7 EVALUATION OF ALTERNATIVES

7.1 General

This chapter will:

- provide a general description of the types of alternative solutions that were considered in order to address the key constraints as defined in **Chapter 4** and potential impacts as summarized in **Chapter 6**;
- provide a description of the criteria that were used to screen the alternative solutions;
- provide an evaluation of the effectiveness of the alternative solutions; and
- discuss the rationale for selecting the preferred solution.

The approach that has been used is outlined as follows:

- establish a long list of alternatives;
- screen the alternatives to determine feasibility and acceptance; and
- undertake a more comprehensive assessment for alternatives that are found to be feasible.

There are several items that need to be considered in evaluating the alternatives. These items have been summarized below:

1. There are two study areas that are under consideration (the Rural Settlement Area (RSA) and the larger Mid Spencer Creek Subwatershed Area). Consistent with other components of this study a more detailed assessment is being undertaken for the RSA.
2. The alternatives must address a wide range of environmental issues relating to groundwater, flooding, erosion, water quality, terrestrial and aquatic ecology. A wide range of general measures should therefore be considered initially.
3. Other initiatives including studies for Source Protection and stewardship have been completed by agencies such as the City and Conservation Authority. These initiatives need to be considered as part of the evaluation.
4. Implementation of the alternatives will take place using a variety of mechanisms and stakeholders. For example, some measures will be implemented by homeowners as part of stewardship programs while other measures will be implemented as part of the planning process. Some of the alternatives may be subject to the Environmental Assessment Act which requires a defined evaluation and selection process. In this regard Approach #1 of the Master Planning process in the MEA Municipal Class EA document has been used.

7.2 Long List of Alternatives – Mid-Spencer Subwatershed

A long list of alternatives or management actions has been identified for the Mid Spencer subwatershed. The list, together with a description of each alternative, is provided below. At the subwatershed level a wide variety of alternatives needs to be considered to address the range of existing land uses and environmental resources. As the focus of the technical work for this study is limited to defining existing conditions and defining general strategies at a subwatershed level the evaluation of the alternatives will be generalized. Implementation of proposed measures will be based on general recommendations made for this study together with the findings/ recommendations of other studies.

The broad range of management actions recommended for the Mid-Spencer Subwatershed area are summarized below:

- Structural Best Management Practices for Rural Areas
- Non-structural BMPs for Rural Areas
- Measures for Rural Estates
- Stream Restoration Programs
- Aquatic Habitat / Fish Community Enhancement Programs
- Terrestrial Habitat Enhancement
- Groundwater Protection
- Aggregate Extraction
- Stormwater Management Alternatives

7.2.1 Structural Best Management Practices for Rural Areas

Applying Best Management Practices technologies to rural lands offers significant benefits both to the environment and farm productivity, while providing the opportunity to restore agricultural streams.

Structural BMP's for Rural Areas include manure storage, feedlot runoff control, constructed wetlands, tile drain outlet controls, nutrient management, and irrigation ponds/water conservation. These programs will include incentives for Rural BMP's, and recognizing the community benefits of the resulting water quality improvements.

Manure/Feedlot Storage

7.2.2 Non-structural BMPs for Rural Areas

Structural BMP's for Rural Areas include livestock access control, nutrient management, cover crops, buffer strips, reduced livestock densities, wildlife management and conservation tillage and would be applied to all existing rural areas. These programs will include Community Education and Outreach Components.

Conservation Tilling

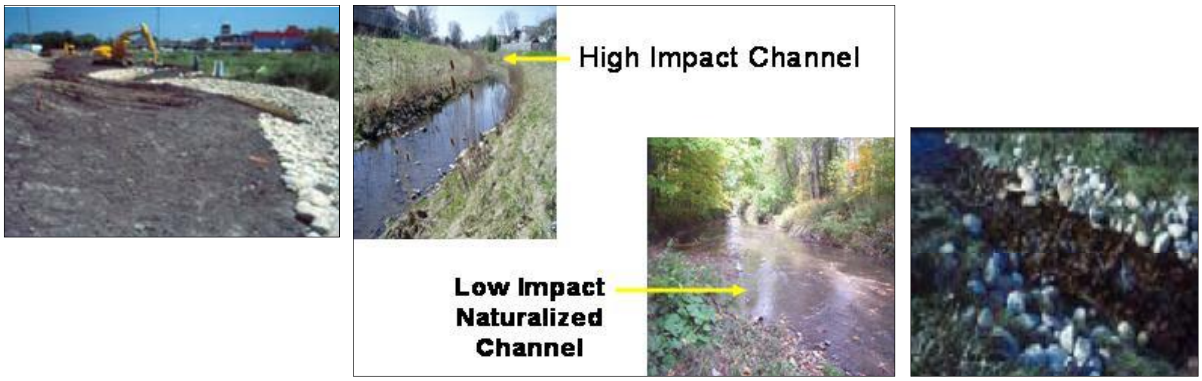
Livestock fencing

7.2.3 Measures for Rural Estates

Rural Estate BMP's include septic system replacement and inspection programs, inspection and review programs for Permits to Take Water, landscaping, and fertilizer and pesticide reduction programs. These programs will include Community Education and Outreach Components.

7.2.4 Stream Restoration Programs

Stream restoration will be implemented on a reach basis to address stream instability, wildlife habitat, and erosion concerns. A natural channel design approach should be implemented on priority reaches to address instability, erosion and sedimentation problems. Other measures include protection of riparian zone, riparian plantings, and reconnection of floodplains. The following inset photos show examples of natural channel design projects:



Natural Channel Design

7.2.5 Aquatic Habitat / Fish Community Enhancement Programs

Aquatic habitat enhancement projects would focus on barrier removal and enhancement of instream habitats associated with the erosion projects outlined in **Section 7.2.4**, as well as select riparian rehabilitation opportunities discussed in **Section 7.4**. Instream habitat enhancement could include a range of measures including creating pool: riffle morphology, increasing instream cover including woody debris, enhancement of spawning habitat and improving habitat conditions for target species such as rainbow darter (*Etheostoma caeruleum*), a sensitive indicator species (Scott and Crossman, 1973).

Stewardship efforts aimed at riparian landowners are considered key to the success of any enhancement program within areas of privately-owned land. Landowners identified as having insufficient riparian buffers should be made aware of available funding and technical assistance for establishing buffers (HCA 2011). Workshops, information sessions, literature, websites, public service announcements, interpretive signage and direct landowner contact can be implemented to promote healthy streams and the creation of larger riparian buffers (HCA 2011). At a minimum, riparian buffer widths should be in accordance with the 30 metre minimum Vegetation Protection Zone widths specified by the City of Hamilton (2013) (**see Section 6.3**).

Existing initiatives are underway through the Middle Spencer Creek Subwatershed Stewardship Action Plan and the future Fisheries Management Plan (currently being finalized). Key components include repair/mitigation/removal of dams, increasing the amount of woody debris in the system, habitat improvement, sediment management and headwater protection. The Middle Spencer Creek Subwatershed Stewardship Action Plan indicates that a feasibility and prioritization study may be undertaken for the removal of dams. Existing initiatives are underway through the efforts of the Hamilton Conservation Authority (e.g. the Crook's Hollow Dam removal project, summary in **Appendix L**). The following inset photos shows examples of instream habitat improvement:

7.2.6 Terrestrial Habitat Enhancement

Priorities for terrestrial habitat enhancement will focus on restoration measures that will increase forest cover within the Subwatershed and establish connections between Natural Heritage Features. Additional terrestrial habitat enhancement opportunities discussed in this report include the following:

- Rubbish removal;
- Floodplain plantings;
- Invasive species management;
- Filling in forest canopy gaps;
- Establishment of wildlife corridors;
- Creation of connections between woodlands;
- Creation of connections between ESAs;
- Wetland enhancements; and
- Wetland creation through online pond removal.

Wetland rehabilitation includes the concept of diversifying the habitat types surrounding wetlands in an effort to provide varied habitat for native species, manage flooding, improve water quality. On a larger scale, reforestation is another important measure, not only for increasing terrestrial habitat but also for carbon sequestering, increasing evapotranspiration, improving local microclimates, and increasing opportunities for wildlife movement.

For a detailed discussion of rehabilitation and enhancement in the Mid-Spencer Creek Subwatershed, including areas within the Greensville Rural Settlement Area, see **Section 7.4**.

7.2.7 Vegetation Protection Outside of the NHS

It is recommended that vegetation outside the boundaries of the NHS be protected and incorporated into development/lot design where possible. Compensation plantings *in appropriate locations* to account for *natural features* that cannot be retained is encouraged at a minimum ratio of 3:1. That is, compensations plantings should account for three times the amount of the natural feature(s) lost.

It is anticipated that some tree loss will occur in order to accommodate development. That is, treed areas not included as part of the NHS (e.g. hedgerows) may be removed to accommodate the proposed large-lot industrial/commercial development parcels. As many hedgerows are located along lot lines, it is probable that hedgerows can be retained post-development. Retention of these hedgerows will likely benefit wildlife, and will also benefit development by providing shade to buildings, employee picnic areas, and/or parking lots.

While it is the opinion of the Study Team that the preservation of trees is favourable, it is not recommended that invasive species within hedgerows be retained. Exotic invasive species such as European buckthorn (present throughout), should be removed so that the threat of these species spreading to valuable retained natural areas within the NHS is greatly reduced.

7.2.8 Woodland Edge Management

Woodland edge management plans are often required when development or site alteration is required near or within an existing woodland edge. The majority of woodlands within the subwatershed study area are included within the NHS and are protected by buffers. Expanding upon the potential impacts listed above in **Table 6.3.1**, typical impacts to remaining woodland communities may include, but are not limited to:

- Direct loss of floral and faunal habitat;
- Trees along the ‘new’ edge may be susceptible to windthrow;
- Reduced species richness and abundance;
- Decreased biodiversity;
- Reduced stability of landforms composed of unconsolidated material;
- Regrading/fill placement along forest edges can impact root systems of retained trees, resulting in root stress/tree decline;
- Loss of canopy cover/shade, resulting in an increase in sunlight penetration;
- Some trees with thinner bark (e.g. Beech) can be susceptible to sunscald and frost cracking due to changes in light penetration. This can weaken the tree's defences, particularly to pathogens.

- Changes in microclimates (increased temperatures, decreased soil moisture) resulting in dessication;
- Site may be more susceptible to invasion by non-native species, pathogens, etc.;
- Soil compaction resulting from unrestricted vehicle and machinery operations; and,
- Loss of native seed bank.
  (TRCA, 2004)

The potential impacts listed above can be avoided in part or entirely through adherence to the Vegetation Protection Zone guidelines in this document (see **Section 4.7.5**). A selection of possible mitigation measures are listed below:

- Direct development activities away from significant and/or sensitive natural heritage features;
- Prevent or reduce construction staging areas adjacent to natural heritage features;
- Install sturdy, well-marked tree protection fencing at an appropriate distance past the dripline of retainable trees and include provisions for tree protection on design drawings;
- Retain native shrubs and groundcover wherever possible;
- Replanting of removed vegetation at a minimum 3:1 ratio in appropriate locations which serve to enhance the configuration or linkage of existing natural areas;
- Retain stumps within 5 m of the new edge to allow for vegetative regeneration from the existing seed bank;
- Plant salt-tolerant species along the edges of parking lots, roads, etc to mitigate the effects of salt spray and runoff on existing natural vegetation, with a preference towards native species;
- Restrict grading and other development activities to areas outside of the VPZ;
- Retain natural drainage patterns;
- Retention of dead or dying trees for wildlife benefit, providing there is no potential for property damage or threats to human safety;
- Prune shallow-rooted trees to avoid windthrow;
- Removal of problem exotics such as European buckthorn;
- Plant early-successional species along woodland edges to provide protection to woodland edges; and,
- Monitoring of edge plantings to ensure effectiveness and survivorship.
  (adapted from TRCA, 2004)

As mentioned above, woodlands (significant or otherwise) within the areas proposed for development are not subject to planned direct modification (i.e. subject to cutting) under the MESP. That is, linear infrastructure and servicing has been placed outside of existing woodland

boundaries. Additionally, all woodlands have buffer widths ascribed to them as a means of protection. Proposed future commercial/industrial development should not occur within buffers.

7.2.9 Fencing

Permanent rear lot/development fencing should be considered to prevent uncontrolled access and encroachment into adjacent natural areas. Hard barriers should be considered between commercial/industrial areas and the NHS. Opportunities for wildlife passage should be considered at appropriate locations when incorporating hard barriers adjacent to natural areas, and live fencing should be encouraged where feasible. It is recommended that species selection for live fencing include woody species with thorns (e.g *Crataegus* spp, *Rubus* spp, *Rosa* spp, *Zanthoxylum americanum*) to discourage encroachment into natural areas. The final recommendations regarding the type of fencing and potential offsetting of the fence onto public lands to preclude fence alterations/gate installation should be developed during subsequent planning stages.

7.2.10 Groundwater Protection

Groundwater is the sole source of drinking water for the Mid-Spencer Creek Subwatershed (population 11,829) and of the Greensville RSA (population 2,525). As reviewed in Chapter 4, there are continuing problems with water quality and quantity within the RSA. Groundwater discharge to Middle Spencer Creek contributes more than 50% of the total annual flow and continued groundwater recharge and discharge is essential to preserve the ecological functions of Middle Spencer Creek. The protection and management of groundwater resources within the subwatershed was identified as a concern under existing conditions. The recent Tier 1, Tier 2 and Tier 3 Water Quality Stress Assessment (WQSA) identified the Mid-Spencer Creek as being under moderate stress. The Assessment Report for the Hamilton Region Source Protection Area included the Well Head Protection Area (WHPA) for the Greensville municipal well and the its vulnerability. Phase 1 and 2 of the Tier 3 Water Budget and Local Risk Assessment for the Greensville Municipal System (Earthfx, 2014) refined the hydrostratigraphy, water demand from quarries and assessed transient water levels and groundwater pumping data to provide a solid foundation for subsequent assessment tasks.

Groundwater protection should address the following objectives

- Protect natural features overlying identified groundwater recharge areas;
- Maintain the water balance at a subwatershed level;
- Implement Well Head Protection policies around the Greensville municipal well;
- Restrict and monitor land uses within highly vulnerable areas associated with the WHPA

- Encourage the maintenance, repair or replacement of failing private septic systems;
- Encourage the maintenance, repair, replacement and proper abandonment of water wells susceptible to bacterial contamination from surface;
- Preserve or enhance the pre-development water budget through policies that promote infiltration at the lot level;
- Consolidate stewardship and regulatory programs that are presently delivered through multiple agencies into a more seamless program to provide sustainable program delivery in terms of staff resources and incentive funding, and to achieve higher degrees of voluntary participation and compliance by citizens;
- Educate staff and elected representatives on state-of-the-art technologies for stormwater management and urban development standards, to build support for incorporating these technologies into infrastructure master plans, new development and redevelopment projects; and
- Increase the combined efforts of all agencies in the area of public education, community outreach and stewardship of tributaries, shorelines and riparian zones to encourage landowners to develop a conservation ethic in the treatment and rehabilitation of these resources and to improve public and agency relations.

7.2.11 Aggregate Extraction

There is one operating quarry in the Mid-Spencer Creek Subwatershed, the Lafarge North Quarry, located 1500 metres north of the RSA Boundary. The Lafarge North Quarry has a Permit to Take Water (PTTW) for quarry dewatering for up to 18,398,207 cubic metres per year. The Lafarge South Quarry (**Figure 7.2.1**) is contiguous to the Greensville RSA and is used for aggregate washing and processing. The Lafarge North and South Quarries have PTTWs for a maximum of 30,548,310 cubic metres per year, although average pumping rates are less than 32% of the permitted rates. It is understood that the water from the North Quarry is directed to the South Quarry for aggregate washing and processing, and then subsequently discharged to a tributary of Logie's Creek in the Logie's Creek Subwatershed.

As such, the quarry dewatering is outside the scope of the present study and is dealt with in the Assessment Report of the Hamilton Region Source Protection Area and the Tier 3 Risk Assessment Report (Earthfx, 2014).

Partnership opportunities to promote progressive rehabilitation and appropriate after-uses supportive of the restoration of the natural environment could be investigated by the City of Hamilton, NEC, HCA, and the Management of Abandoned Aggregate Properties Program of the Ontario Aggregate Resources Corporation, for example.

Figure 7.2.1: The Lafarge South Quarry Retention Pond, viewed from the RSA (2011).

7.2.12 Policy Development

As of March 7, 2012, the Rural Hamilton Official Plan is no longer under appeal and is in full force except for 2 sections. First, a section on Surplus Farm Dwelling Severances (Chapter F1.14.2.2 c ii); and the Hamilton Airport Expansion Area (Volume 3, Special Policy Area "C").

The Greensville Secondary Plan was prepared in 1992 as an Official Plan Amendment (OPA 13) to the Official Plan of the (former) Town of Flamborough. OPA 13 outlines land use policies, guideline for developments, growth patterns and servicing requirements.

The following policies are considered in addition to OPA 13:

- The Greenbelt Plan (2005)
- The Niagara Escarpment Plan (2005)
- Provincial Policy Statement (2014)
- Source Protection Plans (under the Clean Water Act, 2006)
- City of Hamilton Water and Wastewater Master Policy Plan (2005)
- City of Hamilton Guidelines for Hydrogeological Studies and Technical Standards for Private Services (2013)

7.3 Long List of Alternatives – Rural Settlement Area

The Secondary Plan for Greensville (1992) sets out requirements for storm water drainage and hydrogeology studies to be completed prior to new development within the Greensville Settlement Area. This study will, therefore provide alternatives related to drainage and groundwater protection for new developments. In addition, as noted in Chapter 6, impacts associated with new development will impact both surface and groundwater flows.

Chapter 4 of the Secondary Plan for Greensville summarized a variety of issues related to environmental features within the Rural Settlement Area. This would suggest that restorative measures, to be undertaken by homeowners or agencies, are also required.

Lastly, with respect to groundwater, a range of alternatives to protect or enhance groundwater quantity and quality, need to be considered. Several of these alternatives may include works or undertakings that are subject to the Environmental Assessment Act.

In summary, the alternatives that are to be considered for the Rural Settlement Area will have to address a variety of environmental resources and may be generally grouped under the following four categories.

- **Alternatives that are subject to the Environmental Assessment Act:** These alternatives will be subject to an evaluation process within this study.
- **Alternatives that fall under the Planning Act:** These measures will be identified and screened through this study. Refinement and approvals of the proposed measures will be subject to further studies.
- **Alternative that fall under the Niagara Escarpment Planning and Development Act:** These measures will be identified and screened through this study. Refinement and approvals of the proposed measures will be subject to further studies.
- **Alternatives that are classified as Operations and Maintenance undertaken by the City of Hamilton:** These measures are currently undertaken on a regular basis by various City departments.
- **Alternatives that are considered to be Stewardship projects:** These measures will be identified as part of this study and are generally not subject to further approvals. The measures are usually undertaken by homeowners or landowners and are voluntarily (therefore not subject to further approvals).

Provided below (**Table 7.4.1**) is a long list of alternatives that are to be considered for the Rural Settlement Area. Also provided with the list is a brief description of alternative together with the category for which the alternative (or group of alternatives) generally falls under (Environmental Assessment, Planning Act, City Operations and Maintenance, or Stewardship).

The alternatives which fall under the Planning Act or Stewardship will be further discussed in **Chapters 9** and **10**. The process for screening and evaluating alternatives subject to the Environmental Assessment process will be described in subsequent sections of this chapter.

7.4 Alternatives Subject to the Environmental Assessment Process

As noted in **Table 7.4.1** there are several items which are described under the general heading 'Servicing Alternatives'. One of the objectives of the subwatershed study is to identify constraints and opportunities and investigate all alternative solutions. In this regard the subwatershed planning process may make recommendations which lead to undertakings that are subject to the Environmental Assessment Act. As noted previously, in order to meet the intent of the Act, the subwatershed study will be conducted as a Master Plan (Approach #1) and satisfy Phases 1 and 2 of the Municipal Engineer's Association (MEA) Class Environmental Assessment process, in accordance with the established principles for Master Planning. The Master Plan will then become the basis for, and used in support of, future investigations for any specific Schedule B and C projects identified within it.

Provided below is a description of the screening and evaluation process, together with the selection of a preferred alternative for various alternatives that were considered under the general heading of 'Servicing Alternatives' and Stormwater Management.

Table 7.4.1: Long List of Alternatives for Rural Settlement Area

Alternative	Description	Category
Stormwater Management Measures for New Development	• Conventional stormwater facilities to control flooding, erosion, water quality • Low Impact Development measures to meet water balance requirements	Environmental Assessment / Planning Act
Measures for Existing Homes	• Replacement of septic systems • Replacement of existing wells • Septic system inspection programs • Reduce fertilizer use	Stewardship
Servicing Alternatives	• Bring up municipal water • Provide more communal wells • Control/limit development • Provide back up for existing municipal well	Environmental Assessment
Municipal Operation & Maintenance Practices	• Reduce use of road salt • Reduce fertilizer use in parks	City Operations and Maintenance
Policies	• Control/limit development • Enforce existing policies (e.g. lawn watering) • Implement wellhead protection policies	Planning Act Source Protection Act
Stewardship	• Encourage source control (lot level) programs for homeowners to increase infiltration • Self-assessment through the " Landowner Stewardship Guide for the Ontario Landscape" from www.stewardshipmanual.ca	Stewardship
Habitat Enhancement	• Stream restoration • Aquatic habitat • Terrestrial habitat	Stewardship

7.5 Servicing Alternatives

Provided below is a description of each of the alternative solutions that were considered for servicing existing and new growth.

7.5.1 "Do nothing" – Maintain Status Quo

This alternative is traditionally carried forward as a benchmark in the Environmental Assessment process. For the purpose of this study the 'Do-nothing" alternative would essentially equate to

maintaining status quo. This would include continuing the use of the existing municipal well including the necessary on-going operation and maintenance practices.

7.5.2 Control / Limit Community Growth

This alternative would generally consist of limiting growth to within existing system capacities and would therefore negate new development including infills. This alternative would also include continuing the use of the existing municipal well and necessary on-going operation and maintenance practices.

7.5.3 Bring up municipal water

This alternative would involve extending the City's municipal water supply from Dundas up the escarpment to Greensville. Potable water, for part or all the Greensville would ultimately be provided from the Woodward Avenue Water Treatment Plant.

7.5.4 Provide more communal wells

There is currently one communal well, the Briencrest well, which services 26 homes. The well and pumphouse is located on the west side of Haines Avenue, between Briencrest and Kirby Avenues (see location in **Figure 4.4.8**). The well is currently owned by Infrastructure Ontario (formerly Ontario Realty Corporation) and is operated by the Ontario Clean Water Agency (OCWA). For this alternative new, or existing dwellings would be serviced by communal wells.

7.5.5 Maintain status Quo – Add Back up well

This alternative is similar to the Maintain Status Quo alternative with the exception that a backup well would be planned for in the case issues arose at the existing well.

7.6 Description of the Evaluation Criteria

The alternative solutions identified in the previous section were evaluated to select a preferred solution. **Table 7.6.2** presents the evaluation criteria used in the valuation process. The criteria, and approach used to evaluate the servicing alternatives is similar to the approach used in the City of Hamilton Water and Wastewater Master Plan Class Environmental Assessment Report (**Table 7.6.1).**

Table 7.6.1: Information Matrix For Servicing Alternatives

Evaluation Criteria	Do Nothing – Maintain Status Quo	Control – Limit Community Growth	Bring Up Municipal Water	Provide More Communal Wells	Status Quo – Add Back-up Well
Natural Environment	• Minimal impact to natural environment as ongoing activities are limited. Ecological processes likely to maintain current trajectory.	• Minimal impact as further construction activities would be halted	• Significant impact associated with crossing of existing streams and potential impact on the Natural Heritage System	• Moderate potential impact as a result of stream crossings, local impacts to vegetation and wildlife	• Minimal impact to natural environment as ongoing and proposed activities are limited
Socio-Economic	• Impact on existing and proposed development, recreational areas and utilities limited	• Neutral impact as reduction in construction activities would be offset by economic impact	• Significant impacts due to construction including traffic disruption, noise	• Significant localized impacts due to construction noise, traffic disruption	• Impact on existing and proposed development, recreational areas and utilities limited
Legal–Jurisdictional	• This alternative is consistent with existing municipal and provincial policies	• This alternative is not consistent with existing growth policies for the city	• This alternative is not consistent with Provincial or Municipal policy • This would require review by the Niagara Escarpment Commission	• This alternative is not consistent with Municipal policy and the Greensville RSA Plan on partial servicing • This alternative is prohibited by the Greenbelt Plan and the Provincial Policy Statement or the Rural Official Plan	• This alternative is consistent with provincial policy and preferred by municipal policy requirements
Technical	• Level of service is adequate Alternative is technically feasible • Issues will arise if existing well malfunctions	• Level of service for existing homes is adequate	• Technical assessment would need to be confirmed as part of Regional assessment of water distribution system	• Technical assessment would be confirmed as part of subsequent, more detailed assessment	• Reliability of service for existing dwellings serviced by municipal well FDG01 would be improved • Alternative is technically feasible Two wells installed in Johnson Tew Park have required flows for backup
Financial	• Ongoing costs for operation and maintenance are quite low • Future development costs borne by developer / landowner	• Ongoing costs for operation and maintenance are quite low	• This alternative would be significantly more costly than any of the other alternatives	• This alternative would be more costly than others, except the *Bring-up Municipal Water* alternative	• Ongoing costs for operation and maintenance are quite low • Future development costs borne by developer / landowner • Cost for back-up well tied into existing system is of moderate cost
Overall Alternative Rank					

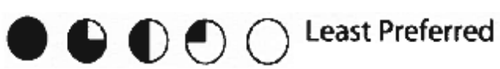
Most Preferred  Least Preferred

Table 7.6.2: Listing of Evaluation Criteria

Physical and Natural Environment

- Impact on vegetation, fish and wildlife; surface drainage and groundwater; soil and geology
- Impact on areas of natural and scientific interest, and environmentally-sensitive areas
- Disruption of topographical features

Social, Economic, and Cultural Environment

- Impact on existing and proposed development
- Impact on archaeological and historic sites
- Impact on agricultural resources
- Impact on recreational areas
- Impact on other utilities
- Coordination with proposed roadway development

Technical Factors

- Level of service
- Security and reliability
- Impact on existing infrastructure
- Constructability
- Impact on operations and maintenance
- Meeting legislated criteria and regulations

Financial Factors

- Construction, operation and maintenance (life-cycle) costs
- Best use of existing infrastructure
- Flexibility for scheduling works

Legal and Jurisdictional Factors

- Provincial Policy Statement
- Greenbelt Plan
- Niagara Escarpment Commission
- City Water and Wastewater Policy Land Acquisition

7.7 Summary of Evaluation Process For Servicing Alternatives

7.7.1 "Do-nothing"

This alternative is traditionally carried forward as a benchmark in the Environmental Assessment process. For the purpose of this study the 'Do-nothing" alternative would essentially equate to maintaining status quo. This would include continuing the use of the existing municipal well (FDG01) which services 34 dwellings (approximately 108 people) and the necessary on-going operation and maintenance practices. The well is located north of Harvest Road, between the Greensville Public School and Forest Avenue (see **Figure 4.4.8**), The Briencrest communal well which services 26 homes would also be maintained. The remaining Dwellings would be serviced by individual wells

Impact Assessment

The potential for impacts associated with the "Do-nothing" alternative was assessed and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

Construction activities would be limited to periodic maintenance activities at the existing municipal well and activities associated with drilling private wells for new development. The potential impact to aquatic, terrestrial, surface drainage and groundwater would therefore be minimal.

Socio-Economic Factors:

The impact on existing and proposed development, recreational areas or other utilities would not be significant. Ongoing issues with the existing Briencrest well would not be resolved.

Legal-Jurisdictional Factors:

This alternative is consistent with existing municipal and provincial policies.

Partial servicing is not permitted under the Greenbelt Plan, the Provincial Policy Statement (1.6.4.5) and the City's Water and Wastewater Master Plan (2005). The creation of new communal wells is permitted in the Greensville RSA if approved by the City (Rural Official Plan, 3.5.12). Under provisions of the Clean Water Act, the future Source Protection Plan will also prevail in the event of a conflict between an official plan, zoning by-law or policies under Section 3 of the Planning Act.

Technical Factors:

The level of service for the dwellings serviced by the municipal well would be adequate although issues may arise if significant operational problems arise at the well.

Financial Factors:

The estimated costs to operate and maintain the existing well are quite low relative to the cost of adding a back-up well. The cost to drill wells for new development are borne by the developer and/or homeowner.

There will be financial costs to the City to provide the residents in the 36 homes supplied by the municipal well with alternate sources of water when it is taken off-line for maintenance and repairs.

7.7.2 Control / limit community growth

This alternative would generally consist of limiting growth to within existing system capacities and would therefore negate new development including infills. This alternative would also include continuing the use of the existing municipal well and necessary on-going operation and maintenance practices.

Impact Assessment

The potential for impacts associated with the control / limit alternative was assessed and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

The impact on the natural environment would be negligible as further construction activities would be halted.

Socio-Economic Factors:

The impact on existing development would likely be neutral as impacts associated with construction activities and associated with new development would likely be offset by the loss

in revenue associated with new development and the application of those funds to recreational areas and to local commerce.

Legal-Jurisdictional Factors:

Under Places to Grow the City is required to plan for future residential and employment growth. This growth and the goals and objectives of the GRIDS process and VISION 2020 would not be met. This alternative is therefore not consistent with existing jurisdictional factors.

Technical Factors:

The level of service for existing homes would be adequate.

Financial Factors:

The cost for this alternative would be limited to operating and maintaining the existing municipal well.

7.7.3 Bring up Municipal Water

This alternative would require extending the existing municipal potable water supply system from Dundas up to the Greensville Area and providing local municipal water mains to service the 900 plus residential units and commercial sites.

Because the Greensville area lands lie at a higher elevation than is currently serviceable through the existing Pressure District #21 in Dundas, a second Dundas Pressure District would need to be created. Creating this district would also require the following:

- Construction of a new booster pumping station
- Construction of a feeder main from Dundas to the Greensville area
- Construction of an elevated storage tank to meet peak flow and fire requirements
- Construction of local water mains to service individual dwellings and commercial/industrial sites.

Impact Assessment

The potential for impacts associated with the bringing up municipal water alternative was assessed and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

Construction activities associated with constructing a booster station, constructing a feeder main from Dundas to Greensville, construction of an elevated tank and associated local water mains would be considerable. These activities would likely require crossings of existing

streams and may impact sensitive environmental features. Dewatering (depending on soil conditions) may also be required which would impact existing wells.

Socio-Economic Factors:

Constructing a booster station, feeder main, and local water mains will result in significant construction noise, and will likely cause traffic disruptions.

The elevated storage tank would likely be constructed within a current undeveloped area, allowing the exact siting of the tank to be within a compatible land use.

Legal-Jurisdictional Factors:

This alternative is not consistent with the Provincial Policy Statement, The Greenbelt Plan nor with the City's Official Plan. In any case, such an alternative, if allowed, would be subject to review by the Niagara Escarpment Commission.

Technical Factors:

Providing all of the servicing requirements as noted above through the existing Pressure District #21 may be somewhat limiting and would have to be confirmed as part of a larger Regional assessment on a City–wide basis. Furthermore, issues relating to twinning the feeder main to ensure a reliable supply would have to be considered.

Financial Factors:

Approximate costs for this alternative were established using unit rates as provided in the City of Hamilton Water and wastewater Master Plan Class Environmental Assessment Report (the unit costs were updated from 2005 to 2012 costs). An estimated cost, based on 1275 residential units is $40 million.

7.7.4 Provide More Communal Wells

There is currently one communal well, the Briencrest well, which services 26 homes. For this alternative new, or existing dwellings would be serviced by communal wells.

Impact Assessment

The potential for impacts associated with the providing more communal wells alternative was assessed and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

The impact on aquatic or terrestrial resources, surface drainage or groundwater would be dependent upon where the communal wells were constructed. Typical impacts could include those associated with watercourse crossings and local impacts to vegetation and wildlife.

Socio-Economic Factors:

Activities associated with construction of communal wells would generally result in significant construction noise, traffic disruption as well as impacts associated with dwellings adjacent to the proposed communal wells.

Legal-Jurisdictional Factors:

This alternative is not consistent with existing municipal and provincial policies.

Partial servicing is not permitted under the Greenbelt Plan, the Provincial Policy Statement (1.6.4.5) and the City's Water and Wastewater Master Plan. Under provisions of the Clean Water Act, the future Source Protection Plan will also prevail in the event of a conflict between an official plan, zoning by-law or policies under Section 3 of the Planning Act.

Technical Factors:

Assessment of the technical factors would also be site dependent. The level of service as well as security may improve if existing wells are subject to supply or quality problems. The impact of long term communal wells with respect to reliability and/or impact on operations and maintenance would generally offset these benefits dependent upon the expertise of those who look after the systems. As mentioned earlier, the sole communal well (Briencrest) not owned by the City is presently owned by Infrastructure Ontario and operated by the Ontario Clean Water Agency (OCWA). Although the well and pumphouse are operating in conformity with requirements of the Safe Drinking Water Act, the distribution system is owned by the individual residents where it lies on their properties and is not owned or managed by Infrastructure Ontario.

Bottled water is also brought in to residents due to the poor quality of the well water.

Financial Factors:

Costs for this alternative are difficult to assess as they would be site dependent, particularly in the case of Briencrest where the distribution system remains under private ownership. Typically this alternative would result in unit costs (cost/dwelling) which are lower than the alternative Bring up Municipal Water, but higher than the other alternatives.

7.7.5 Maintain Status Quo – Add Back Up Well

This alternative is similar to the Maintain Status Quo alternative with the exception that a back up well would be planned for in the case issues arose at the existing municipal well.

Impact Assessment

The potential for impacts associated with the Add Back Up Well alternative was assessed and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

Construction activities would be limited to periodic maintenance activities at the existing municipal well and activities associated with drilling wells for new development as well as for the back-up well. The potential impact to aquatic, terrestrial, surface drainage and groundwater would therefore be minimal.

Socio-Economic Factors:

The impact on existing and proposed development, recreational areas or other utilities would not be significant. Ongoing issues with, and ownership of, the existing Briencrest communal well would not be resolved.

Legal-Jurisdictional Factors:

This alternative is consistent with existing municipal and provincial policies. This alternative is consistent with the City's Water and Wastewater Master Plan Policy Paper, Policy W.04 that states "The City of Hamilton shall provide reliability and security throughout the water distribution system".

Three test wells were installed in Johnson Tew Park, a 14.2 hectare park near Harvest and Brock Roads in February 2013 (Stantec, 2014). Two of the wells were found to provide equivalent maximum day taking and peak hour taking as the existing Greensville well FDG01. The consensus within the Hamilton Water Division is that the new wells be fitted with an independent treatment system to provide full redundancy to the Greensville backup system. The treatment system would be near Cedar Avenue.

Technical Factors:

The level of service for the dwellings serviced by the municipal well would be improved over the Do-nothing alternative as the back-up well would provide a fully-redundant secondary source of water should problems arise at the existing well.

Financial Factors:

The estimated costs to operate and maintain the existing well are quite low, estimated to be $31,100 annually (City of Hamilton staff). The cost to drill wells for new development are borne by the developer and/or homeowner. The estimated cost to bring the two existing backup wells with a separate treatment system on line is $1,000,000.

7.8 Stormwater Alternatives

This section reviews and evaluates stormwater management alternative measures, referred to as Best Management Practices (BMPs), to mitigate the potential development impacts (Chapter 6) and meet the selected objectives. The term Best Management Practice, which includes Low Impact Development measures (LIDs), is defined as a measure that, when implemented will assist in protecting, enhancing, or restoring the environmental features.

In keeping with the Environmental Assessment process, several alternative techniques have been identified to address the potential environmental impacts resulting from the proposed future development lands within the Rural Settlement Area (RSA):

1. Do nothing;
2. Traditional Measures;
3. Low Impact Development (LID) Measures;
4. Low Impact Development (LID) Measures and Traditional Measures

The above alternative measures focus primarily on the development of a stormwater management strategy, which is the key component of an overall Subwatershed Strategy. A description of each of the above options is discussed in more detail below.

1. Do Nothing

This measure involves developing the RSA lands without stormwater management. This alternative would result in a substantial increase in runoff, flooding, erosion and also water quality degradation both within the future development lands and the lands downstream.

2. Traditional Measures

Traditional measures are practices that are typically designed and implemented within the study area. Accordingly, these measures are:

- End-of-pipe controls including wet ponds, wetlands, and dry ponds;
- Traditional Source Control Measures including oil-grit separators and other lot level measurements such as oversized storm sewers, rooftop storage and parking lot storage

End-of-pipe measures involve addressing stormwater management using conventional stormwater facilities such as wet ponds, wetlands and dry ponds at the end of the flow conveyance system (**Figure 7.8.1**). These facilities may be utilized for any combination of erosion, water quantity and quality control applications.

Figure 7.8.1: Example End-of-Pipe Controls (clockwise from top left: Constructed Wetland, Dry Pond, Wet Pond)

Traditional Source Control Measures (**Figure 7.8.2**) are typically used at the "lot-level" within high-density forms of development such as commercial or industrial landuses. Rooftops, parking lots, or oversized storm sewers can be used to temporarily store rainfall from large storm events. The storm runoff is then released at controlled rates to avoid increased rates of erosion and flooding in the receiving streams. In terms of water quality control, oil-grit separator devices are commonly used to remove some pollutants and improve water quality before runoff is released from industrial or commercial development sites.

Figure 7.8.2: Traditional Source Controls (Clockwise, from top left: Rooftop Storage, Parking Lot Storage, Oil-Grit Separator)

3. Low Impact Development (LID) Measures

According to EPA (2007), Low Impact Development (LID) is a stormwater management strategy that seeks to mitigate the impacts of increased runoff and stormwater pollution. LID comprises a set of site design approaches and small scale stormwater practices that promote the use of natural systems for infiltration, evapotranspiration, and reuse of rainwater. These practices can effectively remove nutrients, pathogens and metals from stormwater, and they reduce the volume and intensity of stormwater flows.

LID measures include two main categories; Source Control measures, and Conveyance Control Measures. Both categories include a suite of measures as follows:

- **Source Control Measures** (**Figure 7.8.3**) encourage the infiltration of water into the ground and reduce stormwater runoff. These measures can be integrated into the design of future urban developments and may include:
    - Rainwater Harvesting;
    - Green Roofs;
    - Downspout Disconnection;
    - Soakaway Pits,
    - Bioretention and Special Bioretention:
    - Compost Amendments;
    - Tree Clusters;
    - Filter Strips;
    - Permeable Pavement

Figure 7.8.3: Example LID Source Controls (from L to R: Bioretention, Downspout Disconnection, Permeable Pavement, Green Roofs)

- **Conveyance Control Measures**: Conveyance controls (**Figure 7.8.4**) are linear stormwater transport systems that are often located within the road right-of-way. LID conveyance controls not only provide a conveyance function, but also encourage infiltration of water into the ground, improve water quality and reduce runoff volume. They can include bio-swales, grassed channels and subsurface perforated pipe systems. These measures include:
    - Subsurface Perforated Pipes;
    - Bio-swales;
    - Bioretention units (Bump-outs)

Figure 7.8.4: Example LID Conveyance Controls (From L to R: Vegetated Channel, Subsurface Perforated Pipe, Bio-swale, Grass Channel)

LID practices are considered at the earliest stage of site design, are installed during construction and sustained in the future as a low maintenance natural system. Each LID practice incrementally reduces the volume of stormwater on its way to the stream. In doing so, LID practices can be applied to meet stormwater management targets for water quality, geomorphic and water balance objectives.

4. Low Impact Development (LID) Measures and Traditional Measures

LID practices, together with traditional stormwater BMP's can be applied to achieve an overall stormwater management system which provides better performance, is more cost effective, has lower maintenance burdens, and is more protective during extreme storms than conventional stormwater practices alone. Several LID practices may be needed on each site to get all the required storage and attenuation.

LID techniques plus traditional measures such as ponds, oil-grit separators, and lot-level storage mimic natural systems as rain travels from the roof to the stream by applying a series of practices across the entire development site before discharge to receiving water body. Integrating the two categories would provide a 'treatment train' approach to provide integrated treatment of runoff from development sites.

7.9 Evaluation of Alternative Measures

In order to ensure a transparent selection process (as part of the EA) that considers all possible alternatives, a two-phased evaluation process has been used to assess the alternative measures discussed in the previous Section. The two-phased approach (**Figure 7.9.1**) is composed of:

1. Screening level assessment; followed by a
2. Detailed assessment.

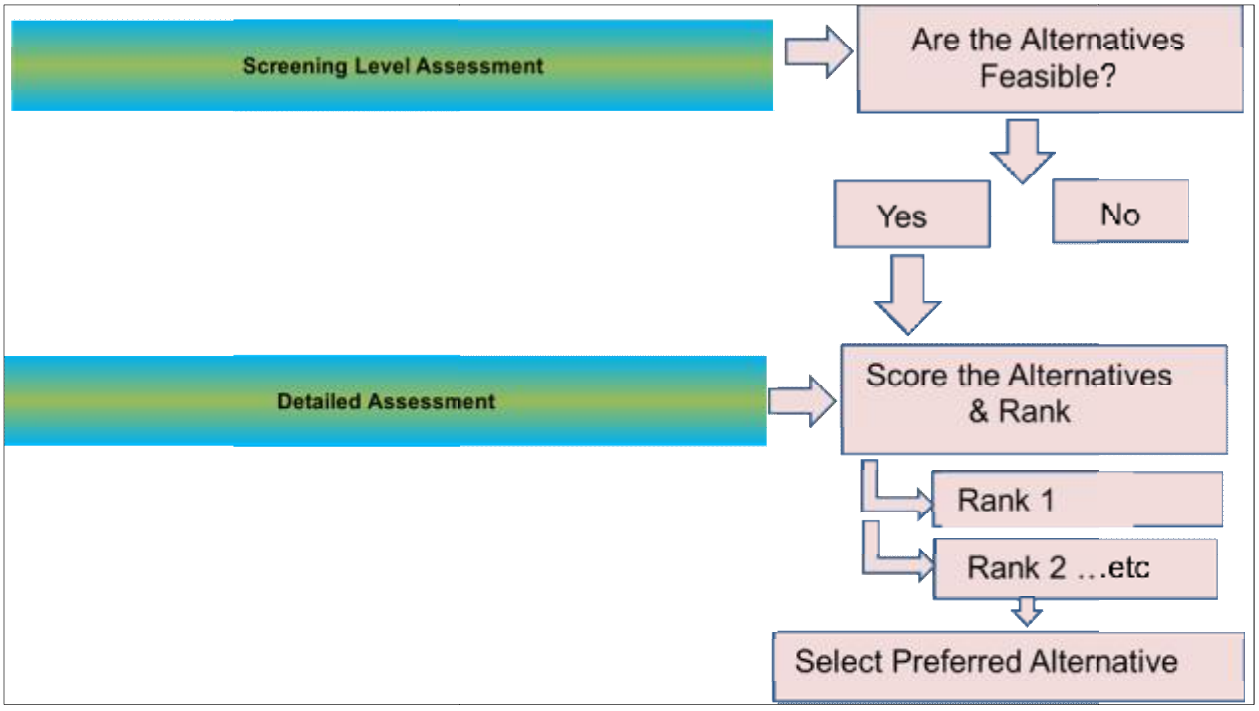


Figure 7.9.1: The Evaluation Process

7.9.1 Screening Level Assessment

The screening level assessment is intended as a coarse screening tool, used to review the stormwater measures that are feasible (and infeasible) for use within the Rural Settlement Area (RSA). To this end, nine (9) screening level assessment criteria have been utilized to determine which stormwater alternatives are to be carried forward to the more detailed assessment phase. The primary criteria include:

1) Technical feasibility;
2) Ability to meet targets for flooding,
3) Ability to meet targets for water quality,
4) Ability to meet targets for erosion and
5) Ability to meet targets for water balance;
6) Cost effectiveness;
7) Land requirements;
8) Public acceptance; and
9) Regulatory agency approval.

Table 7.9.1 describes the screening level assessment criteria and measures for assessment. **Table 7.9.2** presents the results of the screening level assessment. As shown in **Table 7.9.2**, the "Do Nothing" option does not meet flooding, water quality, erosion, or water balance objectives and would also not be acceptable to regulatory agencies. Traditional measures including End-of-Pipe measures tend to be inconsistent with higher-density urban settings due to the relatively large land area requirements, while dry ponds rank poorly in several categories and are not generally favoured by the public or regulatory agencies. These techniques, together with the "Do Nothing" option, were not carried forward to the second, detailed assessment phase.

Table 7.9.1: Primary Criteria used in Screening Level Assessment (Phase 1)

Criteria	Description of Criteria	Measures for Assessment
Technical feasibility	• Ability of the SWM technique to be constructed given the known constraints.	The assessment of the individual stormwater control measures ranges from Excellent to Poor in its ability to meet the identified criteria. Stormwater management techniques that fail to meet primary criteria will be deemed to be an unacceptable option and will <u>not</u> be carried forward to the detailed assessment (scored NA – Not acceptable).
Ability to meet targets for flooding	• Ability of the SWM technique to meet flood control criteria. Technique must control peak outflows for the site to pre-development rates for design storms with return period up to 100yrs. • Cannot increase flooding risks to infrastructure and private property.	
Ability to meet targets for water quality	• Ability of the SWM technique to meet water quality criteria as per Table 3.2 of the 2003 MOE Stormwater Management Manual.	
Ability to meet targets for erosion	• Ability of the SWM technique to control water course erosion in accordance with the 2003 MOE Stormwater Management Manual.	
Ability to meet targets for water balance	• Ability of the SWM technique to maintain the pre-development water balance and prevent adverse changes to site hydrology.	
Cost effectiveness	• Cost effectiveness of the SWM technique in relation to the overall benefit and the collective criteria.	
Land requirements	• A measure of the amount of land required to construct the SWM technique in relation to the overall benefit.	
Public acceptance	• General public acceptance of the individual stormwater management technique.	
Regulatory agency approval	• Ability of the SWM to meet the requirements of Municipal, Provincial, Federal agencies and the respective Conservation Authorities.	

Table 7.9.2: Phase 1 Screening-Level Evaluation Matrix

Stormwater Alternatives	Technical Feasibility	Flooding	Water Quality	Erosion	Water Balance	Cost Effectiveness	Land Requirements	Public Acceptance	Regulatory Agency Approval	Overall
Do Nothing	E	NA	NA	NA	NA	E	E	NA	NA	**NA**
LID Measures										
LID Source Control (infiltration / filtration)	E	P	E	E	E	P	F	G	E	**G**
LID Conveyance (infiltration / filtration)	E	F	G	G	G	G	G	G	G	**G**
Traditional Measures										
Traditional Source Control (storage)	E	E	P	G	P	G	G	G	F	**G**
Wet pond	E	E	G	F	P	G	F	E	E	**G**
Wetland	E	E	E	G	P	P	NA	G	G	**NA**
Dry Pond	E	E	P	G	P	G	F	NA	P	**NA**
	E=Excellent, G= Good, F = Fair, P=Poor, NA = Not Acceptable									

7.9.2 Detailed Assessment

The stormwater management techniques carried forward from screening level assessment were:

- LID Measures (Source control and Conveyance control), and
- Traditional Measures (Traditional source control and Wet ponds)

Both categories were investigated further. A category that combines LID measures and Traditional measures was added to evaluate if implementing both categories would achieve higher score than that achieved by implementing each of them individually. Accordingly, there are seven (7) alternatives that could be classified under the two categories mentioned above (LID measures and Traditional measures). They are:

1. Traditional Measures – Traditional Source Control;
2. Traditional Measures – Wet ponds;
3. Traditional Measures - Traditional Source Control and Wet ponds;
4. Low Impact Development (LID) Measures – Source Control
5. Low Impact Development (LID) Measures _ Conveyance Control;
6. Low Impact Development (LID) Measures – Source Control and Conveyance Control;
7. Low Impact Development (LID) Measures and Traditional Measures

The Detailed Assessment is a much more rigorous and thorough assessment of each alternative, and is based on a set of 19 evaluation criteria under 4 groupings, as described below:

Physical and Natural Environment Criteria

- Ability to meet targets for water balance and mitigate impacts to groundwater recharge and runoff volumes;
- Ability to meet criteria for flooding,
- Ability to meet water quality criteria;
- Ability to meet erosion criteria;
- Impact on terrestrial and aquatic habitat.

Social, Economic and Cultural Environment Criteria

- Impact on existing and proposed development;
- Aesthetic value;
- Potential benefit to the community and public acceptance;
- Coordination with infrastructure design

Technical Criteria

- Level of service and proven effectiveness;
- Regulatory agency acceptance (Municipal, Provincial, Federal and Conservation Authority);
- Impact on existing infrastructure;
- Constructability; and
- Maintenance requirements.

Financial Criteria

- Capital costs;
- Operation and maintenance costs;
- Land requirements;
- Impact on property value; and
- Phasing considerations.

Description of the Detailed Assessment criteria and measures for assessment is provided in

Table 7.9.3. As shown, each stormwater management alternative is given a score of 1 (poor) to 4 (excellent) for each of the evaluation criteria. These scores are then applied and an aggregate score is assigned to each alternative. A matrix illustrating the results of the detailed assessment for each of the three (3) stormwater management alternatives is presented in **Table 7.9.7**.

Table 7.9.3: Description of the Physical and Natural Environment Criteria used in the Detailed Assessment

Criteria	Description of Criteria	Measures for Assessment
Ability to meet targets for Water balance	• Ability of the SWM alternative to mitigate undesired impacts to the pre-development water balance and prevent adverse changes to site hydrology (surface drainage, groundwater recharge, soils and geology).	Scoring ranges from 4 if the potential to mitigate changes to the pre-development is high, to 1 if the potential to mitigate water balance changes are low and post-development changes are anticipated.
Ability to meet targets for Flooding	• Ability of the SWM alternative to meet flood control criteria. Alternative must control peak outflows for the site to pre-development rates for design storms with return period up to 100yrs. • Cannot increase flooding risks to infrastructure and private property.	Scoring ranges from 4 if the potential to meet flooding criteria is high, to 1 if the potential is low and downstream flooding is anticipated.
Ability to meet targets for Water quality	• Ability of the SWM alternative to meet water quality criteria as per Table 3.2 of the 2003 MOE Stormwater Management Manual.	Scoring ranges from 4 if the potential to meet water quality criteria is high, to 1 if the potential is low and water quality impacts are anticipated.
Ability to meet targets for Erosion	• Ability of the SWM alternative to control water course erosion in accordance with the 2003 MOE Stormwater Management Manual.	Scoring ranges from 4 if the potential to erosion criteria is high, to 1 if the potential is low and erosion impacts are anticipated.
Impact on terrestrial and aquatic habitat: Connectivity, Diversity and Sustainability	• Potential for the SWM alternative to mitigate impacts to terrestrial and aquatic habitat. • Ability for the SWM alternative to provide opportunities for connectivity, diversity and sustainability for terrestrial and aquatic habitats.	Scoring ranges from 4 if the potential to mitigate impacts to terrestrial and aquatic habitat and provide additional opportunities for connectivity, diversity and sustainability is high, to 1 if the potential is low and impacts are anticipated.

Table 7.9.4: Description of the Social and Cultural Environment Criteria used in the Detailed Assessment

Criteria	Description of Criteria	Measures for Assessment
Impact on existing and proposed development	• Potential for the SWM alternative to be integrated with the existing and proposed land uses within the study area.	Scoring ranges from 4 if the potential for land use integration is high, to 1 if the potential is low.
Aesthetic value	• Potential for the SWM alternative to provide an aesthetic benefit to the existing and proposed community.	Scoring ranges from 4 if the SWM alternative has potential aesthetic value, to 1 if the potential is low.
Potential benefit to community and public acceptance;	• Potential benefit to the community with respect to integration into natural areas, passive use areas, trails, as well as general public acceptance of the SWM alternatives.	Scoring ranges from 4 if the potential for integration in public areas and public acceptance is high, to 1 if the potential for integration and public acceptance is low.
Coordination with proposed roadway design	• Potential for the proposed SWM alternative to be integrated into the proposed standard roadway cross-sections.	Scoring ranges from 4 if the potential for integration with the proposed roadway design is high, to 1 if the potential for integration is low.

Table 7.9.5: Description of the Technical Criteria used in Detailed Assessment

Criteria	Description of Criteria	Measures for Assessment
Level of service and proven effectiveness	• Degree to which the SWM alternative has been proven effective through scientific literature and long-term implementation and monitoring.	Scoring ranges from 4 if the SWM alternative has been proven effective, to 1 if the alternative is unproven.
Regulatory agency acceptance	• General level of acceptance of the SWM alternative by the various regulatory agencies (Municipal, Provincial, Federal and CA)	Scoring ranges from 4 if the SWM alternative is generally accepted by the various regulatory agencies, to 1 if the alternative is generally not accepted.
Impact on existing infrastructure	• Potential disruption to existing infrastructure (services, roads, etc)	Scoring ranges from 4 if the potential for disruption is low, to 1 if the potential for disruption is high.
Constructability	• Degree of difficulty in constructing the SWM alternative given the existing site conditions and constraints.	Scoring ranges from 4 if the general constructability is high, to 1 if it is low.
Maintenance Requirements	• Degree of anticipated future effort required to maintain the SWM alternative in good working order.	Scoring ranges from 4 if the level of anticipated future maintenance is low, to 1 if the alternative requires extensive future maintenance.

Table 7.9.6: Description of the Financial Criteria used in the Detailed Assessment

Criteria	Description of Criteria	Measures for Assessment
Capital costs	• The relative cost of constructing the SWM alternative.	Scoring ranges from 4 if the relative cost is low, to 1 if the relative cost is high.
Operations and Maintenance Costs	• The relative cost of operating and maintaining the SWM alternative	Scoring ranges from 4 if the relative cost of maintenance is low, to 1 if the relative cost is high.
Impacts on property value	• Potential impacts (positive or negative) to local property value, based on aesthetic benefits, potential land-use synergies and general economic incentives.	Scoring ranges from 4 if the potential benefit to property value is high, to 1 if the potential benefit is low.
Phasing Considerations	• Degree to which the SWM alternative can be effectively implemented as per the proposed construction phasing plan.	Scoring ranges from 4 if the potential to implement to SWM alternative as per the construction phasing plan is high, to 1 if the potential is low

Table 7.9.7: Detailed Assessment Matrix for Selecting the Preferred Alternative

Alternative #	Alternative Description	Physical and Natural Environment					Social and Cultural Environment				Technical Criteria					Financial Criteria					Aggregate Score
		Water Balance	Flooding	Surface Water Quality	Erosion	Terrestrial and Aquatic Habitat	Existing Land Uses	Aesthetic Value	Benefit to Community and Public Acceptance	Coordination with Infrastructure Design	Proven Effectiveness	Regulatory Agency Acceptance	Impact on Existing Infrastructure	Constructability	Maintenance Requirements	Capital Costs	Operation and Maintenance Costs	Land Requirements	Impacts on Property Values	Phasing Considerations	
Traditional Measures																					
1	Traditional Measures – Traditional Source Control Only	1	3	1	3	1	2	1	1	3	3	3	3	3	3	3	4	4	1	4	**47**
2	Traditional Measures – Wet Ponds Only	1	4	3	3	2	3	3	3	4	4	4	3	4	3	2	3	1	3	2	**55**
3	Traditional Measures - Traditional Source Control and Wet Ponds	1	4	3	3	2	3	3	3	4	4	4	3	4	3	3	3	2	2	3	**57**
Low Impact Development (LID) Measures																					
4	LID Measures – Source Control Only	3	1	3	2	3	3	3	3	3	3	2	2	3	2	3	2	3	3	4	**51**
5	LID Measures _ Conveyance Control Only	2	1	2	2	3	2	2	2	2	3	2	2	2	2	3	2	3	2	2	**41**
6	LID Measures – Source Control and Conveyance Control;	4	1	3	2	3	3	3	3	2	3	2	2	2	2	2	2	3	3	2	**47**
7	**LID Source Control and Traditional Measures**	4	4	4	4	4	3	4	4	4	4	3	3	2	2	2	2	1	3	2	**59***

*The preferred alternative for the RSA study area is Alternative 7 – LID Source Control Measures and Traditional Measures

7.10 Selection of the Preferred Alternative

As shown in **Table 7.9.7**, the preferred alternative for the Rural Settlement Area is Alternative 7, which consists of LID source control measures combined with Traditional measures, which include end-of-pipe wet ponds and oil and grit separators. This alternative ranks highly under the physical and natural environment criteria, and the social-cultural criteria. It also ranks relatively well under the technical criteria. The higher score of the LID source control measures compared to the score of the combined LID (source and conveyance) measures was the reason it was selected to be combined with the traditional measures.

In terms of stormwater management objectives, the use of LID source controls as part of this strategy would provide water balance, water quality, and erosion benefits. And the use of wet ponds as part of the strategy would provide further water quality, erosion and flood control benefits.

It should be noted that the feasibility of an end-of-pipe stormwater pond is constrained somewhat by the size of the area it services. In general, the MOE Stormwater Management Planning Manual (MOE, 2003) suggests that the service area for a stormwater pond should preferably be at least 10 hectares, and not less than 5 hectares. Through a review of the location of future development lands together with drainage patterns, it is understood that some future development sites may not be large enough to be serviced by a stormwater pond. In this case, LID source controls in addition to oil and grit separators would provide the desired water quantity and quality benefits. Accordingly, the following recommendations would be appropriate for the study area.

***Preferred* Stormwater Management Strategy (for sites > 5ha):**

- LID source controls;
- End-of-pipe wet ponds

***Alternate* Stormwater Management Strategy (for sites < 5ha):**

- Traditional source controls (i.e. surface storage and Oil/Grit separators);
- LID source controls