Third Party Review – Carp River Restoration Plan, March 2009

Phase 1 Report

3.4 TSH Revised HEC-RAS model (Jan 2009)

Table 3-6, Comparison of Water Level Changes with Revised TSH Models, shows flood level increases between Hazeldean and Palladium from 0.18cm to 0.28cm - and these levels do not include the "worst case scenario" volumes that would increase levels a further 4 or 5 cm.

If these levels represent the final results, incorporating all TPR recommendations, it is not clear how such increases can be deemed acceptable – particularly when existing development within the reach is being impacted. These are not "minor fluctuations" as indicated on p.74. Why has the restoration plan not been revised to eliminate such significant water level increases? for instance, by widening the corridor?

4 Calibration Issues

On p. 42, the TPR notes: *The HEC-RAS model run using the Sept 2004 storm used for calibration purposes by CH2MHill was not used by the Auditor General's consultant to arrive at the conclusions being made in the report to Council. This calibration model run has also not been made available to the Third Party Review to complete the investigation.*

Given the concerns raised regarding the lack of calibration, why have these calibration runs not been updated with the revised volumes and datum adjustment? This should be included in the final TPR report.

There appears to be too much emphasis that the 'missing volumes' will significantly improve the match between observed and simulated levels given some volumes have been removed and others added:

	Original	Adjusted (worst case)
Drainage area correction:	-186, 380m3	-211700m3
Conduit volumes added:	123, 909m3	123909m3 (no adjusted volume given?)
"Worst case" volume added:	0	276,675m3
Total	**-62, 471m3**	**188, 884**

Based upon CH2MHill's original parameters, there would be even less volume in the system than was used for the original calibration run. Even with the adjusted parameters, it is not clear that this maximum additional volume (along with the datum adjustments suggested by the TPR) will account for the extended recession of water levels due to the poorly-drained condition downstream of Richardson Side Road. This poorly-drained condition (which is not mimicked by the simulated levels) is not directly addressed in the TPR, yet all of the assumptions used to determine required storage volumes presume a well (or at least better)-drained watercourse than what is actually observed. While additional monitoring data will be helpful to characterize the timing issues with Poole Creek, additional data is not required to arrive at the fundamental conclusion that the Carp River downstream of Richardson Side Road is poorly drained – this is more than adequately demonstrated by the September 2004 event. If this extended response is not reflected in the existing conditions model, then the full impacts of at least 900 hectares of new development – and all the excess runoff volume that will come with it – will not be reflected in the post-development model.

It is notable that as early as the 1970s, MVC identified problems with the poorly-drained river (before any significant development had occurred in the upper watershed) and undertook a study to improve drainage (Carp River Channelization Study, MVCA, 1974). Unlike the current proposal, however, the 1974 study area began *downstream* of Richardson Side Road. There is nothing to suggest that the poorly-drained conditions identified 35 years ago have changed, and the increased runoff from 900ha of additional development can only be anticipated to exacerbate the problem. The current restoration proposal and the TPR do not account for these conditions.

5 Watershed Overview – Volumetric Issues

p.55 A number of the options to incorporate the recommended "potential volume deficit" are questionable, perhaps even untenable. The use of rain barrels – while a useful BMP from a source control perspective - is not appropriate to mitigate flood risks given the difficulties (impossibility?) of ensuring compliance by presumably hundreds of private property owners. Further, the suggestion that additional storage can be provided by ponding in parks runs counter to the direction taken in the last several Community Design Plans (including Kanata West) that the City has undertaken. Parks and Recreation staff have consistently identified concerns with major system ponding in parks and it is no longer being recommended in new plans. It is not evident why such an exception should be made for Kanata West.

Rather, the safest and most efficient solutions to any storage deficit are also suggested by the TPR: increasing downstream flow efficiency and widening the corridor. As noted in previous comments regarding the calibration issue, if nothing else can be learned from the level data collected during the September 2004 event, it is that the upper Carp River is not a well-drained watercourse. Further, widening the corridor provides certainty in terms of the additional storage to be provided, can be managed efficiently through an adjustment to the design of the corridor (rather than having

to deal with a hodge podge of measures at the approvals stage) and does not expose the City to the potential liability of depending on other measures such as rain barrels. Given their obvious benefits, why have these two solutions not been explicitly recommended by the TPR?

6.5 Method to Demonstrate Maintenance of Flood Plain Storage

The rationale given regarding the method to calculate "flood plain storage" repeats MVC's previous justification which depends on flexibility within the Lakes and River Improvement Act Technical Guidelines.

The LRIA guidelines for channelization read as follows:

> *The following hydraulic characteristics of the natural river channel shall remain the same in the proposed channel:*
> *1) travel time (not to be decreased); and*
> *2) the stage storage and stage discharge relationships of the natural river and its flood plain are to be maintained (evaluated in 0.3 m elevation increments from the channel bed to the flood level per Provincial Natural Hazards Technical Guide, 2002).*
>
> *These criteria maintain a flood plain area in the channelized reach identical to that of the original watercourse. The strength of these criteria is that they are straightforward to apply and easily verified by the approving agency.*

The LRIA guidelines go on to identify conditions under which exceptions to the above criteria may apply:

> *Exceptions may be considered where the following objectives of the criteria are met:*
> *1) the cumulative impacts of all future works in the watershed are quantified through sub-watershed studies and are considered insignificant;*
> *2) there are no downstream impacts (i.e., channel outlets to one of the Great Lakes);*
> *3) the discharge storage relationship of the water course is maintained on an incremental basis for all floods from the 2 year return flood to the flood per provincial standards for defining natural hazards; and*
> *4) routing calculations are provided which conclusively demonstrate that there would be no increase in downstream peak flows and total storage has been maintained or increased.*

It is evident that the restoration plan as currently proposed does not meet the conditions that would warrant an exception to the 0.3 m incremental cut/fill balance requirement:

1. The cumulative impacts of all future works in the (upper) watershed have not been quantified (and arguably are difficult to quantify in any permanent sense due to the ongoing potential of urban

boundary expansions). Specifically, the urbanization of the Fernbank lands has not been accounted for. As well, the City is now reviewing possible expansion areas through its Official Plan update.
2. The downstream channel is subject to impacts, i.e., the channelization does not outlet immediately to a much larger water body that would be relatively insensitive to cumulative impacts. Likewise, the rather "sluggish" nature of the Carp River within and well downstream of the study reach is well documented.
3. and 4. Depending on these criteria to demonstrate the objectives is concerning given that the supporting modelling is not adequately calibrated or validated.

Given the recognized uncertainty with the modeling, the prudent approach would be to *maintain a flood plain area in the channelized reach identical to that of the original watercourse,* as the LRIA Technical Guidelines indicate.

Also, this section indicates that the future corridor has more storage than the existing. Based on the increased flood levels documented in Table 3-6, this is not surprising. Rather, if apples were compared to apples, i.e., the storage provided at existing flood levels compared to the post development storage at that same existing water level, there may in fact be less storage available in the future corridor. This statement must be qualified as a post-development model has not been made available for review. However, a quick check of the volume represented by the flood level increases between Hazeldean and Palladium supports this contention:

> Approx. length of reach Hazeldean to Palladium = 1500m
> Avg. increase in flood elevation = (+/-) 0.22m
> Corridor width = 150m
> Volume = 1500*150*0.22 = **49,500m3**

Taking into account the flood level decreases in the vicinity of Highway 417, this is very close to the 36,000m3 that is being represented as the increase in flood storage in the post-development condition. Increasing flood levels over existing conditions is not an acceptable means of providing increased storage in the post-development condition.

Further, this section has made no distinction between riparian storage and total storage within the corridor, riparian storage being the existing volume within the reach that should be matched in the post-development condition. Riparian storage should not include the storage created for stormwater management purposes. Including SWM storage volumes would, in effect, be double-counting. There is no detail regarding how the volumes were calculated – did post-development volume include the SWM storage volumes? If so, it should be excluded and a revised volume comparison done (notwithstanding the methodology did not employ an incremental balance as it should have).

6.6 Design Storm Selection

The upper Carp River watershed has a drainage area of approximately 5500ha with a time of concentration in the order of several hours. It is not surprising that 1 hour and 4 hour events would not be critical either from a runoff volume or peak flow/water level perspective. Also, even a cursory review of the ultimate land use in the upper watershed (and a further reduction in rural area due to the drainage area correction that directs 440ha to the Jock River watershed) indicates a clear shift from primarily rural conditions to primarily urban conditions. Why has a storm distribution more appropriate to urban conditions such as the Chicago distribution with a duration more appropriate to the size of watershed (12 or 24 hours) not been assessed in this comparison? At least for the ultimate land use condition? This is standard practice, recommended in the City of Ottawa Sewer Design Guidelines as well as the MTO Drainage Manual. A Chicago distribution was used to generate flows for the flood remediation works required in the Glencairn community. Why has there been no consideration of consistency or at least running the Chicago events to dispel or confirm any doubts about the most critical event?

6.8 Stormwater Management Facility Strategy

The rationale provided in this section is difficult to follow. There are currently no defensible SWM criteria – one can only conclude this is the case given the significant flood level increases documented in Table 3-6. The flood level increases can be attributed to insufficient SWM controls, encroachment into the floodplain and/or local influences, changes in timing, insufficient outlet downstream of Richardson, or some combination of all of the above.

Concern has been noted that applying full post to pre control could aggravate flood level increases, hence, quantity control has been limited to the 10 year event. The TPR notes: *The proposed SWM facilities are adequate for quantity control should these volumetric issues be provided through other means as suggested.* And yet, the TPR later concludes that: *Interim SWM facilities are to be designed for post to pre conditions up to and including the 100 year storm event*. It is not clear what the basis is for these apparently conflicting recommendations. Further, if interim SWM facilities are permitted, what would post to pre control mean? Control to ensure that existing flood levels are not increased? Or that the future proposed increased flood levels are not increased even further?

A key purpose of planning on a subwatershed basis is to develop defensible SWM criteria. This avoids situations where a combination of various SWM facilities results in unintended consequences. As it stands, the TPR would appear to be allowing for significant flood level increases in an area of existing development while at the same time acknowledging that further data is required to confirm the SWM criteria.

Further, since the SWM facilities are located in the floodplain, this creates the problem of having to allow for interim facilities since the ultimate ponds cannot be built in advance of the restoration - further reason to have kept the SWM facilities out of the floodplain in the first place.

6.9 Review of Hydraulic Design Brief – Restoration Plan

What is the basis for the following statements (on p.75)? *It is better to qualify the acceptable fluctuation in water level with seasonal changes in vegetation and the undulation in flows with any field measurements. A 10 cm range of flow level change should be acceptable for comparison purposes. This is valid only if there is no change to flood risk at the particular location. Water level changes greater than 10cm could be supported with field data to support there is no change to flood risk.*

Regardless of the complexity of the analysis, and the limitations of models, changes in water level indicate an impact or effect, and over time, the cumulative effect of even minor fluctuations can be significant. The above statements make no account of cumulative impacts, the avoidance of which is a key purpose of watershed management. Further, neither the City nor the MVC have the authority to encumber private lands with flood level increases, however minor, without permission from the landowners. In the case of increasing flood levels on public lands, that would presumably require the endorsement of the governing body. The above-noted statements in the TPR should be revised accordingly and the proposed flood level increases addressed.

Phase 2 Report:

3.2 City Official Plan Implications

The proposed restoration plan is a mechanism to create developable land from floodplain in exchange for stream rehabilitation. This is not consistent with the natural hazards policies of the Provincial Policy Statement (which make no mention of "modified one-zone) and is not consistent with the draft update to floodplain policies in the City's Official Plan. This project may be unprecedented in Ontario in terms of the wholesale creation of developable land from floodplain and sets a very bad precedent.

5 **Fernbank Lands Contribution**

The exclusion of the Fernbank lands in a developed condition is clearly inconsistent with a watershed approach to stormwater management – in other words, standard practice long-supported by the Provincial Policy Statement, the City's Official Plan and other provincial

documents. While there may have been some rationale for this in 2006 when the original EA documents were completed, there remains no justifiable rationale not to include the urbanization of Fernbank in the updated model – especially given the significant number and type of model revisions the TPR has recommended. The suggested approach further complicates what will already be a complicated approval process as once the "model of record" is completed it will effectively have to be updated again – by a different consultant, presumably – to reflect the urbanization of Fernbank. The "model of record" and restoration plan should be updated to reflect full OP build-out before the EAs are re-posted.

Also, in a previous review of the modeling several months ago, I noted that the Carp Road Corridor lands did not appear to have been accounted for as urbanized in the post-development condition. Has this been addressed in the updated model?

General Comment:

Finally, there is much emphasis on the "worst case scenario" throughout the TPR which corresponds to the maximum runoff volume that could be generated by the upper catchments. While this may be a "worst case" for runoff volume from those catchments, it does not address other factors (noted above) that would be expected to "worsen the worst case scenario," including:

- issues of timing/shape of hydrographs;
- not accounting for full OP build-out (Fernbank);
- not considering the impacts of a storm distribution and duration that may be more appropriate to the post-development watershed; and
- not accounting for the poorly-drained condition downstream of Richardson Side Road as evidenced by the extended recession of water levels from the observed data.