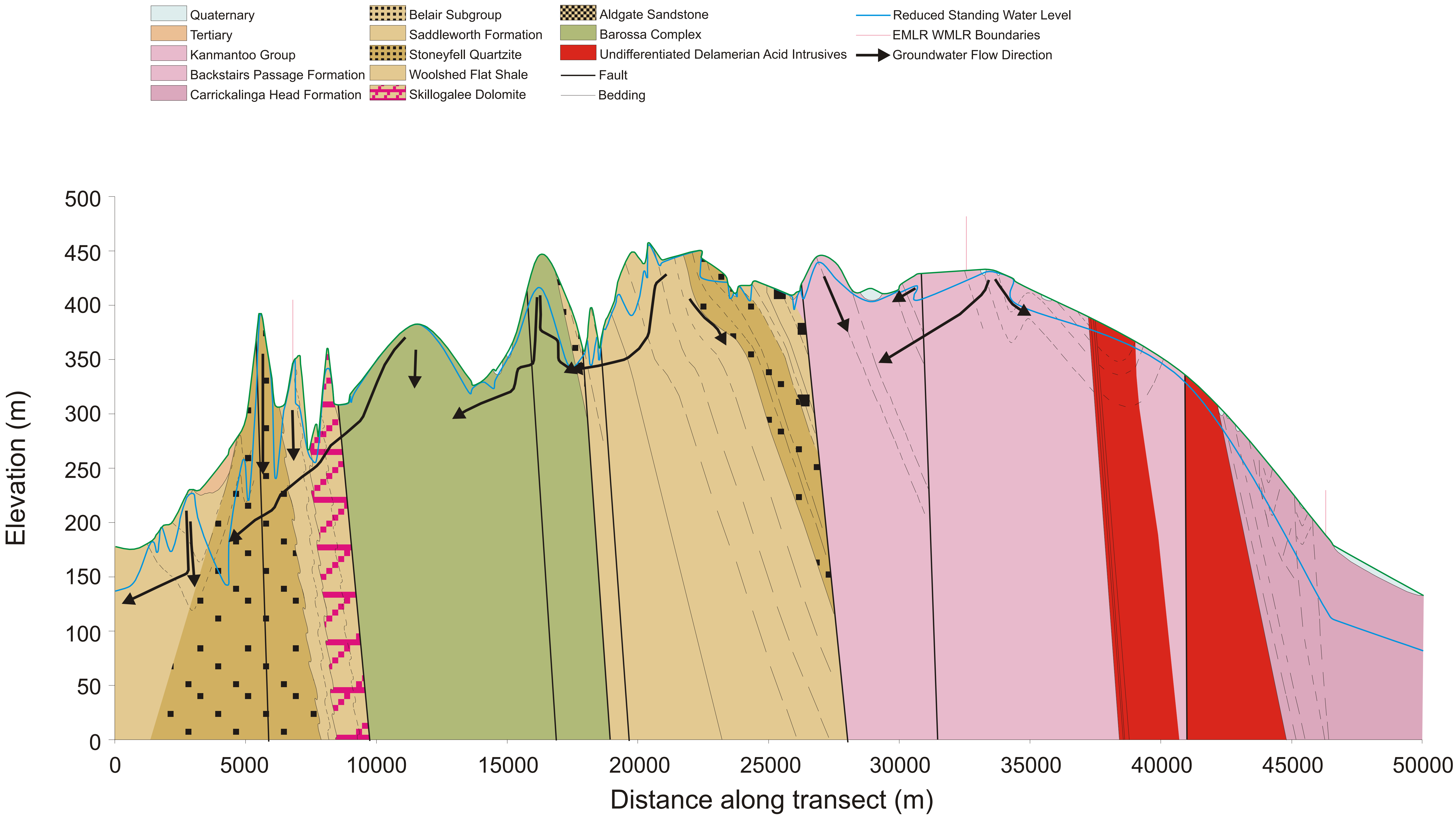


Figure 4. Transect 3

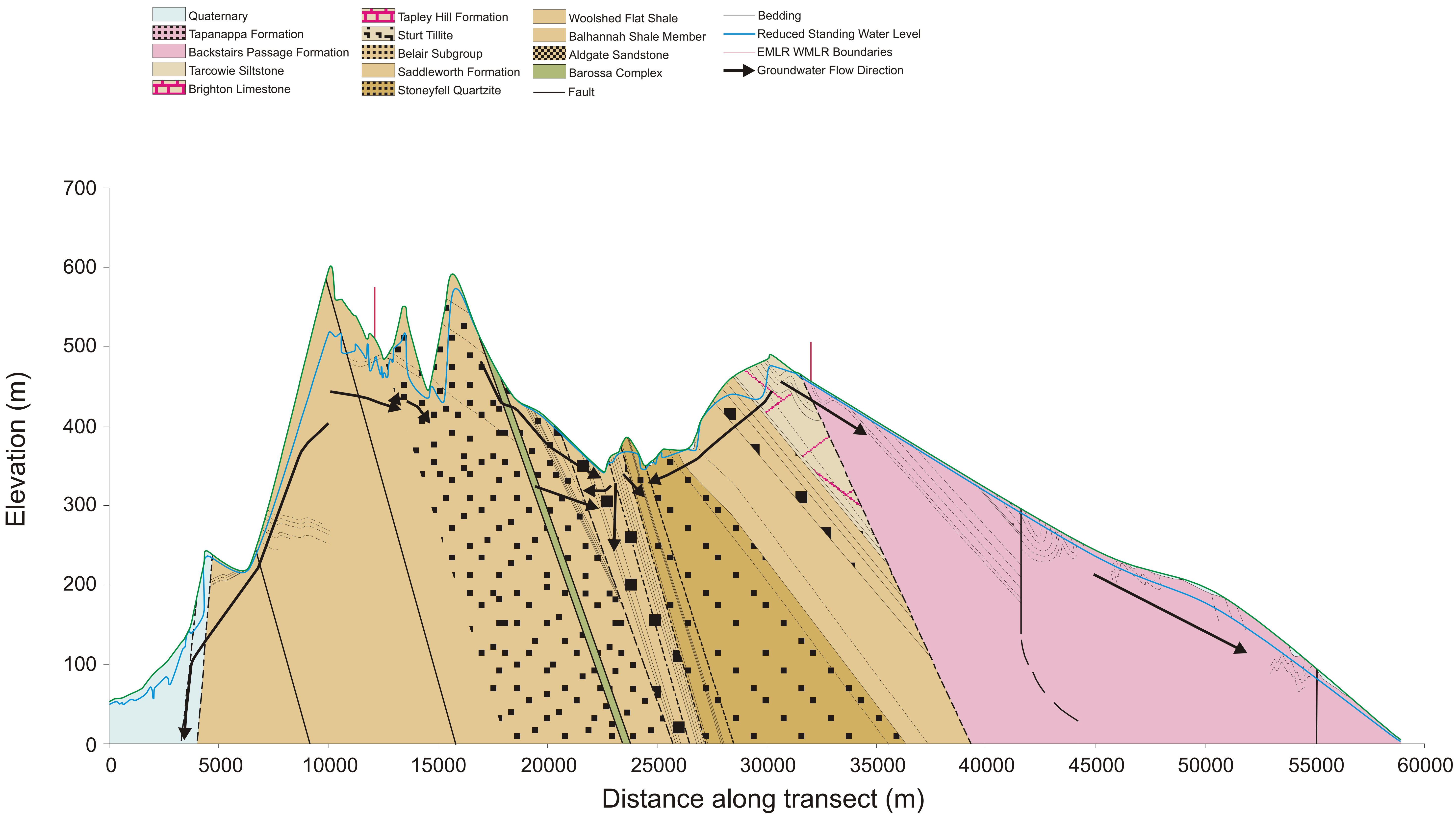


Figure 5. Transect 4

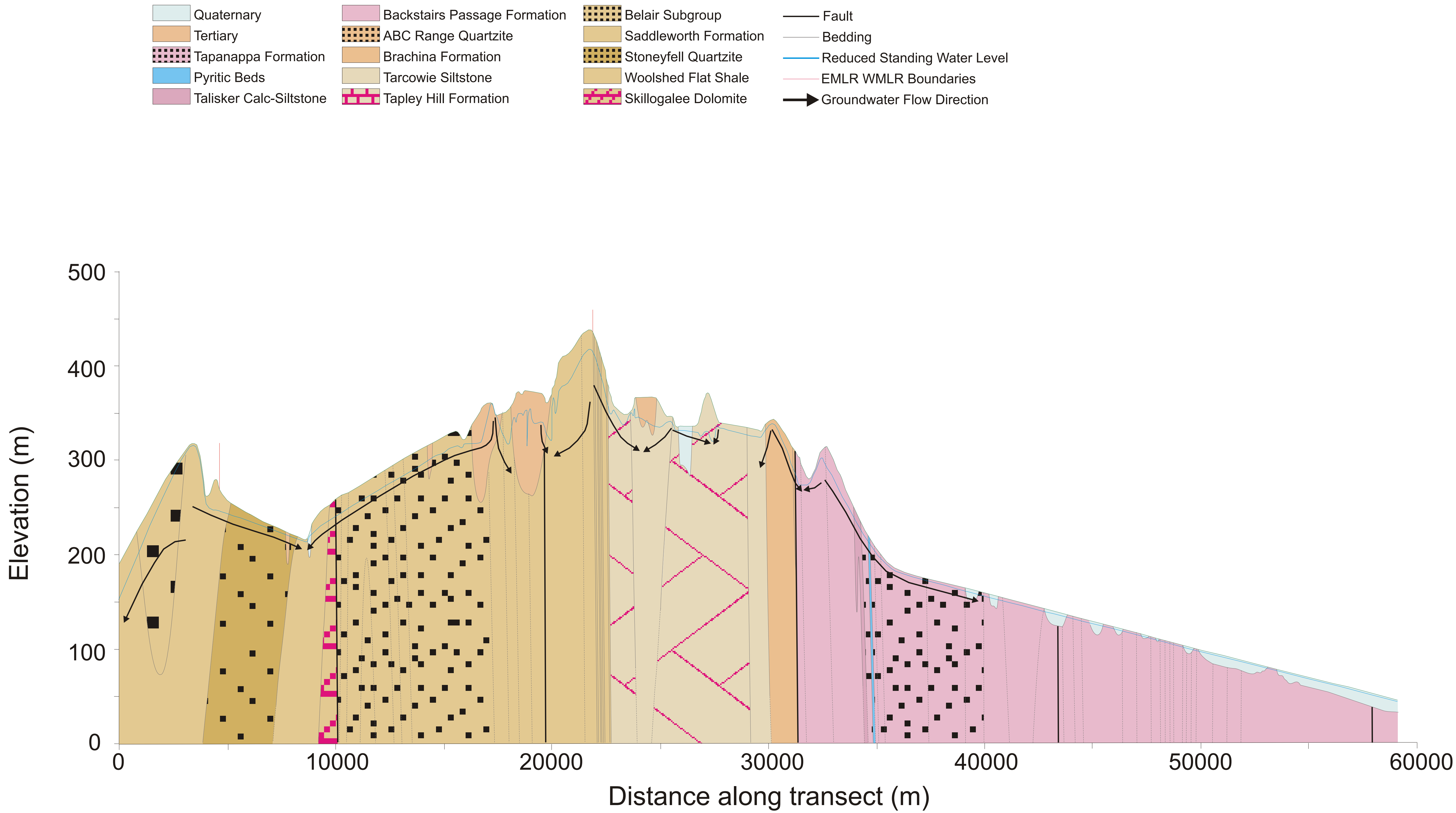
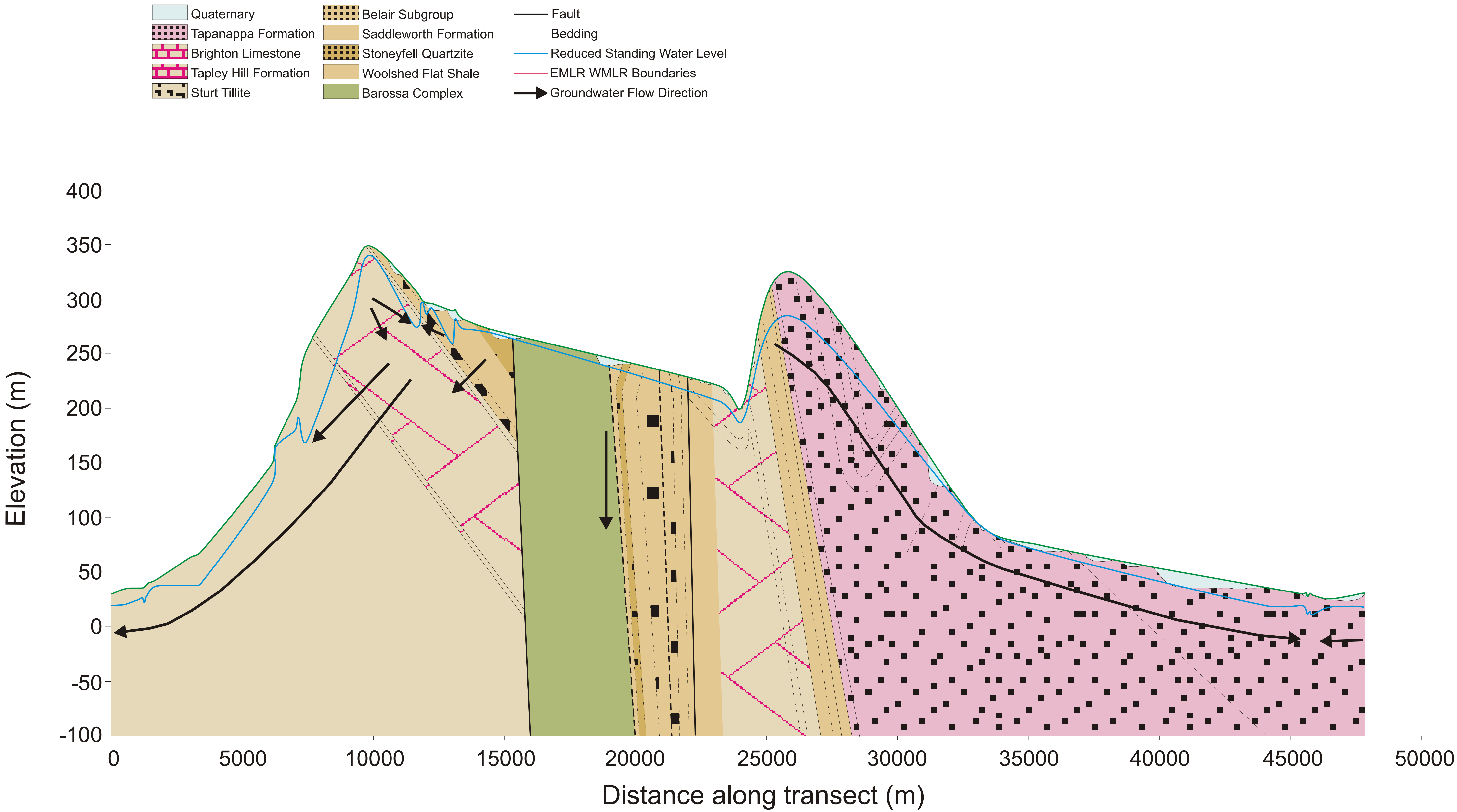


Figure 6. Transect 5



APPENDIX A

Figure A.1. Transect 1 Equipotentials

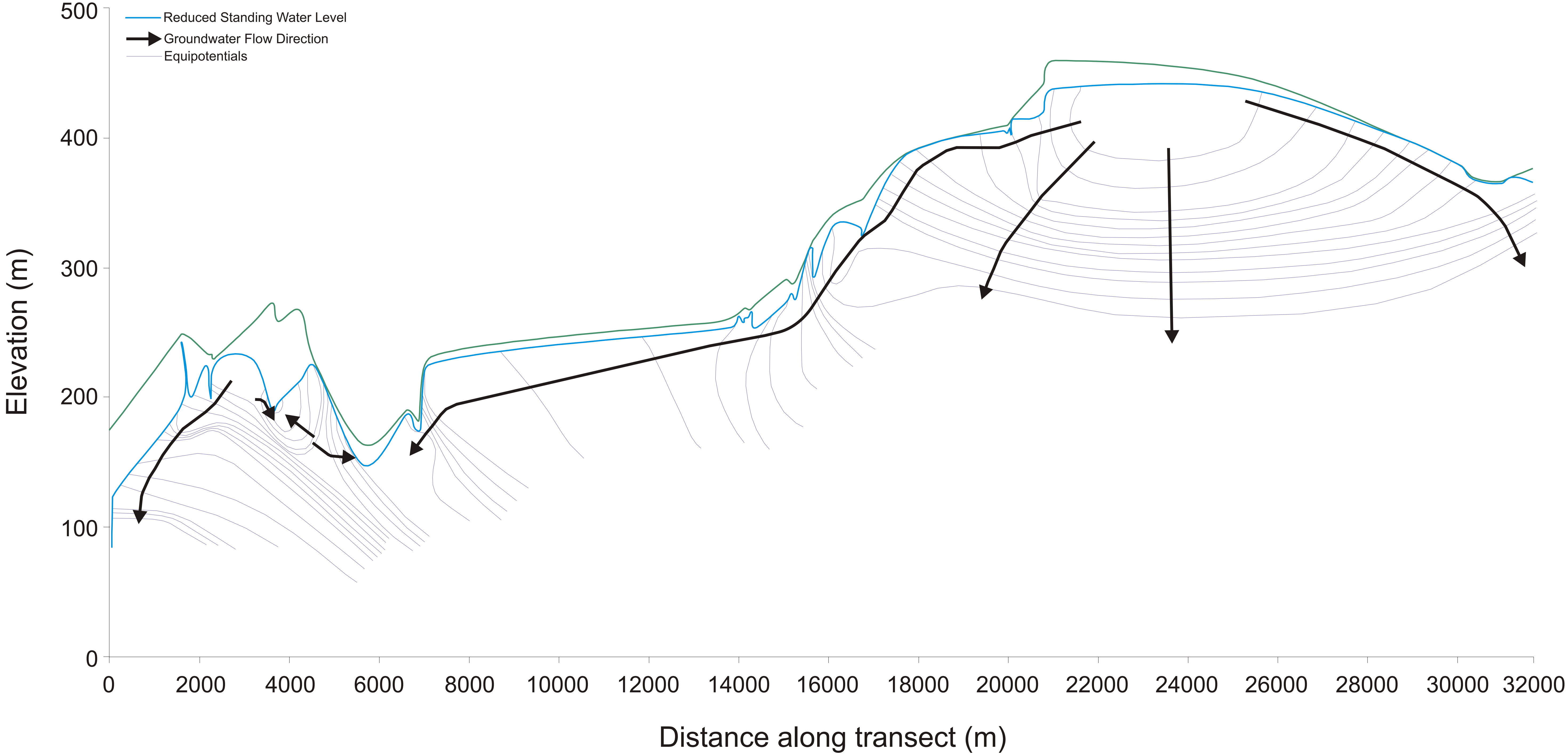


Figure A.2. Transect 2 Equipotentials

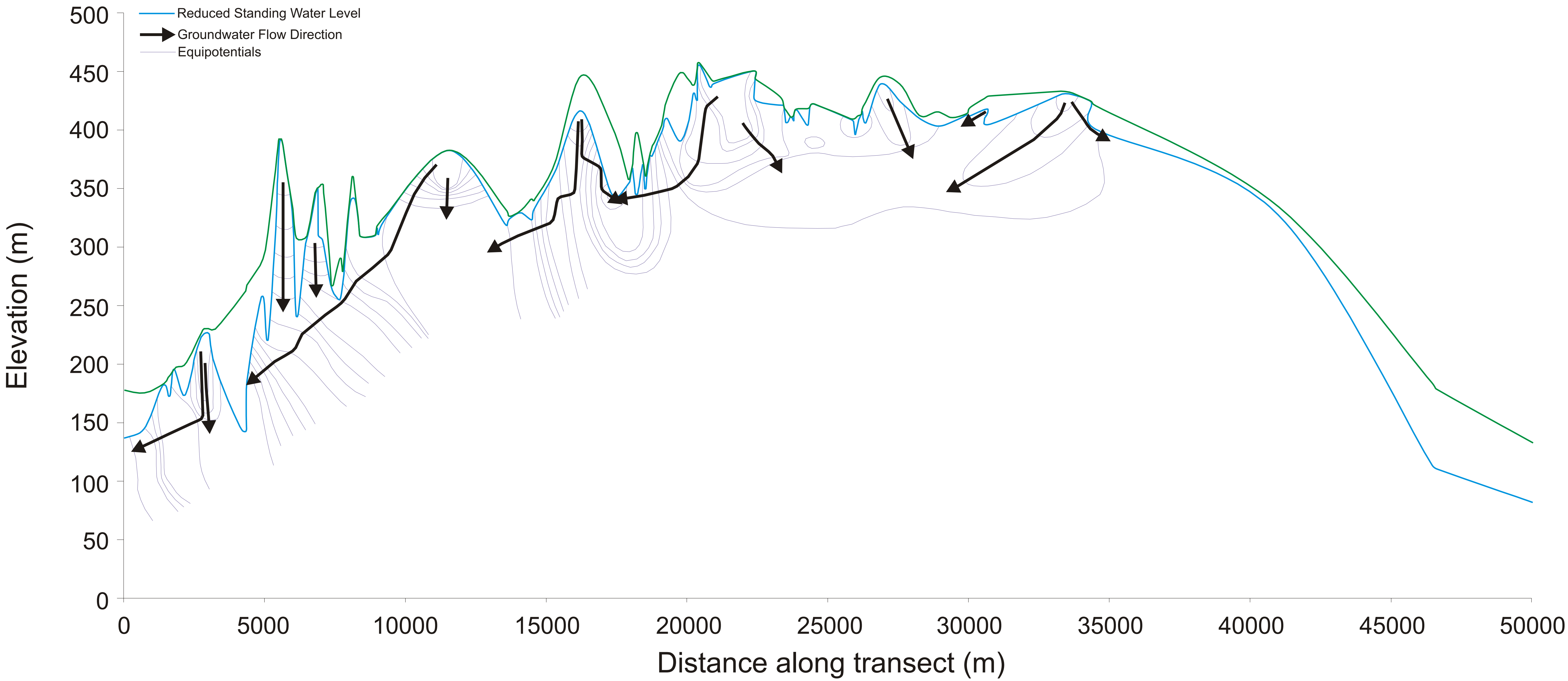


Figure A.3. Transect 3 Equipotentials

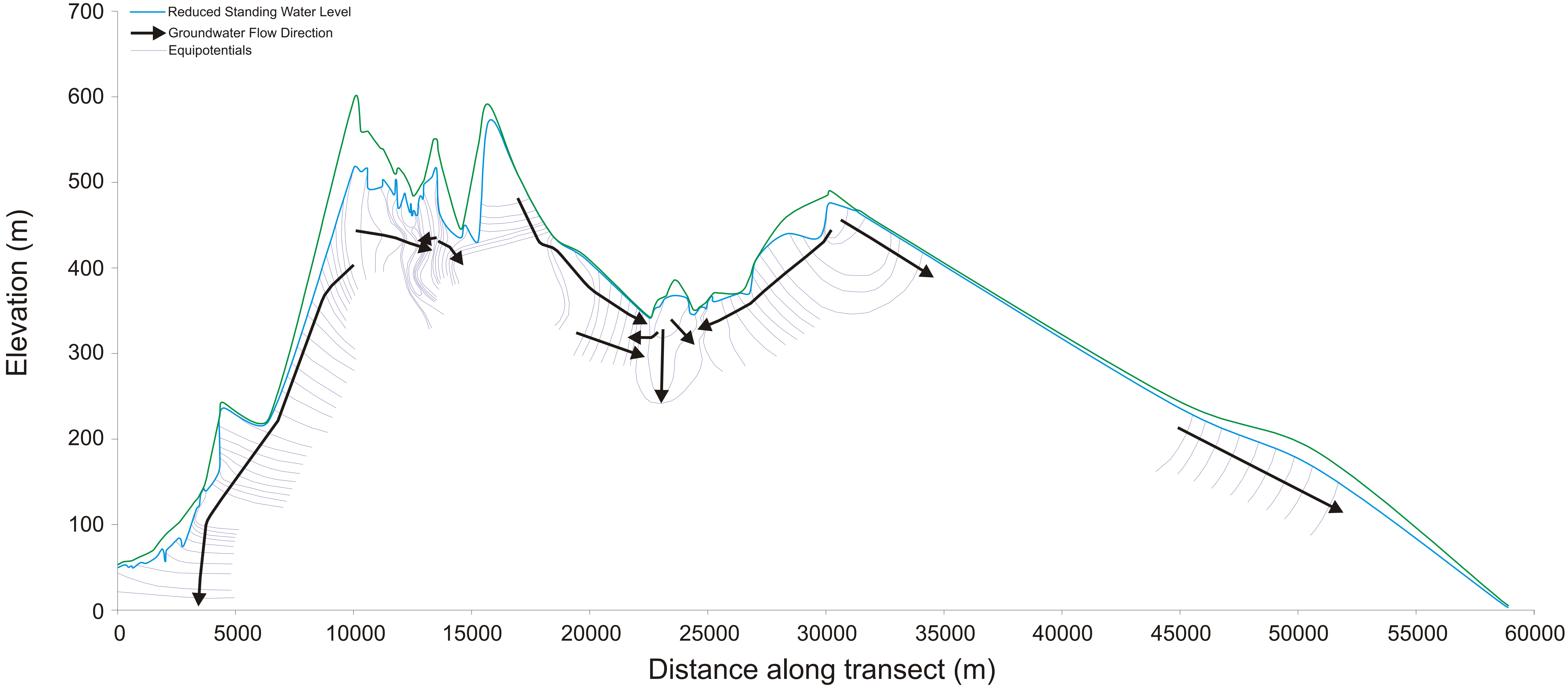


Figure A.4. Transect 4 Equipotentials

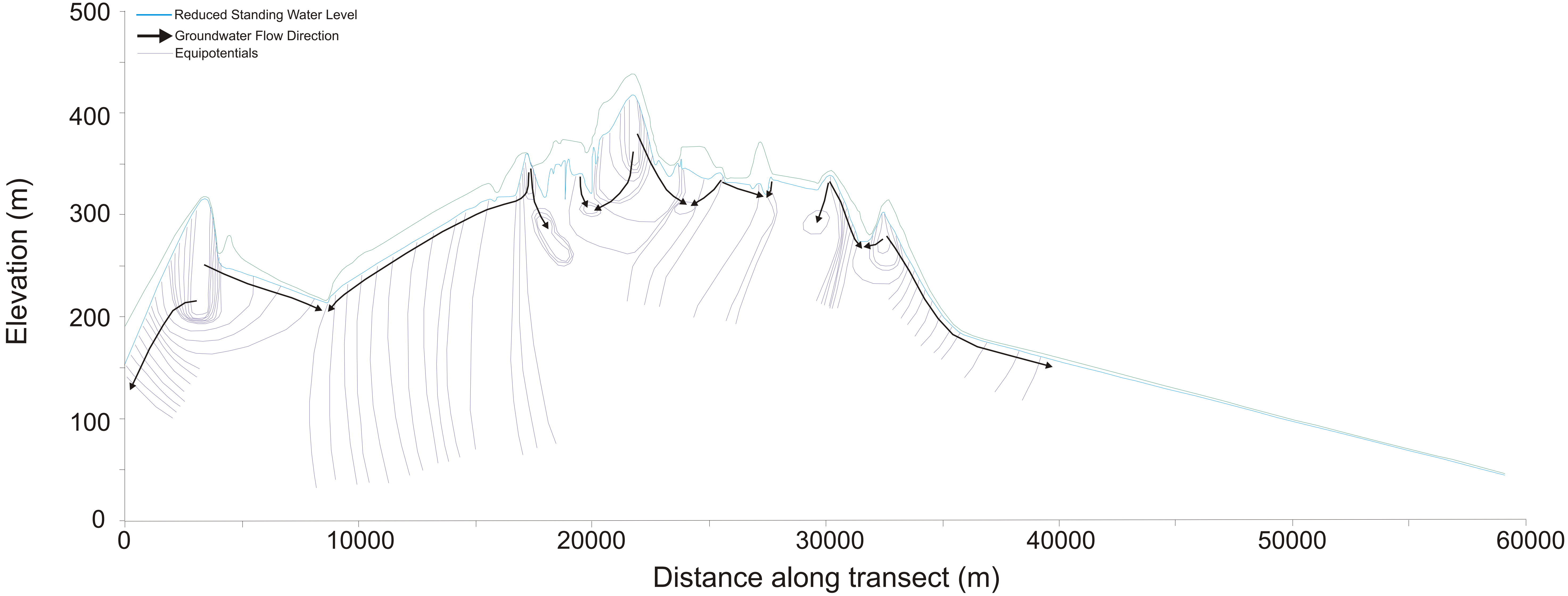


Figure A.5. Transect 5 Equipotentials