# Appendix G:

# Compensation Strategy for Fish Habitat Alterations

Canada

U.S. Department of Transportation
Federal Highway Administration

Ontario

MDOT
Michigan Department of Transportation

## Canada-United States-Ontario-Michigan

## Border Transportation Partnership

# Compensation Strategy for Fish Habitat Alterations

**July 2009**

# COMPENSATION STRATEGY FOR FISH HABITAT ALTERATIONS

## INTRODUCTION

A preferred alternative route (The Windsor-Essex Parkway), plaza and crossing have been chosen for the Detroit River International Crossing project (DRIC) in Windsor, Ontario (*Detroit River International Crossing Study Environmental Assessment Report* December 2008). The Windsor-Essex Parkway is a below-grade extension of Highway 401 along Talbot/Huron-Church Road and to the south of E.C. Row Expressway. The plaza is located at the southern end of Sandwich Street bordered by Broadway Street to the south, Ojibway Parkway to the east, the Detroit River to the west, the Brighton Beach Power facility, and Keith Transformer Station and Nemak Automotive property to the north. A number of watercourses will be affected by The Windsor-Essex Parkway and plaza. The location of these watercourses and potential effects resulting from this project are discussed below.

## EXISTING CONDITIONS

The existing conditions within all watercourses located in the study area are presented in **Section** 2.3.3.2 of the *Draft Practical Alternatives Evaluation Working Paper – Natural Heritage* (July 2008).

## PROPOSED WORK AND IMPACTS

As noted above, The Windsor-Essex Parkway will consist of below-grade sections of roadway. It will extend from the current termination of Highway 401 to the new plaza near the Detroit River. Seven watercourses/drains currently cross the existing roadways within the study area and, in the future, will continue to cross and/or run parallel to The Windsor-Essex Parkway. These watercourses/drains are, listed from east to west, Wolfe Drain, Cahill Drain, Lennon Drain, Grand Marais Drain (Turkey Creek), Youngstown Drain, Basin Drain and McKee Drain. All of the noted watercourses/drains will be affected at their current crossing locations as a result of the construction of The Windsor-Essex Parkway. An additional drain (Healy Drain) will be affected by construction of the plaza.

### *Wolfe Drain*

The work required at Wolfe Drain to accommodate the construction of The Windsor-Essex Parkway will entail a culvert extension or replacement of the existing culvert with a larger one (in the same location). The existing culvert is a 57 m long open-footing concrete structure. The extended/new culvert will be 90 m in length (alteration of 33 m or 66 $m^2$ based on a 2 m wide channel).

In addition, a large portion of Wolfe Drain currently runs parallel to Talbot Road/Highway 3 between Cousineau Road and Outer Drive (2,423 m or 4,046 $m^2$). This channel is located within the area for The Windsor-Essex Parkway and will need to be realigned to the north to accommodate the construction and operations of The Windsor-Essex Parkway (details provided below). The thirty (30) entrance culverts associated with the residences along Talbot Road/Highway 3 will be removed, which will also "daylight" approximately 180 m (360 $m^2$) of fish habitat (i.e., the enclosures currently created by the entrance culverts will be removed).

### *Cahill and Lennon Drains*

Early on in the EA study it was proposed that the crossings of the Cahill and Lennon Drains would be via aquaducts 'at grade'. However, to maintain a full-depth channel and provide for flow capacity requirements, it was determined that the roadway would need to be deeper (i.e., the roadway would need to be sunk further below grade to accommodate the elevation needed to pass the flow over the road at the surface). Upon further investigation it was determined that the quality of the underlying soils was too poor to accommodate such construction of The Windsor-Essex Parkway. Due to the poor quality of the soils in the vicinity of Cahill and Lennon Drains alternative crossing methods were investigated.

Investigations were undertaken to determine the feasibility of passing fish over The Windsor-Essex Parkway via fish locks. These locks were designed and their feasibility assessed (see Feasibility Study, URS 2009). After the study was completed, and through additional consultation with DFO, it was determined that the crossings would need to be via submerged culverts. The submerged culverts would help to maintain flows through a connected channel (from upstream to downstream) and would be built underneath the below-grade section of The Windsor-Essex Parkway. As such, the inverts of the culverts will be approximately 7-8 m below the invert of the watercourses at surface. These two submerged culverts will be approximately 105 m in length to accommodate construction and operation of The Windsor-Essex Parkway, road slopes and service road.

Due to the depth and length of the submerged culverts, they result in a likely barrier to fish passage. The submerged culverts, therefore, effectively isolate the upstream portions of these watercourses from downstream areas. This isolation will result in a reduction of productive capacity to support upstream fish populations. Given the likely barriers to fish passage, the habitats upstream of the submerged culverts will need to become self-sustaining for resident fish species (warmwater baitfish) and will no longer be accessible to migrating Northern Pike (*Esox lucius*) for spawning. Northern Pike in these two locations currently use both drains, at least in part, for this life history function).

The general habitat contained within these two drains is marginally suitable to Northern Pike for spawning and their spawning success is not known. The habitat remaining upstream in Lennon Drain is not extensive enough to support self-sustaining fish populations. As such, the provision of a large wetland downstream of The Windsor-Essex Parkway will compensate, in part, for this loss. Also, the enhancement of linear habitat elsewhere in the Turkey Creek system will add additional compensation area.

The upstream habitat includes Lennon Drain up to Geraedits Drive (760 m or 1,520 $m^2$), Cahill Drain (2,249 m or 2,964 $m^2$), Wolfe Drain (2,706 m or 4,329 $m^2$) and Collins Drain (233.5 m or 467 $m^2$). Much of the area identified above (4,131.5 m or 7,463 $m^2$ in total) is currently available to Northern Pike for spawning. As such, new spawning habitat for this species (as well as habitat for resident warmwater baitfish) will need to be created either downstream in Cahill or Lennon Drains or in adjacent areas. The creation of new habitat will help to compensate for the potential loss of spawning habitat for this species.

A portion of Cahill Drain (730 m or 1,430 $m^2$) between the culvert under Talbot Road/Highway 3 and Cousineau Road runs parallel to Talbot Road/Highway 3 within the new alignment of The Windsor-Essex

Parkway. As such, the channel will need to be realigned to the north to accommodate the construction of The Windsor-Essex Parkway. The general details of the realigned channel works are described below.

### *Grand Marais Drain (Turkey Creek)*

A new structure will convey flows under The Windsor-Essex Parkway and service road. This structure will be approximately 100 m longer than the existing culvert, which will affect approximately 150 $m^2$ of fish habitat. The habitat in this drain consists of a concrete channel, floodplain and valley slopes with little or no current breaks or cover for fish. To enhance this habitat and to compensate for losses within this drain and elsewhere within the system, the concrete will be removed and the channel naturalized for a large portion of the drain downstream of the crossing. The details that describe these proposed works are provided below.

### *Youngstown Drain*

Youngstown Drain has both a southern and northern branch. The southern branch of Youngstown Drain, which runs westerly to the south of the backyards of residences along Spring Garden Road, will remain relatively unaffected by the proposed project. This branch does not contain direct fish habitat and likely conveys drainage during rain events only (i.e., provides indirect fish habitat). The northern branch, which flows in a southwesterly direction from its origin within the E.C. Row Expressway/Huron Church Road interchange, is accessible to fish moving upstream from Basin Drain. No fish have been captured/observed from this drain. This drain was found to contain standing water for part of the year and its invert is likely below the shallow water table during wetter months. As such, it likely flows only after precipitation events. The Windsor-Essex Parkway will pass over the northern branch of Youngstown Drain as it curves to the west. The upstream portion of the channel will be diverted at its outlet from the culvert under the E.C. Row Expressway W-N/S ramp to the Basin Drain culvert, a distance of approximately 450 m. As a result, the upstream portion of this drain will not contribute water to the downstream portion and will not be accessible to fish. With The Windsor-Essex Parkway crossing plus the loss of upstream channel, approximately 160 $m^2$ of channel will be destroyed or become inaccessible to fish (includes 80 m of 1 m wide channel within the cloverleaf of the interchange and approximately 80 m of 1 m wide channel downstream of the interchange).

### *Basin Drain*

A new culvert will convey Basin Drain under The Windsor-Essex Parkway in a transition area between a below-grade portion of The Windsor-Essex Parkway and an at-grade portion. This new culvert at Basin Drain is expected to be 120 m long, which is 35 m longer than the existing culvert. Basin Drain curves 90° after exiting the culvert, then again approximately 40 m downstream. The new culvert will bypass this reach of drain and as a result and additional 40 m of channel will be lost. As such, the new crossing will result in the loss of 75 m of channel (150 $m^2$ of habitat based on a 2 m wide channel).

Fish habitat is limited upstream of E.C. Row Expressway, however fish have been found in this location despite the culvert characteristics (long length and ditch inlet upstream end). Although fish were found upstream of the existing culvert at E.C. Row Expressway, it is unclear if the culvert passes fish.

### *McKee Drain*

One new crossing of McKee Drain is expected to occur as a result of construction of The Windsor-Essex Parkway and will be located upstream of Matchette Road. Between Matchette Road and E.C. Row Expressway a new storm water management facility is proposed that will be on-line. McKee Drain flows in a northwesterly direction within this portion of the study area and will continue to pass under E.C. Row Expressway through the current culvert. The new crossing and the proposed storm water management facility will not affect direct fish habitat as there is a barrier (165 m, small diameter pipe) downstream of the study area that is likely a barrier to fish passage. As such, the new culvert under The Windsor-Essex Parkway and the storm water management facility will not affect fish habitat within McKee Drain.

### *Healy Drain*

The construction of the plaza will cause the loss of the downstream portion of this small, seasonal watercourse. Approximately 243 m (243 $m^2$) of channel/seasonal fish habitat will be lost.

## COMPENSATION

Due to the harmful alteration, disruption or destruction (HADD) of existing fish habitat that will be caused by the construction of The Windsor-Essex Parkway and the plaza, compensation measures will be necessary. The HADD consists mainly of loss of access for fish in areas upstream of the two submerged culverts in Lennon and Cahill Drains (including Wolfe and Collins Drains), enclosure of habitat within new culverts and channel realignments. Due to the loss of Northern Pike spawning habitats in areas upstream of the submerged culverts, new wetland habitat (including pike spawning habitat) will be created in areas downstream of The Windsor-Essex Parkway that will be accessible to this species. For those fish that are resident upstream of the submerged culverts, habitats will be enhanced including through the construction of feature to support important life functions (such as wetland pockets) to ensure that these populations can be self-sustaining.

Details of the compensation strategies for each drain/watercourse are provided below. Details on loss and compensation areas are illustrated in Figure 1.

### Upstream of The Windsor-Essex Parkway

The areas upstream of The Windsor-Essex Parkway consist of the portions of Youngstown Drain, McKee Drain, Lennon Drain and Cahill/Wolfe/Collins Drains north (or south for McKee Drain) of The Windsor-Essex Parkway. The total area of upstream fish habitat in Lennon and Cahill, Wolfe and Collins Drains is 5,948.5 m or 9,280 $m^2$. This upstream fish habitat will need to fully support all life history functions of resident fish species (which potentially include juvenile Northern Pike).

### *McKee Drain*

There are no practical opportunities for the enhancement of the indirect fish habitat within McKee Drain upstream of The Windsor-Essex Parkway.


LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Drainage
- Realigned/Enhanced Habitat

Data Sources: LGL Limited field surveys, Essex Region Conservation Authourity, Spring 2006 aerial photography.

**DRAFT**

**FISHERIES COMPENSATION STRATEGY**

LGL LIMITED
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| | | | |
|---|---|---|---|
| **Project:** | TA4137 | **Figure:** | 1a |
| **Date:** | June 2009 | **Prepared By:** | KDT |
| **Scale:** | 1 : 10,000 | **Checked By:** | GNK |


LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Drainage
- Realigned/Enhanced Habitat

Data Sources: LGL Limited field surveys, Essex Region Conservation Authourity, Spring 2006 aerial photography.

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**FISHERIES COMPENSATION STRATEGY**

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| **Project:** TA4137 | | **Figure:** | 1b |
| **Date:** | June 2009 | **Prepared By:** | KDT |
| **Scale:** | 1 : 10,000 | **Checked By:** | GNK |


LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Drainage
- Realigned/Enhanced Habitat
- Downstream Wetland

Data Sources: LGL Limited field surveys, Essex Region Conservation Authourity, Spring 2006 aerial photography.

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**FISHERIES COMPENSATION STRATEGY**

LGL LIMITED
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| **Project:** | TA4137 | **Figure:** | 1c |
| **Date:** | June 2009 | **Prepared By:** | KDT |
| **Scale:** | 1 : 10,000 | **Checked By:** | GNK |


## LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Drainage
- Realigned/Enhanced Habitat
- Wetland Pockets

Data Sources: LGL Limited field surveys, Essex Region Conservation Authourity, Spring 2006 aerial photography.

**DRAFT**

# FISHERIES COMPENSATION STRATEGY

LGL LIMITED
environmental research associates

| | | | |
|---|---|---|---|
| **Project:** | TA4137 | **Figure:** | 1d |
| **Date:** | June 2009 | **Prepared By:** | KDT |
| **Scale:** | 1 : 10,000 | **Checked By:** | GNK |

### *Youngstown Drain*

As discussed above, approximately 160 m (160 $m^2$) of Youngstown Drain will be lost due to the construction of The Windsor-Essex Parkway. Much of this channel, which contains water only seasonally, currently consists of a single long flat. There is an opportunity to enhance an 85 m portion of the existing channel downstream of The Windsor-Essex Parkway. The enhanced channel will meander and its morphological diversity will be increased through the creation of large pools. These pools will act as refugia for resident fish species during dry periods of the year. The riparian areas will be planted with shrubs and small trees to provide shading and sources of allochthonous inputs. Habitat structures such as boulders and root wads will be added and emergent vegetation plantings will be placed along channel margins to increase habitat diversity and provide cover for resident fish species. In total, excluding the extra length provided by meanders (which has not been calculated yet), approximately 85 m or 170 $m^2$ of fish habitat will be enhanced, based on a 2 m wide channel.

### *Lennon Drain*

There are limited opportunities for habitat enhancements within Lennon Drain upstream of The Windsor-Essex Parkway. Much of the drain/watercourse exists outside of the right-of-way and is owned by the City of Windsor. The area immediately upstream of the crossing currently has a small bridge/culvert over the drain for a residential access. The crossing is approximately 10 m wide and will be removed. This removal will open 10 m or 20 $m^2$ of habitat, based on a 2 m wide channel.

### *Cahill Drain*

As noted above, the upstream portion of Cahill Drain constitutes 2,249 m or 2,249 $m^2$ of fish habitat of which 715 m or 1,430 $m^2$ consists of habitat that runs along the north side of Talbot Road/Highway 3. The reach of Cahill Drain that parallels the existing road will need to be realigned to the north to accommodate The Windsor-Essex Parkway. Opportunities exist to enhance this habitat which currently consists of a clay-lined, shallow channel with limited water depth, vegetative cover and habitat features. Creating small meanders will increase overall channel length and the incorporation of morphological features such as refuge pools and riffles, and structural features such as boulder clusters and root wad revetments, will increase habitat diversity and quality. Plantings of riparian vegetation will provide stream shading and overhead cover. Because water levels and flow drop during the dry portions of the year, refuge pools will provide areas where fish can congregate until water levels rise. The provision of structures such as boulders and root wads will provide cover for these fish within the pools. The riffles will increase the diversity of habitat and provide an area for aeration, benthic invertebrate production and suitable spawning habitat for some cyprinid species. Please see the Stream Rehabilitation/Enhancement section below for details regarding the proposed enhancements to Cahill Drain and Figure 3.

Work in the upstream portions of Cahill Drain (i.e., along Cousineau Road) will not occur as it is outside of the MTO right-of-way.

### *Wolfe Drain*

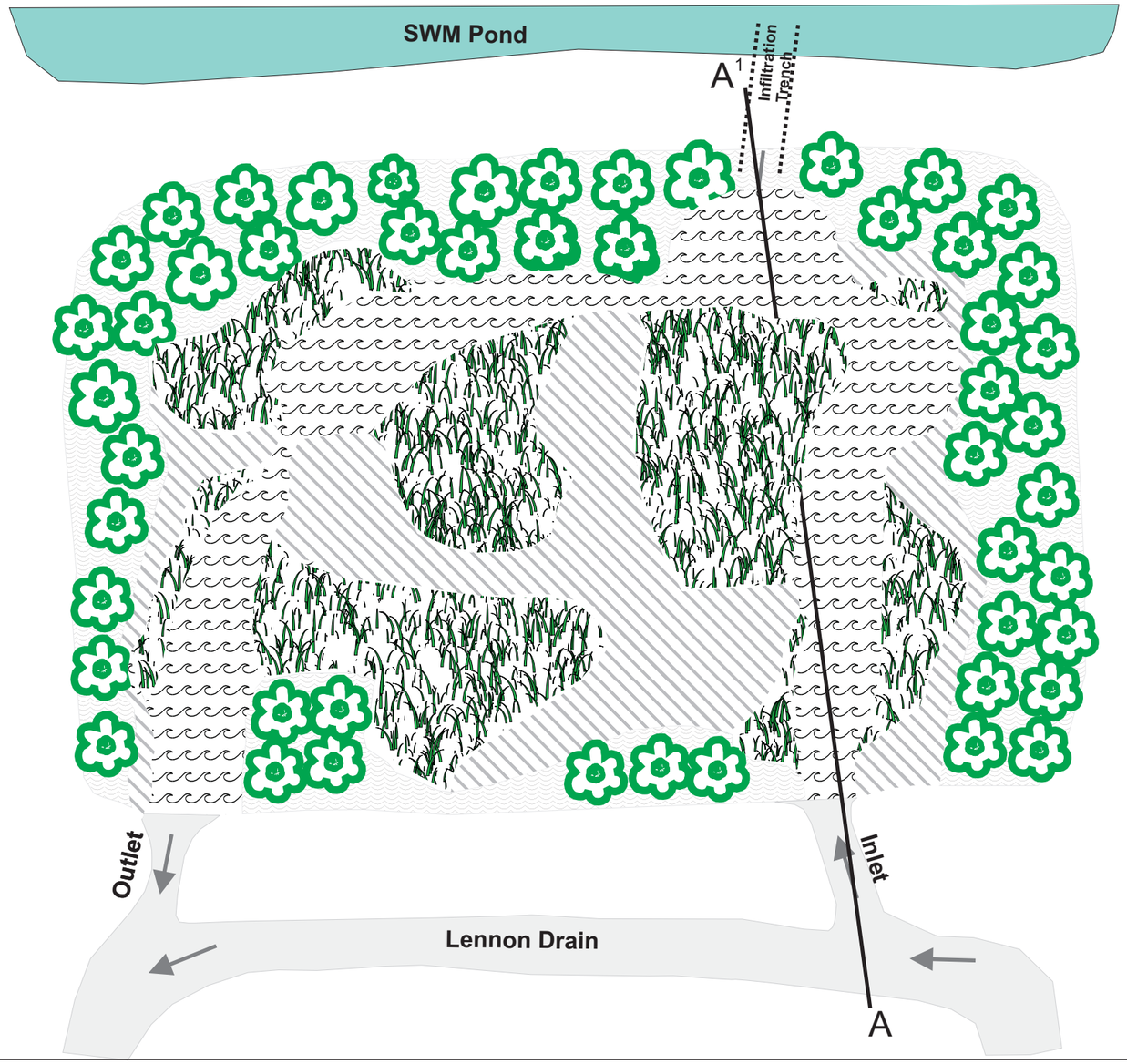
The situation along Wolfe Drain is similar to that along the portion of Cahill Drain that runs parallel to Talbot Road/Highway 3. This area, which constitutes approximately 2,706 m or 4,329 $m^2$ of fish habitat,

will require realignment to the north and is a tributary of Cahill Drain. The purpose of the new Wolfe Creek channel will follow the same format as that discussed above for Cahill Drain and its design is described below in the Stream Rehabilitation/Enhancement section. Morphological diversity (refuge pools and riffles), increased cover (boulders and root wads) and increased shading and overhead cover (riparian plantings) will be done to enhance the productive capacity of this drain/ watercourse. Meanders will be employed to increase overall channel length and thus increase habitat area.

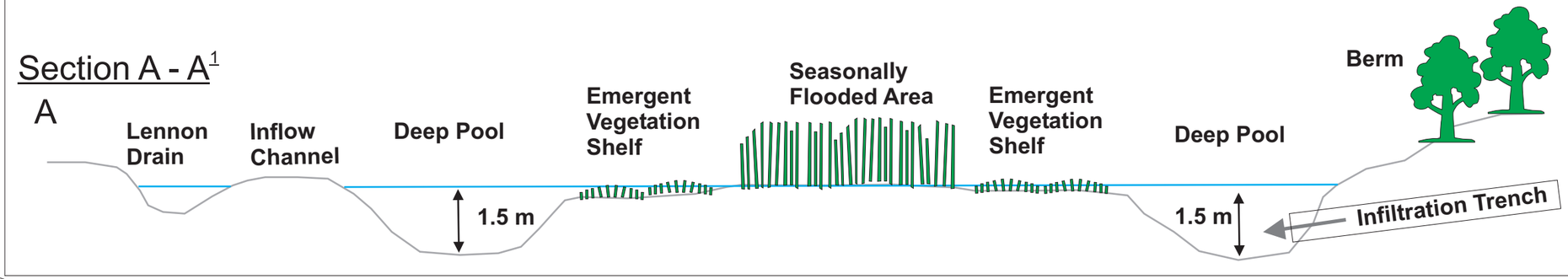
Wetland pockets within the right-of-way of The Windsor-Essex Parkway will be provided which will provide additional and more diverse habitat for resident fish within the Collins/Wolfe/Cahill Drain system. As the habitat upstream of The Windsor-Essex Parkway will need to provide for all of the life history functions of resident fish species, the wetlands, along with the realigned and enhanced channel, will afford a higher diversity of habitat types than what exists currently. Deep pools within some of these wetland pockets will be constructed to provide refugia for fish during low-water periods and submerged, floating-leaved and emergent vegetation will provide cover. As these wetland pockets will be located adjacent to the proposed storm water management ponds, these ponds will be used as additional sources of clean water for the wetland pockets wherever possible. The additional water will ensure that the wetland pockets do not dry out and/or trap fish using them as refugia. In discussions with URS Water Resources Group, water can be provided at the upstream ends of the wetlands through a sub-surface infiltration trench emanating from the storm water management facility's permanent pool. The trench will be filled with granular materials to slow flows for continuous release over long periods (weeks) to provide baseflow into the ponds to ensure a constant supply of water, even when baseflow in the drain is at its lowest. The transfer of water will be sub-surface and slow and water entering the wetland will be cool. The slow flow will also ensure that adequate settling of particulates within the storm water management facility occurs. In addition, the wetlands will have inflow channels that connect them directly to the main drain channel so that higher flows (e.g., after rain events) will cause water to enter, providing an additional source of water. Figure 2, although illustrating the downstream wetland along Lennon Drain specifically, shows how a wetland of this type will look with similar water sources and habitat types. Please note, that there is a commitment to provide the water levels necessary for all of the constructed wetlands that are to be used as fish habitat to function as designed and that adjustments will be made to ensure their functioning once constructed. A water balance study and stream flow monitoring for the Cahill/Wolfe Drain and for Lennon Drain will be conducted during later design stages to aid in establishing the parameters from which to design the inverts and water control structures to ensure that the wetlands function as intended. In addition, a hydrogeological study will be conducted to determine whether groundwater will infiltrate the wetlands or cause exfiltration to occur. If exfiltration is likely, the wetlands will be lined to ensure water retention as necessary.

Wetlands located in areas that will not receive storm water management pond flow will rely entirely on the baseflow of the drain. As such, these wetlands will be designed to be seasonally flooded and will contain standing water for short periods after rain events and during the spring. The habitat in these wetlands will consist of emergent vegetation and will contain shallow water during flooded periods. They will be accessible to resident fish during the spring and can be used as spawning habitat. During the dryer portions of the year, these wetlands will not contain much standing water and will not be accessible to fish. Tree and shrub plantings and/or other methods of shading (e.g., inverted root wads/tree trunks) will ensure shading to moderate water temperatures within the wetlands. In total, the area for wetland creation

## Plan View




## Section A - A1




### LEGEND

- Emergents (*Carex sp., Calmagrotis canadensis*) in clusters
- Submergents and Floating-leaved (*Potamogeton sp., Elodea canadensis, Nymphaea odorata*)
- Emergents (*Iris virginia, Sagitaria latifolia, Scirpus validus, Pontederia cordata*)
- Deciduous Trees (*Salix sp., Acer sacchirinum, Fraxinus pennsylvanica*)
- Seeding Area

**Detroit River International Crossing**

***Lennon Drain Fish Habitat Creation***

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| Project | Figure |
|---|---|
| TA 4137 | 2 |
| Date: June 2009 | |

will total as much as 36,145 $m^2$, and these wetlands will be situated in various locations along both banks of the watercourse where space permits.

In addition to the channel realignment and wetland pocket creation, 30 residential entrance culverts will be removed. These culverts currently enclose 180 m or 360 $m^2$ of fish habitat.

The realignment of the Wolfe Drain channel will involve its lengthening and enhancement through natural channel design with the addition of meanders and morphologic features (see below). In total, the elimination of entrance culverts will add 180 m and up to 36,145 $m^2$ of permanent or seasonal fish habitat will be added through wetland pocket creation. Thirty three meters (33 m) will be lost due to culvert extensions.

### *Collins Drain*

Collins Drain is generally out of the construction zone of The Windsor-Essex Parkway. However, new road construction will occur in the general vicinity and, as such, some additional landscaping work will be done in this area. The planting of riparian vegetation along the drain margins will increase stream shading which will moderate stream temperatures within the watercourse and further downstream into Wolfe Drain.

## Downstream of The Windsor-Essex Parkway

Opportunities exist in downstream portions of the drains/watercourses within the study area to provide opportunities for both Northern Pike spawning and general fish habitat. These areas will be designed to compensate for the loss, or potential loss, of general and pike spawning habitat upstream of The Windsor-Essex Parkway as a result of the possible barriers to fish passage caused by the submerged culverts discussed above. In some areas, the existing habitat will be enhanced while in others, new habitat will be created (Figure 1).

### *Lennon Drain*

A reach of Lennon Drain to the west of Huron Church Road has recently been realigned to accommodate the construction of a retirement facility. The habitat in this area was designed, in part, for Northern Pike spawning (J. de Laronde, DFO, pers. comm.). MTO has purchased a portion of the adjacent lands (agricultural field) and some of this area can be used to create spawning habitat for Northern Pike.

Both general wetland and pike spawning habitat will be created throughout this area by creating a marsh with a variety of habitat types, some of which will hold permanent open water and some that will be flooded in the spring. This wetland will be connected to the main Lennon Drain via small inlet and outlet channels in the realigned section and would become flooded during the spring and after precipitation events. Additional water will feed the upstream end of the marsh via an infiltration trench connected to the large storm water management facility (as with the Wolfe Drain wetland pockets) that will be located adjacent to the area and will ensure a more constant supply of water to the habitat. Marsh vegetation will be planted throughout the various habitat areas to provide medium upon which the fish can spawn and nursery habitat for juveniles. The underlying topography of the wetland will undulate between deep areas (up to 1.5 m), areas of medium-shallow depths (10 cm) to areas where the water level is at the level of the substrate during much of the year. The deep areas are designed to provide permanent habitat for resident

fish, the medium-shallow areas to provide a mix of spawning habitat for Northern Pike as well as spawning and nursery habitat for all species and the shallow areas will only provide direct fish habitat during flood conditions. The entire wetland area, including a bermed area on which deciduous trees will be planted for shade, is approximately 175 m x 70 m. The total potential area for this marsh is approximately 12,475 $m^2$. See Figure 2 for details regarding the proposed marsh.

### *Cahill Drain*

Limited opportunities exist for the creation of habitat in the downstream portion of Cahill Drain. Currently, there are no known areas that exist for habitat creation/enhancement within the property limits. The rehabilitation/enhancement of the Grand Marais Drain channel, discussed below, will aid in offsetting the downstream habitat loss in Cahill Drain created by the footprint infringement created by The Windsor-Essex Parkway and submerged culvert.

### *Grand Marais Drain (Turkey Creek)*

To compensate for the loss of habitat due to the 100 m enclosure of habitat under a culvert/bridge structure and general habitat alterations elsewhere within the project, restoration of the stream channel, floodplain and valley slopes will occur. Although the habitat conditions are poor, the fish community within the Grand Marais Drain was found to be the most diverse and the fish the most abundant within the entire study area. As a result of this, habitat restoration within a small section of the drain will have a large positive effect. Removal of the concrete channel and provision of natural substrates and in-stream cover will greatly increase the quality of the habitat. Removal of the floodplain concrete and planting of vegetation will open up habitat that could be used during periods of high water (potentially by spawning Northern Pike) and will provide shading to the watercourse. Removal of the concrete valley walls and the planting of shrubs and trees will further enhance this habitat and provide additional habitat for wildlife.

This type of habitat restoration/compensation was recommended by DFO (it was suggested that this type of habitat enhancement would be good for the project as a whole (J. de Laronde, DFO, pers. comm.) and was also discussed with ERCA. Because all other affected drains within the study area, with the exception of McKee and Healy Drains, are part of the Turkey Creek watershed, habitat restoration within Grand Marais Drain (which is the main branch of Turkey Creek) will have a net benefit to the entire system and can be applied to compensate for other drains/watercourses. Currently, there is approximately 62 m of concrete channel, floodplain and valley slopes downstream of the current Huron-Church Road crossing. An additional 890 m of concrete channel with more natural floodplain and valley slopes exist beyond that before the channel becomes naturalized. With a channel width of 1.5 m, the total area of compensation will be 1,428 $m^2$ if all concrete is removed. Once concrete is removed from the low flow channel, morphological diversity will be added to the watercourse using natural design principles similar to that described for Cahill and Wolfe Drains in other sections of this report.

### Stream Rehabilitation/Enhancement

Rehabilitation/enhancement of Cahill/Wolfe Drain upstream of The Windsor-Essex Parkway and of Grand Marais Drain downstream is part of the proposed compensation plan as described above. Both systems will be rehabilitated/enhanced to provide a dynamically stable channel with a naturalized corridor to improve their overall integrity. The established designs will be based on input from water resources

engineers, fluvial geomorphologists, fisheries biologists, environmental specialists and landscape architects in consultation with DFO, MNR, ERCA, City of Windsor and the Town of LaSalle. The designs will be based on natural channel design principles and proven approaches as experienced by the design specialists. The selected designs will require approval from the regulatory agencies before implementation.

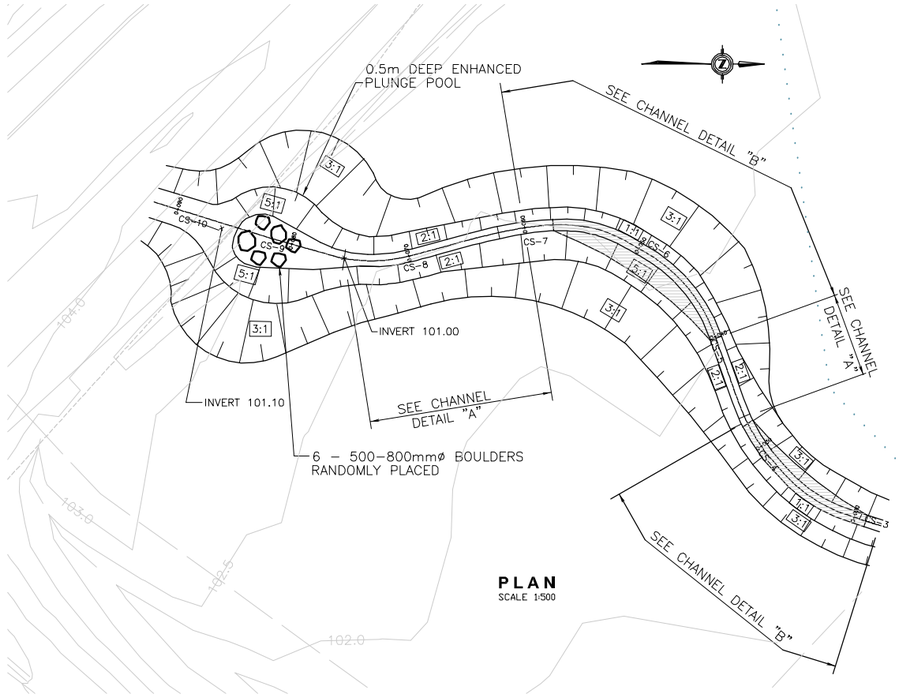
Appropriate channel form and design elements will be based upon the results of detailed geomorphological assessments. Further, the natural channel design will be guided by the following principles:

- Balance of erosive and resisting forces to provide a channel in a state of dynamic equilibrium;
- Provision of enhanced aquatic and terrestrial habitats;
- Enhancement of retention and detention functions for flow and sediment; and
- Improvement in downstream water quality.

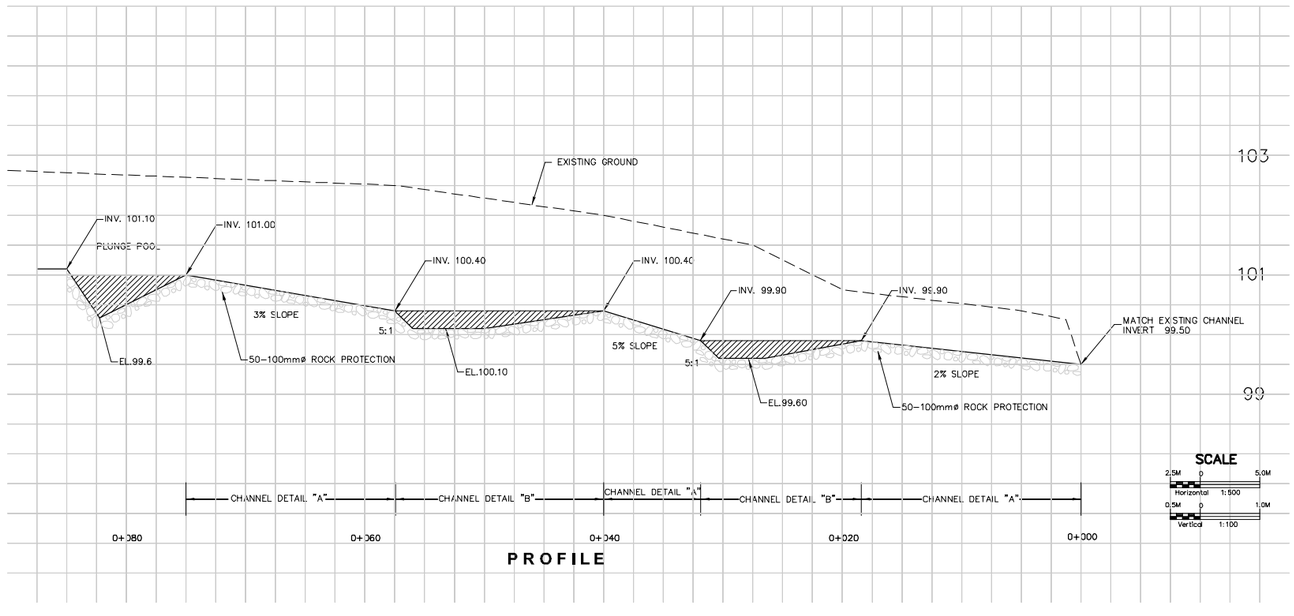
Various strategies will be employed to achieve the above. The enhancement of aquatic habitat, for instance, will be realized by varying the geometry of the low flow channel. Sediment and flow retention and detention functions will be attained by the installation of offline wetland features (in Wolfe Drain). Varying the geometry and placement of these wetland features will also enhance terrestrial habitat on the entire floodplain. In general, the design will replicate natural processes to the extent possible, while accommodating the constraints imposed by the proposed highway, available drainage corridor and existing site conditions.

At the conceptual design stage specific fluvial, hydrologic and hydraulic details of the drains in question are not available. Based on our field inspections however and other available information, we would anticipate that the new drainage features/habitats would be based on a pool/riffle sequence. A typical plan and profile of such a system is shown in Figure 3. For a meandering system such as that anticipated for the Grand Marais Drain, the pools are typically located at the outer bends. Along Cahill/Wolfe Drain the new drainage system will be straighter because of existing constraints. The pools would therefore be located at the downstream section of a riffle or run section. As the design of the new channel is to provide fish habitat, the depth of the pools will vary from 0.5 m to 1.0 m. Section X as shown in Figure 3 is representative of a typical bend found on a large drainage system such as the Grand Marais Drain. Here added erosion protection, such as the use of root wads, would be considered for stability along the outer bends. Along the straight section of channel (riffles or runs) river stone maybe required in addition to the use of live fascine bundles. A typical detail of a straight section is given in Section Y. The bed materials will be based on a review of the current substrate found along the systems with additional erosion protection being provided where required. A detailed hydraulic analysis is required to confirm the type of bank and bed protection required to provide stable systems. Cahill/Wolfe Drain has a relatively small catchment area and the proposed channel profile is relatively flat. As a result, the flow velocities will be relatively low which will allow for a naturalized form of protection to be provided. For this system it is anticipated that the use of live stakes and live fascine bundles will provide adequate erosion control. Where constraints are significant the use of armourstone protection will be required. Detail A and Detail B as provided in Figure 3 show a typical straight section and a bend on Cahill/Wolfe

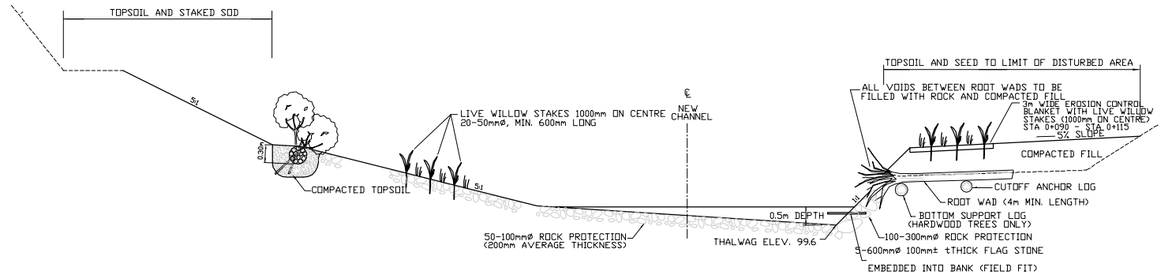
Detroit River
Binational Areas
STUDY



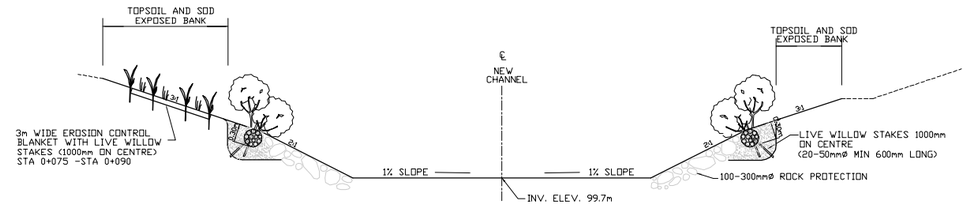

**PLAN**
SCALE 1:500




**PROFILE**




**GRAND MARIAS DRAIN**
**(TYPICAL BEND SECTION "X")**
NOT TO SCALE




**GRAND MARIAS DRAIN**
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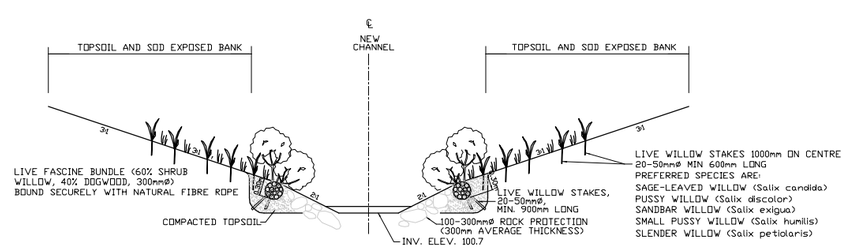
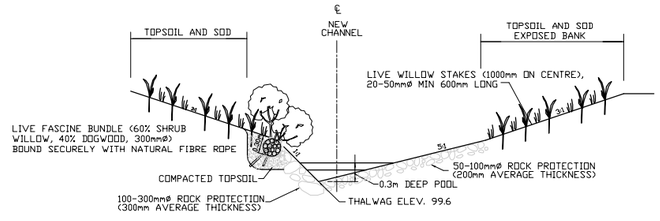



**CAHILL / WOLFE DRAIN**
**(TYPICAL STRAIGHT SECTION "A")**
NOT TO SCALE




**CAHILL / WOLFE DRAIN**
**(TYPICAL BEND SECTION "B")**
NOT TO SCALE

FILENAME: O:\DRIC\19_WaterResources\Preliminary Design\06 Drawings\Stream Restoration\Fig 1 Conceptual Detail.dwg
PLOTDATE: Jun 25, 2009 – 4:32pm
PLOTTED BY: Ana_Ignacio

Ontario
Ministry of Transportation

**THE WINDSOR-ESSEX PARKWAY**
**STREAM REHABILITATION**

URS

**CONCEPTUAL DETAIL**

SCALE
AS SHOWN

DATE
JUNE 2009

FIGURE
3

Drain. As previously identified the details provided are conceptual with specifics to be confirmed based on the results of future comprehensive technical assessments.

The proposed rehabilitation plan will include the development of a detailed riparian habitat plan that will extend a maximum distance of 15 m from the top of the bankfull channel where feasible. This landscape plan will be developed by a landscape architect who has experience in riverine systems. The plan will mimic the hummocky features observed naturally with the irregular form providing an increased perimeter for a given area and thus creating extensive transition zones between aquatic and terrestrial habitats. The vegetation plan will provide stream cover which will improve aquatic habitat and water quality. The planting plan will include the seeding of deep rooting native grasses and other herbaceous plants, flood tolerant native trees and shrub species, and the use of local soils with their available seed banks, where possible.

Construction of the Cahill/Wolfe Drain channel and wetlands and the Lennon Drain wetland will occur offline while water continues to flow through the existing channels. Only when construction of the new channel/wetlands are completed and stabilized will water be allowed to enter. Details regarding construction methodology and staging will be investigated during later design phases and as part of the regulatory process.

Please note that during future design phases, specific details of the channel design at Grand Marais Drain will be discussed with other stakeholders (ERCA, Detroit River Canadian Cleanup, City of Windsor, etc.) to ensure that the channel design and riparian plantings match any works that have been undertaken, or will be undertaken, in downstream areas of the system.

### Other Areas

Broadway Drain discussed below is not crossed by The Windsor-Essex Parkway. It is, however, located within the property limits associated with the project (plaza) and contains at least seasonal fish habitat. This drain has the potential to be enhanced for use by spawning pike and other species and to compensate for the loss of seasonal fish habitat in Healy Drain.

#### *Broadway Drain*

Broadway Drain discharges water directly into the Detroit River. It is located directly to the south of the proposed plaza. It is likely seasonally flowing and connected to the Detroit River during spring. However, a small gravel berm at its outlet prevents fish passage from the river. By removing this berm and enhancing the channel through deepening, widening and vegetation removals, this area will contain enough water to support Northern Pike (and other species) through the spawning season. The channel is currently densely packed with *Phragmites*. Removing this species and replacing it with native marsh vegetation will enhance the habitat potential for fish spawning. Deepening and widening the channel will potentially provide longer periods of inundation and removal of the berm will allow for fish to move back and forth between the drain/watercourse and the Detroit River. The total length of channel in which the enhancements will occur is 545 m. With a 2 m wide channel, approximately 1,090 $m^2$ of habitat will be enhanced/created.

## Monitoring

It is recognized that, as a condition of the *Fisheries Act* Authorizations for works or undertakings on watercourses affected by the DRIC project, a comprehensive monitoring program will be implemented. This monitoring program will begin with the commencement of construction and will continue for a specified period of time post-construction (time length subject to conditions of the site specific authorizations). The monitoring program will be in place to ensure that mitigation and compensation measures are effective and working as designed. If any such mitigation and/or compensation measures are found to be deficient or not effective, corrective actions will be taken or additional measures will put in place to correct deficiencies. The specific attributes of the monitoring program will be derived during the authorization process. Any alterations to the approved mitigation and/or compensation plans during construction will be forwarded to the agencies, including DFO, for review and approval prior to implementation.

## TABLE 1.
## SUMMARY OF FISH HABITAT ALTERATION AND COMPENSATION AREAS

| Fish Habitat Alteration Area | Fish Habitat Compensation Area and Type |
|---|---|
| Amount of upstream habitat to be isolated by submerged culverts at The Windsor-Essex Parkway including Northern Pike spawning (or potential) spawning habitat:<br>• Lennon Drain: 760 m (1,520 $m^2$)<br>• Cahill Drain: 2,249 m (2,964 $m^2$)<br>• Wolfe Drain: 2,706 m (4,329 $m^2$)<br>• Collins Drain: 233.5 m (467 $m^2$)<br>• **Total = 5,948.5 m (9,280 $m^2$)**<br><br>Please note that not all habitats upstream are suitable for Northern Pike spawning. Total suitable for pike is less 1,817 m (1,817 $m^2$) in Cahill and Wolfe Drains. Thus total loss for **Pike** is **4,131.5 m (7,463 $m^2$)**. | New/Enhanced habitat (including Northern Pike spawning habitat) located downstream of The Windsor-Essex Parkway or in other locations:<br>• Lennon Drain: 12,475 $m^2$<br>• Broadway Drain: 545 m (1,090 $m^2$)<br>Wetland Pockets along Wolfe Drain upstream of new Parkway:<br>• Wolfe Drain: 36,145 $m^2$<br>• **Total = 49,710 $m^2$**<br><br>Please note that it is not known, until later design stages, how much linear habitat will be provided in the proposed wetland areas at Lennon, Cahill and Wolfe Drains |
| Culverts (extensions and new) and general loss:<br>• Grand Marais Drain: 100 m (150 $m^2$)<br>• Lennon Drain: 45 m (90 $m^2$)<br>• Cahill Drain: 58 m (116 $m^2$)<br>• Wolfe Drain: 33 m (66 $m^2$)<br>• Basin Drain: 75 m (150 $m^2$)<br>• **Total = 311 m (572 $m^2$)** | Culverts (removals):<br>• Lennon Drain: 10 m (20 $m^2$)<br>• Wolfe Drain: 180 m (360 $m^2$)<br>• **Total = 190 m (380 $m^2$)** |
| Seasonal Habitat:<br>• Healy Drain: 243 m (243 $m^2$)<br>• Youngstown Drain: 160 m (160 $m^2$)<br>• **Total = 403 m (403 $m^2$)** | Realigned/Enhanced Habitat:<br>• Cahill Drain: 732 m+ (1,464 $m^2$+)<br>• Wolfe Drain: 3,400 m+ (6,800 $m^2$+)<br>• Grand Marais Drain: 952 m (1,428 $m^2$)<br>• Youngstown Drain: 85 m (170 $m^2$)<br>• **Total = 5,169 m (9,862 $m^2$)** |
| **TOTAL: 6,662.5 m (10,255 $m^2$)** | **TOTAL: 59,952 $m^2$** |