Revisions to the LTVSPA Assessment Report – Section 4

White Cells- original text
Grey cells- new text
Yellow highlight- area of original text to be changed
< > - indicates empty space where content needs to be added
Bright Green highlight- area of new text

Section 4– Vulnerability Assessment

Section	Page	Text	Reason For Change	Changes Made
4.1	2	The peer review committee reviewed each technical report, met with the consultants and project teams to discuss the project and submitted comments based on their review and the discussion. Comments were considered and responded to by the consultant or project team members. These comments and the responses form part of the peer review record along with the terms of reference for the peer review committee discussed above. The peer review process added considerable value to the technical report by ensuring that the work was well documented.	Peer Review of Vulnerability Assessment needs content about IPZ-3	
		The peer review committee reviewed each technical report with the exception of the recent IPZ-3 technical work, met with the consultants and project teams to discuss the project and submitted comments based on their review and the discussion. Comments were considered and responded to by the consultant or project team members. These comments and the responses form part of the peer review record along with the terms of reference for the peer review committee discussed above. Peer review for work initiated following the completion of the peer review process, including the IPZ-3 work, was provided by technical staff at the Ministry of the Environment and Climate Change, ongoing involvement of the project teams of the Thames-Sydenham and Region and Essex Region and the Technical Advisory committee formed by the Thames-Sydenham and Region SPC. The peer review process added considerable value to the technical report by ensuring that the work was well documented		

Section	Page	Text	Reason For Change	Changes Made
4.1	2	However, following the completion of the peer review of all of these studies, it has been suggested that the peer reviewers provide a relative comparison of the uncertainty of the projects so that a consistent interpretation between studies is available. This may result in changes to the uncertainty reported in this Assessment Report, which would be documented in a subsequent amendment to the Assessment Report.	Document additional work that remains uncompleted	
		However, following the completion of the peer review of all of these studies, it was suggested that the peer reviewers provide a relative comparison of the uncertainty of the projects so that a consistent interpretation between studies is available..		
4.2	3	An Intake Protection Zone (IPZ) is delineated around an intake in a surface water body. In the Lower Thames Valley Source Protection Area, the intakes draw water from Lake Erie. Map 4-1 shows the location of the intakes and the IPZ around the intakes. An Intake Protection Zone is comprised of an IPZ-1, IPZ-2 and IPZ-3. The IPZ-1 and IPZ-2 in the Lower Thames Valley Source Protection Area were delineated through two projects as discussed below. The IPZ-3 delineation and assessment will be considered in an amended assessment report.	Relect IPZ-3 work completed	
		An Intake Protection Zone (IPZ) is delineated around an intake in a surface water body. An Intake Protection Zone is comprised of an IPZ-1, IPZ-2 and IPZ-3. In the Lower Thames Valley Source Protection Area, the intakes draw water from Lake Erie. The Stoney Point water treatment plant intake, located in Lake St. Clair in the Essex Region Source Protection Authority, has an IPZ-3 that extends into the Lower Thames Valley Source Protection Area. Map 4-1 shows the location of the intakes and the IPZ around the intakes. The IPZ in the Lower Thames Valley Source Protection Area were delineated through three projects as discussed below. IPZ-3 delineation and assessment for the West Elgin and Chatham/South Kent intakes may be considered in a future update to the Assessment Report.		
4.2.1	3	Another project was led by the Municipality of West Elgin with the Ontario Clean Water Agency (*OCWA*) providing technical and project management services for the municipality. The West Elgin water treatment plant is owned by the Municipality of West Elgin and is managed by the Tri-County Water Management Committee. The vulnerability assessment study was also undertaken by Stantec Consulting Limited, who retained Alex McCorquodale for the hydrodynamic modelling work.	Surface Water Vulnerability Assessment Projects section needs content for IPZ-3	

Section	Page	Text	Reason For Change	Changes Made
		Another project was led by the Municipality of West Elgin with the Ontario Clean Water Agency (*OCWA*) providing technical and project management services for the municipality. The West Elgin water treatment plant is owned by the Municipality of West Elgin and is managed by the Tri-County Water Management Committee. The vulnerability assessment study was also undertaken by Stantec Consulting Limited, who retained Alex McCorquodale for the hydrodynamic modelling work A third project was led by Lower Thames Valley Conservation Authority staff to assess the IPZ-3 for the Stoney Point water treatment plant intake that extends into the Lower Thames Valley Source Protection Area. This work was based on prior work conducted by Baird and Associates and used similar methodologies to assess how far upstream the impacts could be realized at the intake. A further project was lead by the ERCA to assess fuel spill in Lake Erie tributaries as they pertain to systems in the Essex Region. This work included tributaries in the ERSPA which could result in a threat to the Wheatley intake in the LTVSPA. The in lake modelling was completed by Baird and linear dispersion analysts was completed by ERCA staff with input from LTVCA staff.		
4.2.1	4	The above referenced technical reports are peer reviewed and components finalized, so that they could be included in the Assessment Report. The technical studies are listed below In Table 4-1. The May 2008 West Elgin vulnerability assessment technical study was updated in an addendum report in November 2009, in order to meet current technical rules. *Table 4-1 Technical Studies on Vulnerability Assessment*	Changes to table required to reflect IPZ3 work	
		The above referenced technical reports are peer reviewed as described in the peer review section and included in the Assessment Report. The technical studies are listed below in Table 4-1. *Table 4-1 Technical Studies on Vulnerability Assessment* *Add LTVCA and Bair Report references*		

Section	Page	Text	Reason For Change	Changes Made
4.2.4	10	parcels abutting the buffered watercourses were included in the IPZ as transport pathways.	Need to specify IPZ-2 as not all IPZs used transport pathways	
		parcels abutting the buffered watercourses were included in the IPZ-2 as transport pathways.		
4.2.5	11	4.2.5 IPZ-3 Delineation A third zone around intakes can also be developed. This zone is referred to as an Intake Protection Zone-3 (IPZ-3). For Great Lakes intakes, the IPZ-3 includes areas which can contribute contaminants under an extreme event at a concentration which would result in a deterioration of the source water for the purposes of human consumption. The IPZ-3 work is yet to be undertaken and will be part of an amended Assessment Report.	Remove Great Lakes comment as St. Clair is not a Great Lake under the rules and the statement is valid without it. New content required for IPZ-3	
		This section 4.2.5 is replaced by the new section which follows this change log		
4	12	According to Rule 88, IPZ-1 is assigned an area vulnerability factor of 10, while the factor for IPZ-2 is between 7 and 9,	Scores for IPZ-2 come from Rule 89	
		According to Rule 88, IPZ-1 is assigned an area vulnerability factor of 10, while according to Rule 89, the factor for IPZ-2 is between 7 and 9,		
4.2.6	13	*Insert the following new text before source vulnerability factor is discussed*	describe IPZ3 scoring	
		The methodology for determining the Area Vulnerability factor for the Stoney Point IPZ-3 is that same as that used for determining the IPZ-2 Area Vulnerability factors. The upland area in the IPZ-3 is composed of greater than 66% land. The area is very flat and mainly under agricultural production. Most of the area is tile drained. The dominant soil types in the area are clay with some loam type soils. The IPZ-3 is broken up into zones of 6 hours of travel time. The zone immediately at the		

Section	Page	Text	Reason For Change	Changes Made
		mouth of the Thames River starts with an Area Vulnerability factor of 7 which is consistent with the area vulnerability assigned in the ERSPA. From this score the value decreases by 1 for every additional 6 hours of travel time up the tributaries. These Area Vulnerability Factors are the same as those used on the Essex Region Source Protection Area side of the IPZ-3. Taken on its own, the 15,000 L IPZ-3 in the Lower Thames Valley Source Protection Area would not be represented well by the above description as the area mostly covers the community of Lighthouse Cove. However, when combined with the 15,000 L IPZ-3 on the Essex Region Source Protection Area, the values are likely representative of the whole of the 15,000 L IPZ-3, and for the sake of consistency, the same Area Vulnerability factors have been used.		
4.2.6	14	*Insert the following new text after the paragraph ending* A factor of 0.6 was assigned to the Wheatley primary intake while a factor of 0.7 was assigned to the Wheatley emergency intake considering intake depth, length and number of water quality concerns.	Insert a few sentences about IPZ3 scoring range and what to consider	
		The Source Vulnerability factor for the Stoney Point intake was determined by prior technical work conducted by the Essex Region Source Protection Authority and was determined to have a value of 0.9.		
4.2.6	14	http://www.ec.gc.ca/raps-pas/default.asp?lang=En&n=299C927C-1)	Bad web link	
		http://www.ec.gc.ca/raps-pas/default.asp?lang=En&n=96C6AD6F-1		
Table 4-3	14	*Table 4-3 Summary of Vulnerability Score of Intakes*	Add Vulnerability Scoring for IPZ-3	
		Replace with new table shown at the end of this change log		
4.2.6	14/15	Activities in these Great Lakes intakes vulnerable areas are not classified as significant threats because for a Great Lakes intake, the vulnerability scores that can be assigned are less than 8. Further, in IPZ-2 for the Chatham/South Kent Intake there can be no threats as the rules require that for an activity to be considered a threat it must occur in an area with a vulnerability score greater than 4. This is discussed in more detail in Section 7 - Threats and Risk Assessment. <>	Add content discussing implications of IPZ-3 scoring in Lake St. Clair	

Section	Page	Text	Reason For Change	Changes Made
		Activities in these Great Lakes intakes vulnerable areas are not classified as significant threats because for a Great Lakes intake, the vulnerability scores that can be assigned are less than 8. Similarly, even though intakes on Lake St. Clair are considered Type C and not Great Lakes intakes, the Vulnerability Scores start at 6.3 and decrease from there. Consequently, there can be no significant threats in the IPZ-3 based on the Vulnerability Scoring. Further, in IPZ-2 for the Chatham/South Kent Intake there can be no threats as the rules require that for an activity to be considered a threat it must occur in an area with a vulnerability score greater than 4. This is discussed in more detail in Section 7 - Threats and Risk Assessment		
4.2.7	15	Table 4-4 below summarizes the uncertainty assessed for the Chatham/South Kent and Wheatley Intake Protection Zones as identified by the consultants involved in the studies	Consultants only did IPZ-1 and 2 work	
		Table 4-4 below summarizes the uncertainty assessed for the Chatham/South Kent and Wheatley IPZ-1s and IPZ-2s as identified by the consultants involved in the studies		
4.2.7	17	Further details are available in the Stantec Consulting Ltd. vulnerability assessment technical report on the Wheatley and Chatham/South Kent intakes.	Insert section about uncertainty in IPZ-3	
		Further details are available in the Stantec Consulting Ltd. vulnerability assessment technical report on the Wheatley and Chatham/South Kent intakes. The uncertainty associated with the Wheatley IPZ-3 and the Stoney Point IPZ-3 are both high. These IPZ-3 were determined using the same models as was used for the IPZ-2 modelling. Therefore, the discussion above regarding why the IPZ-2 were assigned a uncertainty of high are equally applicable to the IPZ-3 delineations		
4.3.4	20	Two other WHPAs can be delineated for wells which are under the direct influence of surface water (Groundwater Under the Direct Influence or GUDI). Systems are assessed to determine if they are GUDI through requirements of the Safe Drinking Water Act, 2002 (subsection 2(2) of O. Reg 170/03). Highgate is currently identified as a GUDI system. The status of this system as GUDI is being discussed with MOE. Should a surface water body effectively bypass the aquifer's protection, a WHPA-E must be delineated. Rule 49(3) states that a WHPA-E is to be defined if the interaction between surface water and groundwater has the effect of decreasing	Update for status of Highgate	

Section	Page	Text	Reason For Change	Changes Made
		the time of travel of water to the well when compared to the time it would take water to travel to the well if the raw water supply for the well was not under the direct influence of surface water. Rule 50 requires that a WHPA-F be delineated if the WHPA-E was delineated, and if the well is subject to issues which originate from outside the other parts of the WHPA. The MOE directed that the workplans for WHPA-E and WHPA-F for the Highgate system not be included in the Assessment Report as information available at this time indicates that the system does not meet the test in Rule 49 (3).		
		Two other WHPAs can be delineated for wells which are under the direct influence of surface water (Groundwater Under the Direct Influence or GUDI). Systems are assessed to determine if they are GUDI through requirements of the Safe Drinking Water Act, 2002 (subsection 2(2) of O. Reg 170/03). Should a surface water body effectively bypass the aquifer's protection, a WHPA-E must be delineated. Rule 49(3) states that a WHPA-E is to be defined if the interaction between surface water and groundwater has the effect of decreasing the time of travel of water to the well when compared to the time it would take water to travel to the well if the raw water supply for the well was not under the direct influence of surface water. Rule 50 requires that a WHPA-F be delineated if the WHPA-E was delineated, and if the well is subject to issues which originate from outside the other parts of the WHPA. There are no GUDI municipal drinking water systems in the LTVSPA.		
4.3.5	21	A grid of particles to be released at the water table was established. Particles were spaced 100 metres apart in the upgradient area of each well. The travel time of each particle to move from its original position to the water table was then calculated, in order to determine WWAT.	correction	
		A grid of particles to be released at the water table was established. Particles were spaced 100 metres apart in the upgradient area of each well. The travel time of each particle to move from its original position to the well was then calculated, in order to determine WWAT.		
4.3.5	23	As described in section 4.3.4, the MOE directed that the workplans for WHPA-E and WHPA-F for the Highgate system not be included in the Assessment Report as information available at this time indicates that the system does not meet the test in Rule 49 (3).	Highgate is not GUDI	

Section	Page	Text	Reason For Change	Changes Made
		Delete paragraph		
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		Update Assessment Report November 14, 2014		

4.2.5 IPZ-3 Delineation

A third zone around intakes can also be developed. This zone is referred to as an Intake Protection Zone-3 (IPZ-3).

As per Rule 68 an IPZ-3 may be delineated if modelling demonstrates that a release of a chemical parameter or pathogen from an activity or a proposed activity during an extreme event would be transported to the intake and result in the deterioration of the water for use as a source of drinking water. The Technical Rules define an extreme event as a period of heavy precipitation or up to a 100 year storm, or a freshet. General approaches to the modelling were provided in the MOE's Technical Bulletin: Delineation of Intake Protection Zone-3 Using Event Based Approach (EBA) dated July 2009.

In order to delineate the extent of the IPZ-3 it is necessary to establish the concentration of contaminant which would result in a deterioration of the water for use as a source of drinking water. The Ontario Drinking Water Quality Standards were selected as the benchmark to be applied to the IPZ-3 delineation. This is consistent with the benchmarks used for identifying an Issue.

A model was developed by Baird and Associates through the IPZ-2 work which was also used in the delineation of IPZ-3. This model was used to explore the possible extent of boundaries to an IPZ-3 through reverse particle tracking. The model was then used to determine concentrations of a contaminant which would arrive at an intake following a spill. The model was used to simulate the contaminant travel within Lake Erie or Lake St. Clair while an analytic approach described in MOE's Technical Bulletin was used to consider the dispersion and dilution within the tributaries flowing towards the lakes.

The following sections address the work conducted for those portions of the IPZ-3 in the Lower Thames Valley Source Protection Area for the Wheatley intake and for the Stoney Point intake in the Essex Region Source Protection Area. IPZ-3 work for the Chatham/South Kent and West Elgin intakes has not been undertaken and may be included in a future Assessment Report update.

4.2.5.1. Wheatley IPZ-3

The Wheatley intake is located very close to the Lower Thames Valley Source Protection Area's boundary with the Essex Region Source Protection Area and as a result the IPZ-3 is delineated in both Source Protection Areas.

In the case of the Wheatley intake, the concern is fuel spills and the parameter chosen to model was the benzene component of the fuel. The modelling completed for the Wheatley IPZ-3 followed the general approach outlined in the MOE Technical Bulletin (July 2009). Based on previous IPZ-2 work, it was decided that modelling one spill upstream on a tributary in Pelee/Hillman Creek (west of the intake in the Essex Region Source Protection Area) would be sufficient as the results could be extrapolated to other nearby tributaries. A fuel spill of 34,000 L of gasoline (with 2% benzene content) was chosen as this roughly corresponds to the volume contained in a tanker truck. However, the modelling would be equally applicable to a fixed storage of equal size. The location of the spill was chosen to be the Highway 77 crossing, 12.3 km upstream from the lake, near the headwaters of the watershed. The spill location is shown on Map 4-3b. Modelling was used to determine contaminant concentrations arriving at the intake from the spill under 5 different extreme events. The extreme events were selected as 100-year return period events using a joint probability analysis on wind direction, speed and duration as well as tributary flows.

Three of the extreme events modelled found that contaminants from a 34,000 L spill near the headwaters of Pelee/Hillman Creek reached the Wheatley primary and emergency intakes at a concentration above the benzene Ontario Drinking Water Quality Standard of 0.005 mg/L. As a result, Baird and Associates recommended delineating an IPZ-3 from the mouth, throughout all the upstream tributaries, all the way to headwaters of Pelee/Hilllman Creek. They also recommended including the smaller tributaries between

Pelee/Hillman Creek and the intake as spills in these locations would be expected to result in similar or higher concentrations arriving at the intake.

The concentrations arriving at the intake were sufficiently high that it was concluded that a 15,000 L spill would also produce an exceedance of the Ontario Drinking Water Quality Standard. As a result, both Source Protection Authorities have moved forward using a potential 15,000 L spill for Threat and Risk Assessment work.

Based on the results of modelling in Pelee/Hillman Creek, it was determined that the Two Creeks watershed, located east of the intakes in the Lower Thames Valley Source Protection Area, should also be included in the IPZ-3. Two Creeks is a smaller watershed than Pelee/Hillman and its longest path up the drainage network is also shorter than Pelee/Hillman. As a consequence there would be less in-stream dilution in Two Creeks for the same size spill.

The outlet of Two Creeks is also closer to the intakes than the outlet of Pelee/Hillman. Two Creeks is approximately 1.5 km from the intakes whereas Pelee/ Hillman is approximately 4.0 km away. In terms of in-lake travel times, the outlet of Two Creeks is also closer as it lies within the Wheatley IPZ-2 whereas Pelee/Hillman lies outside the IPZ-2. As a consequence there would also be less in-lake dilution in Two Creeks for the same size spill.

While these arguments are largely qualitative, they all indicate that, based on the modelling undertaken for Pelee/Hillman Creek, for the same size spill anywhere along the Two Creeks drainage network, there would be an exceedance of the Ontario Drinking Water Quality Standard at the intake.

The next Lake Erie tributary east of Two Creeks is Yellow Creek. This drainage system is extremely flat and has multiple outlets to Lake Erie. As such, the simple inferences made to include Two Creeks in the IP-3 can't be applied in the case of Yellow Creek. It is possible that future modelling work may show that this tributary should also be included in the IPZ-3.

As specified in the Technical Rules, the IPZ-3 extends on to the land a distance of 120 metres, or to the Floodplain Regulation Limit whichever is greater (as long as water from the land actually flows to the watercourse). Transport pathways were not considered in the IPZ-3 delineations. The extent of the Wheatley IPZ-3 is shown on Map 4-3b.

4.2.5.2 Stoney Point IPZ-3

The Stoney Point intake is located in the Essex Region Source Protection Area very close to the boundary with the Lower Thames Valley Source Protection Area. As a result, the IPZ-3 is delineated in both Source Protection Areas.

In the case of the Stoney Point intake, the concern is fuel spills and the parameter chosen to model was the benzene component of the fuel. The modelling completed for the Wheatley IPZ-3 followed the general approach outlined in the MOE Technical Bulletin (July 2009). The modelling used to delineate the IPZ-3s for Essex Region Source Protection Area Lake St. Clair tributaries will not be discussed in this report as the IPZ-3 delineation in the Lower Thames Valley Source Protection Area is not dependant on that work.

Based on previous IPZ-2 work and some preliminary IPZ-3 work conducted by the Essex Region Source Protection Authority, Baird and Associates modelled 3 spills in the downstream portion of the Thames River watershed. Two fuel spills of 34,000 L of gasoline (with 2% benzene content) were chosen as this roughly corresponds to the volume contained in a tanker truck and one fuel spill of 68,000 L was chosen as it roughly corresponds to the volume contained in a rail tanker. While the spills chosen were transportation related, the modelling would be equally applicable to a spill from a fixed storage of equal size. Re-

sults of this early modelling indicated that the IPZ-3 would extend substantially further upstream in the tributaries. Therefore, staff at the Lower Thames Valley Conservation Authority expanded the Baird and Associates work by conducting additional modelling in the tributaries using the analytic approach described in MOE's Technical Bulletin.

Modelling in Lake St. Clair was conducted to determine contaminant concentrations arriving at the intake from a spill leaving the mouth of the Thames River under 2 different extreme events. The extreme events were selected as 100-year return period events using a joint probability analysis on wind direction, speed and duration as well as tributary flows. Those events include a 10-year return period wind event, 2 year return period flow in the St. Clair River and mean flow from the Thames River. This modelling showed that for one of the events, a 0.49 mg/L peak benzene concentration at the mouth of the Thames produced a 0.18 mg/L peak benzene concentration at the intake; an exceedance of the of the Ontario Drinking Water Standard (0.005 mg/L benzene) by a factor of 36.

Two spill locations for a 15,000 L gasoline spill and three spill locations for a 34,000 L spill were modelled using the analytical approach to determine the resulting concentrations at the mouth of the Thames River. The spill locations for the 15,000 L spills were 1) on the Thames River 1 km upstream of the Big Creek confluence and 2) on Big Creek 250 m upstream of the Baptiste Creek confluence. The spill locations for the 34,000 L spills were 1) on the Thames River 2 km upstream of the Prairie Siding Bridge approximately where the diking stops, 2) on Jeanettes Creek at the Forbes Internal Drain pump station, and 3) at the furthest upstream confluence in the Big Creek watershed on the West Ogle Drain in the Municipality of Leamington. The spill locations are shown on Map 4-10.

The 5 modelled fuel spills each produced a peak benzene concentration at the mouth of the Thames River of 0.20 mg/L or greater. This is approximately two-fifths of the concentrations used for the in-lake modelling that produced a 36 times exceedance at the intake. As a result, two IPZ-3, one for a15,000 L fuel spill and one for a 34,000 L fuel spill have been delineated upstream from the mouth of the Thames River to these locations.

As the West Ogle Drain location was the furthest upstream confluence in the Big Creek watershed, all other branches and tributaries in the watershed were included in the 34,000 L IPZ-3 delineation. Spills on these watercourses should all produce similar or greater concentrations at the mouth of the Thames River since they all would have shorter travel times in the drainage network and smaller flows which would produce less dilution and dispersion between the spill and the mouth of the Thames River.

The area of the lower Thames River watershed, including the Big Creek and Jeanettes Creek watersheds, through which this IPZ-3 is being delineated, presents some particular challenges for modelling. The area is extremely flat and the elevation of the land is very similar to Lake St. Clair water levels. In order to keep the land dry enough for agriculture, much of the area is covered by dikes and pumping schemes. The pump stations are essentially dams that keep Lake St. Clair water from backing up the drainage network. The dams have pumps associated with them to pump the water from the upstream side of the dam to the lake side of the dam. The existence of these pumps present some challenges in applying the simple analytical models outlined in the MOE Technical Bulletin.

Preliminary exploratory modelling of the pumping schemes using the simple analytical models led to the conclusion that the watercourses behind the pumping schemes should be excluded from the IPZ-3. The operation of the pumps are not tied directly to flow in a tributary nor necessarily related to flows in the Thames River. No particular pump can be assumed to be in operation just because a mean flow situation exists in the downstream tributary. If the pump is running, that means there is a significant depth of water accumulated on the upstream side of the pump. These depths far exceed what would be expected under gravity driven flows. Preliminary exploratory modelling using a modest upstream depth of 1 m when a pump is sending out mean flows suggested that this additional volume behind the pump was creating enough dilution that watercourses behind the pump scheme should be excluded from the IPZ-3, especially when combined with the substantial dilution incurred when the smaller tributary exits into the much larger Thames River.

As specified in the Technical Rules, the IPZ-3 extends on to the land a distance of 120 metres, or to the Floodplain Regulation Limit whichever is greater, as long as water from the land actually flows into the watercourse. The extensive diking system though this area limits the extent to which the IPZ-3 extends onto the land. Throughout much of the downstream portion of the Thames River and Big Creek watersheds, the 34,000 L IPZ-3 only extends to the top of the dike, not the full 120 m nor to the Regulation Limit.

The upstream extents of the 34,000 L IPZ-3 on Thames River and Jeanettes Creek were determined primarily based on where the uncertainty was too great to include areas further upstream in the IPZ-3, rather than specific numeric results from the modelling areas upstream of these locations. On Jeanettes Creek, the IPZ-3 terminates at a large wetland pond area with a couple of islands in the middle. The simple analytical methods used for modelling dispersion and dilution in the watercourses were not designed for this situation. Rather than introducing additional uncertainty into the calculation by making a series of assumptions to deal with this area, the IPZ-3 terminates at that location. On the Thames River, the 34,000 L IPZ-3 was terminated at the upstream end of the dike system, about 5 km downstream from the City of Chatham. The additional uncertainty introduced by modelling through an urban area containing a complex storm drainage system, is not appropriate given the density of properties and uses within the area. As a result the IPZ-3 was terminated downstream of Chatham. The 15,000 L IPZ-3 was terminated at a location that produced the same peak benzene concentrations at the mouth of Thames River as that determined from the 34,000 L spill located on the Thames River. More thorough and site specific modelling should be considered in the future which might demonstrate that areas further upstream should be included in the IPZ-3 as part of a future update to this assessment report.

It is also possible that the IPZ-3 extends further north and east along the Lake St. Clair shoreline. However, the next few outlets into the lake are controlled by pump schemes. Based on the preliminary exploratory modelling on pump schemes, it didn't seem likely that these drainage systems would be included.

It should be noted that the technical report by Baird and Associates also showed that a spill in the Thames River could reach the Belle River intake in the Essex Region Source Protection Area with a concentration exceeding the Ontario Drinking Water Quality Standard. Should consideration be given to delineating an IPZ-3 into the Lower Thames Valley Source Protection Area for that intake at some point in the future, it should be noted that the Stoney Point IPZ-3 would be larger and be assessed a higher vulnerability. Source Protection Plan polices could be written to address these concerns at the Belle River intake by applying similar policies designed to protect the Stoney Point intake. System operators should however be aware that some spills resulting in an exceedance at the Stoney Point intake could also result in an exceedance at the Belle River intake.

Transport pathways were not considered in the IPZ-3 delineations. The extent of the Stoney Point IPZ-3s are shown on Map 4-10.

Replace table 4-3 with the following

Table Error! No text of specified style in document.**-1 Summary of Vulnerability Score of Intakes**

Intake	Area Vulnerability Factor			Source Vulnerability Factor	Vulnerability Score		
	IPZ-1	IPZ-2	IPZ-3		IPZ-1	IPZ-2	IPZ-3
Chatham/South Kent Intake	10	8	na	0.5	5.0	4.0	na
Wheatley Primary Intake	10	8	na	0.6	6.0	4.8	na
Wheatley Emergency Intake	10	8	na	0.7	7.0	5.6	na
West Elgin Primary Intake	10	7	na	0.6	6.0	4.2	na
West Elgin Emergency Intake	10	8	na	0.7	7.0	5.6	na
Stoney Point intake (ERSPA)	na	na	7, 6, 5, 4, 3	0.9	na	na	6.3, 5.4, 4.5, 3.6, 2.7