EXPERT WITNESS STATEMENT
BY
STANLEY EDWARD DENHOED, P.ENG., M.SC.

HARDEN ENVIRONMENTAL SERVICES LTD.
R.R. 1 , MOFFAT,
ONTARIO, L0P 1J0

FILE REFERENCES

OMB CASE NO.
OMB File No.
OMB File No.

I Stan Denhoed of the Township of Puslinch, in the province of Ontario make oath and say:

1. QUALIFICATIONS

I am a Registered Professional Engineer in the Province of Ontario. I hold a Bachelor of Applied Science Degree in Geological Engineering from the University of Waterloo (1986) and a Master's of Science Degree in Hydrological Engineering from the Institute of Hydraulic Engineering in Delft, The Netherlands (1994).

I have been a principal of Harden Environmental since 1993 and have been involved in groundwater related projects throughout Ontario including several in the Regional Municipality of Waterloo since 1986.

A description of my groundwater and surface water experience is attached as Appendix A.

2. OPINIONS

1. The development of the Waterloo West Side Development Lands will remove a significant contributing source area for an environmentally sensitive feature in the Environmentally Sensitive Protection Area 19 (ESPA 19). Specifically, the wetland area identified to me as W-12 within ESPA 19 will have the portion of its contributing source area that falls west of the ESPA 19 buffer area removed during the development of Waterloo West Side Development Lands. That is, water that is presently running off of the Waterloo West Side Development Lands and into the wetland will be diverted into a stormwater management area adjacent to Clair Creek as a

result of the development. Therefore, if the lands are developed and serviced as described in the Preliminary Servicing Report (Stantec, 2005a) there will be a significant decrease in runoff presently supporting wetland W-12. The approximate location of the contributing area that will be lost is shown on Figure 1. During a site visit of ESPA 19 on Friday, July 11th, 2008 I observed runoff from the Waterloo West Side Development Lands into ESPA 19 and this water eventually discharged into wetland W-12, as on Figure 2. It is my opinion that the loss of this substantial portion of the contributing area of this wetland will significantly affect the water balance of this wetland.

2. There is insufficient supporting documentation to ascertain that the clean water collection system will either result in a similar distribution (laterally or vertically) of recharge water as presently occurs or a similar volume of recharge water as presently occurs. Clean water that does not infiltrate through the walls of the service trench is intended to flow into a perimeter drain system around the Vista Hills North, Vista Hills South and Greyerbiehl Stormwater Management (SWM) Facilities.

   It is difficult to verify the groundwater and soil conditions around the proposed Greyerbiehl SWM as records for neither BH128 nor BH131 were included in the digital copies of the 2005 Naylor Engineering Report available from the City of Waterloo. There is data from BH20 nearby which shows approximately three metres of silt/silt till and a water level less than 1.7 metres below ground surface on December 24, 20031. In addition, the area proposed for the Greyerbiehl SWM is not recognized on Figure 17 (Naylor, 2005) as being suitable for deep groundwater recharge. Therefore it is my opinion that the existing documentation does not provide adequate information to determine that the perimeter drain system will function as intended with respect to underlying soil and groundwater conditions.

   The soil and groundwater conditions for the proposed perimeter drains for the Vista Hills North and Vista Hills South SWM facilities are also appear to be marginal as infiltration facilities. Testpit records for TP220 and TP221 both show very fine sand and silty fine sand to an elevation of approximately 368.5 m AMSL, or a depth of more than three metres from ground surface. For the Vista Hills North SWM facility, testpits TP219 and TP218 are shown to have clay/silt or silty sand to a depth of 3.66 m. In-situ testing for the silty sand suggests a hydraulic conductivity of 10^{-6} to 10^{-7} cm/s (Naylor, 2005) which is approaching properties of material suitable for hydraulic barriers to minimize groundwater movement. Therefore, additional investigations should be conducted to verify that a perimeter drain system will function at the proposed locations.

1 After December 24, 2003 there are no other groundwater readings for BH20

3. There has been inadequate monitoring to accurately calculate existing runoff conditions, infiltration conditions and groundwater discharge to Clair Creek and therefore these components of the water balance may be grossly inaccurate. Very rudimentary flow calculations were used to estimate groundwater flow to Clair Creek and thereby identify which component of infiltration contributes to a shallow system and which component contributes to a deeper system. It is my opinion that more detailed calculations and streamflow observations should be used to verify baseflow conditions. Continuous streamflow measurements for a 12 month period at two locations will assist in the determination of volumes of runoff and volumes of groundwater discharge and groundwater recharge in/out of Clair Creek.

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Signed Dated
Stan Denhoed, P.Eng., M.Sc.

Attachments:

Appendix A: Curriculum Vitae for Stan Denhoed
Figure 1: Estimated Area Contributing to ESPA 19
Figure 2: Location of Wetland W12

References:

Stantec Consulting Ltd, May 2005a, Waterloo Westside Development, Greyerbiehl, Clair Creek Meadows and Vista Hills, Preliminary Servicing Report

Stantec Consulting Ltd, May 2005b, Waterloo Westside Development, Greyerbiehl, Clair Creek Meadows and Vista Hills, Preliminary Stormwater Management Report

Naylor Engineering, May 2005, Hydrogeological and Geotechnical Study, Waterloo Westside Development, Wilmot Line, Waterloo, Ontario for Stantec Consulting Ltd.

APPENDIX A

CURRICULUM VITAE
STAN DENHOED, P.ENG., M.SC

Stan Denhoed, P.Eng., M.Sc.
Curriculum Vitae

Education:

Institute for Hydraulic Engineering, Delft, The Netherlands, 1994
Master's of Science in Hydrological Engineering Degree

University of Waterloo, Waterloo, Ontario, 1986
Bachelors of Applied Science Degree, Geological Engineering

Employment History

1993-Present Harden Environmental Services Ltd., Moffat, Ontario
President

1991-1992 Keewatin-Aski Ltd., Concord, Ontario
Manager of Hydrogeological Projects

1987-1990 M.M. Dillon Ltd., Toronto, Ontario
Project Hydrogeologist

1986-1987 Environment Canada, Burlington, Ontario
Research Hydrogeologist

Professional Experience

Document Review
Review of extractive license applications, subdivisions, golf courses and septic system impacts on behalf of the Township of Puslinch and the County of Wellington. Evaluation of applications to gauge compliance with Ministry of the Environment policies and environmental guidelines developed by the Township and the County.

Water Resources
Supervision of aquifer testing for water supply and for cone of influence of pumping wells or dewatering systems. Supervision of drilling contractors for the installation of pumping wells. Extensive experience with the evaluation of groundwater movement through fractured rock and the analysis of pumping test data related to confined and unconfined aquifers.

Aggregate Licensing
Environmental investigations to ascertain potential impacts from dewatering or extractive activities in bedrock and sand and gravel. Compliance monitoring of active quarries and pits. Development of detailed water balances for extractive operation.

Environmental Audits
Investigations of properties during real estate transactions to ascertain potential environmental liabilities associated with the property.

Surface Water / Groundwater Interactions
Evaluation of changing groundwater levels on wetlands and fisheries. Working with both the Ministry of Natural Resources and the Federal Department of Fisheries and Oceans on projects related to man-induced groundwater level changes and their real and potential impacts on cold water fisheries. Investigation of groundwater inflow component to wetlands to evaluate potential impacts of urbanization in recharge areas.

Associations

Professional Engineers of Ontario

PUBLICATIONS

Denhoed, S.E., 1994, *The Role of Sorption in the Accumulation of Arsenic by Peat in the Western Netherlands*, M.Sc. Thesis, Institute for Hydraulic Engineering, Delft, The Netherlands

Denhoed, S.E., Kell, R. and G. Parker.,1990, *Predictive Monitoring of Groundwater Quality at a Municipal Landfill Site*, Proceedings of Canadian Society for Civil Engineers, Annual Conference, Hamilton, Ontario, May 1990

Priddel, M., Jackson, R.E., Novakowski, K.S. and Denhoed, S.E., 1986, *Migration and Fate of Aldicarb in the sandstone Aquifer of Prince Edward Island*, Groundwater in Canada, Special Issue.

Figure 1: Estimated Area Contributing to ESPA 19

Base Source: Figure 2.0 Subwatershed Delineations / Existing Conditions Drainage Plan (Stantec, 2005b)

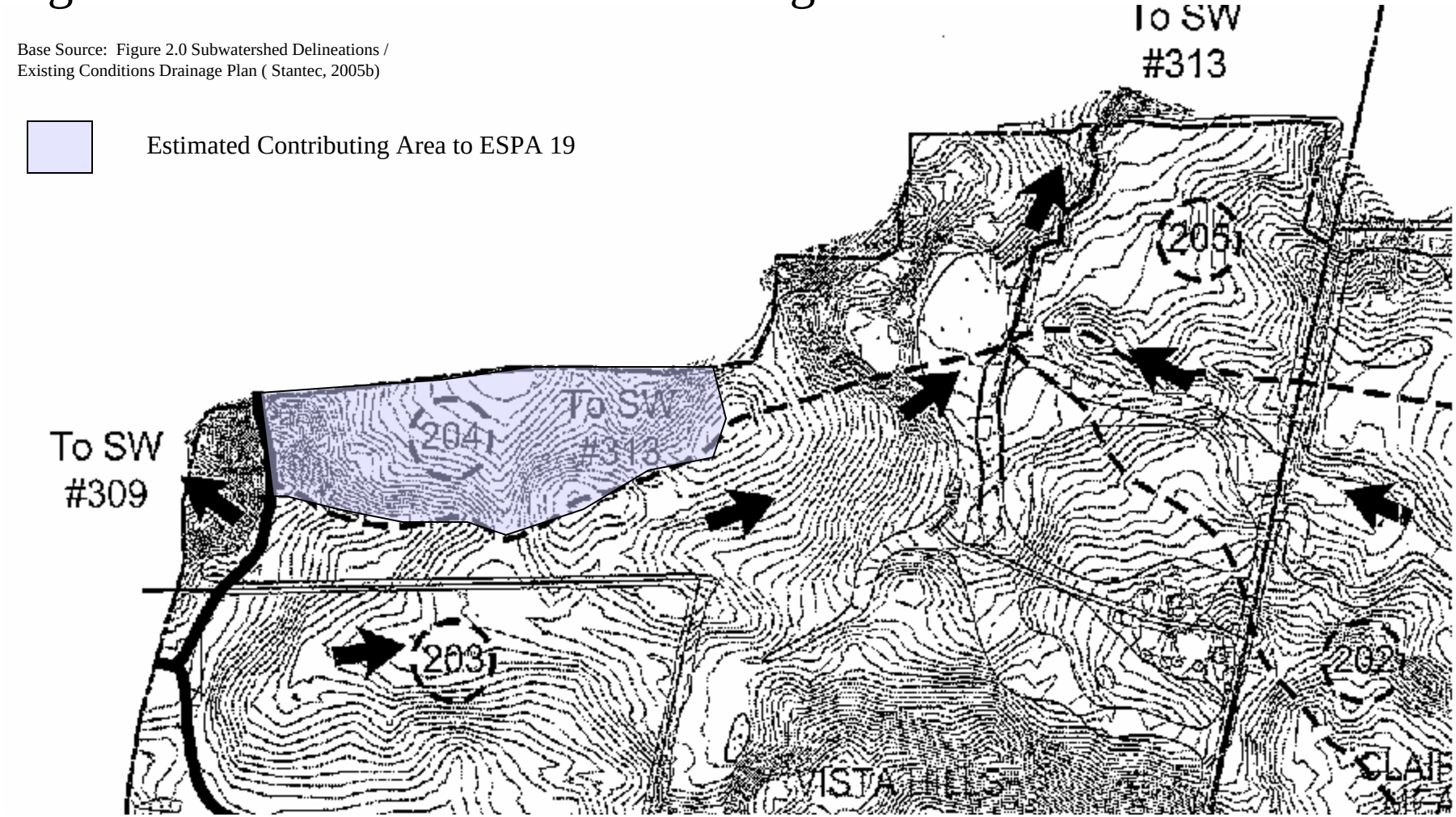

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Figure 2: Location of Wetland W12

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Source: Email from Louisette Lanteigne..origin of photo is Ken Cornelisse, MNR.