

INVENTORY OF POTENTIAL IMPACTS AND MITIGATION MEASURES

OCEAN DISPOSAL OF DREDGED SEDIMENTS¹

PHASE A IMPACTS OF SEDIMENT DREDGING² AND LOADING

On hydrodynamics, ice and sedimentology

Ref. ³	POTENTIAL IMPACTS	CUMULATIVE ⁴	MITIGATION MEASURES
A-1	<p>a) <u>Impacts on the bathymetric, hydrodynamic and sedimentological conditions at the dredging site</u> The impacts will generally be negligible given the limited extent of the modifications, which will be very localized and in most cases relatively imperceptible.</p> <p>b) <u>Modification of the ice regime</u> The dredging of sediments in shallow waters could result in very localized, short-term changes in the ice regime (freeze-up period, thickness, area of ice cover).</p>	--	None
		--	None

On the characteristics and quality of the ocean floor

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
A-2	<p>a) <u>Modification of the characteristics of the ocean floor associated with dredging operations</u> The sediments removed are generally similar to those that remain in place. The changes to the characteristics and quality of the ocean floor are therefore negligible.</p>	--	None

1 This document covers **UNCONTAMINATED** sediments only.

2 This document covers **MINOR** dredging operations only.

3 The reference numbers correspond to the numbers in Section 2 of the questionnaire (ENVIRONMENTAL ASSESSMENT).

4 In the column 'Cumulative', the word "Potential" indicates that the impact is likely to combine with similar impacts associated with the same or other projects in the area. The numbers refer to the sections following the tables that provide more detailed information.

On water quality

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
A-3	<p><u>Disturbance due to an increase in turbidity and suspended solids at the dredging site</u> During dredging, sediments may become re-suspended and transported by currents. The amount will depend on the duration of dredging operations, the proportion of fines, the volume of materials dredged, water depth and current velocity. The persistence of turbidity will depend on the currents and the particle size of the sediments transported.</p> <p><i>Case 1: The dredged materials consist of fine sediments.</i> The increase in turbidity will have an impact on water quality. The significance of the impact will depend on the extent and duration of the phenomenon.</p> <p><u>In unsheltered environments</u> The amount of materials that will be re-suspended in the hours or days during which dredging is carried out seems to be minimal given the natural turbidity associated with the phenomena of mixing and re-suspension by waves, tides or navigation in this sector.</p> <p><u>In sheltered environments</u> Given the nature of the dredged materials and the fact that the area to be dredged is very sheltered, the small proportion of fine sediments that might be re-suspended will remain in place. The scope and duration of the re-suspension of sediments due to dredging will therefore be very limited, and the impacts on water quality will be minor.</p> <p><i>Case 2: The dredged materials consist of coarse sediments.</i> Given that the dredged materials consists of coarse sediments, a very small proportion will be re-suspended due to dredging and the impact will be minor and short-term.</p>	--	<ul style="list-style-type: none"> Select the most appropriate dredging equipment and techniques for minimizing re-suspension (Consult the <i>Guide sur les choix et l'opération des équipements de dragage</i> produced by the St. Lawrence Centre in 1992).
		--	No particular measures.

On terrestrial flora and fauna

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
N/A	The dredging activities will have no impact on terrestrial flora or fauna.	--	N/A

On marine wildlife and habitats

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
A-4a	<p>a) <u>Effects on fish</u> The dredging operations may temporarily drive fish away from the affected area. There may also be entrainment of some organisms (fish, benthos) due to the suction of hydraulic dredges.</p> <p>Dredging may have a direct impact on benthic organisms (molluscs, sponges, coelenterates, etc.), fish eggs and larvae and others due to smothering, delaying or preventing fixation of molluscs, etc. These effects can result in very local changes in the composition of communities due to the dominance of tolerant species. There may also be very short-term disturbances of fish spawning and nursery activities.</p>	--	<ul style="list-style-type: none"> In carrying out the work, avoid or take account of important activities for mobile aquatic organisms (e.g., spawning and nursery activities).
A-4b	<p>b) <u>Disturbance of marine habitats</u> In the case of capital projects, there may be very localized losses of habitats used by fish and other aquatic organisms for reproduction or foraging, due to encroachment or modification of conditions. The extent of habitat loss will depend on the significance, type and quality of the initial habitat. It is important to note, however, that benthic organisms from the immediate vicinity will quickly colonize the habitats affected. In the assessment of the impacts of dredging, the area of the site, and the volume and quality of dredged sediments must be taken into account.</p> <p>Dredging may result in the destruction of aquatic vegetation.</p>	Potential 4.01	<ul style="list-style-type: none"> Where significant impacts are anticipated, use protective barriers (impermeable membranes) at the dredging site or other sensitive sites. Where significant impacts are anticipated, contribute to the development of adjacent areas in order to restore the level of biological potential that existed prior to the dredging operations.
A-4c	<p>c) <u>Disturbance of habitats due to increased turbidity</u> The increase in turbidity due to dredging operations may affect aquatic organisms (fish, filter feeders, etc.) in the sector. However, the phenomenon will generally be very limited in time and space, particularly if the natural turbidity is already variable.</p>	--	<ul style="list-style-type: none"> Where significant impacts are anticipated, use protective barriers (impermeable membranes) at the dredging site or in sensitive areas.
A4-d	<p>d) <u>Disturbance due to the use of explosives</u> The use of explosives may have an impact on organisms, fish and mammals.</p>	--	<ul style="list-style-type: none"> Adopt measures designed to minimize the effects of explosives (spreading out charges, small explosions preceding the main blast to scare away wildlife).

On birds and coastal habitat (or riparian habitat)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
A-5	<p>a) <u>Loss or modification of habitat</u> The key potential impacts on birds are associated with the loss or modification of habitat due directly to dredging of sediments in aquatic environments, including marshes.</p>	Potential 5.01	<ul style="list-style-type: none"> Study environmentally acceptable options (avoid dredging in sensitive habitats, particularly emergent and riparian vegetation). Where there is a significant loss of habitat, contribute to the development of alternative sectors in order to restore the biological potential of the environment to the level that existed prior to the operations.
	<p>b) <u>Disturbance of birds by noise</u> During dredging operations, birds (gatherings or colonies) may be disturbed due to the presence of equipment and the noise of the engines.</p> <p><i>Case 1: There are important staging areas near the dredging site.</i> The dredging operations could disturb marine birds (e.g., colonies, rafts of male eider ducks in the summer). However, the impact will be minor to negligible, given the short-term nature and infrequency of the disturbance.</p>	Potential 5.02	<ul style="list-style-type: none"> Avoid marine bird staging areas or periods (critical migration and breeding periods).
	<p><i>Case 2: There are no bird staging areas near the dredging site.</i> There are no bird staging areas or habitat near the dredging site. No impacts are anticipated.</p>	--	N/A

On recreational activities (swimming, water sports, sport fishing, hunting, etc.)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
A-6	<p><u>Disturbance of recreational activities</u> <i>Case 1: Recreational activities are carried out near the dredging site.</i> The presence of equipment may disturb activities (water sports, diving, swimming, etc.) carried out in the vicinity (noise and congestion).</p> <p><u>Or:</u> The dredging of sediments is unlikely to have adverse effects on recreational activities carried out in the sector, given the short-term nature of the actual dredging operations and the small area affected.</p>	Potential 6.01	<ul style="list-style-type: none"> Avoid periods and areas of heavy recreational use. Publish a notice for boaters.

On recreational activities (cont'd)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
A-6	<i>Case 2: No recreational activities are carried out in the vicinity.</i> No impact is anticipated on these elements.	--	N/A

On commercial activities (fishing, navigation and aquaculture)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
A-7	<u>Disturbance of commercial activities</u> The presence of equipment (pipelines of hydraulic dredges, barges, ships) and their operation may temporarily hinder navigation and commercial fishing. The dredging activities are of limited scope and their impact is generally negligible.	--	<ul style="list-style-type: none"> Give navigators prior notice of the operations (post public notices).
A-7a	a) <u>Disturbance caused by the presence of the equipment</u> The physical presence of equipment stationed at the dredging site may temporarily hinder commercial activities (e.g., hauling in of fishing gear, aquacultural activities, etc.). The impact will be minor and short-term.	Potential 7.01, 7.02	<ul style="list-style-type: none"> Avoid sites or periods of intensive commercial activity (e.g., lobster fishing season). Inform users of the dock of the dredging activities. If the disturbance of fishing or aquacultural activities is inevitable, give the persons concerned prior notice of the operations.
A-7b	b) <u>Disturbance caused by the re-suspension of sediments</u> Depending on the location of the dredging site, the dredging of sediments is likely to disturb fixed gear fishing activities and aquacultural activities owing to the impact on the water quality.	Potential 7.01, 7.02	<ul style="list-style-type: none"> Avoid sites or periods of intensive commercial activities (e.g., lobster fishing season). Inform users of the dock and its approaches of the date and scope of the activities. When the disturbance of commercial activities is inevitable, give the fishermen prior notice of the activities.
A-7c	c) <u>Disturbance of fishing areas</u> The modification of the ocean floor can affect the fishing grounds.	Potential 7.01	No particular measures.

On historic or archaeological sites

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
A-8	<u>Sediment dredging in a protected area</u> In the case of capital projects, there could be losses or degradation of recognized or potential archaeological sites.	--	<ul style="list-style-type: none"> In the event of the discovery of artifacts or remains, suspend operations, inform the responsible authorities and conduct a salvage operation.

On aesthetic and scenic resources

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
A-9	Sediment dredging activities are not likely to have significant impacts on aesthetic or scenic resources, because they are of a short-term nature, involve little equipment and are carried out in areas designated for this type of activity.	--	N/A

On quality of life

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
A-10	<p><u>Disturbance of residents by noise</u></p> <p><i>Case 1: People live in the vicinity of the dredging site.</i> The noise of the dredging equipment is likely to affect the quality of life of people living in the vicinity.</p> <p><i>Case 2: No residents in the vicinity of the dredging site.</i> This impact can be considered negligible, particularly since the dredging activities will be carried out in areas where there is already some level of activity.</p>	--	<ul style="list-style-type: none"> In carrying out operations, avoid or take into consideration critical areas and periods in terms of the quality of life in the vicinity of the dredging site.
		--	N/A

On existing infrastructure (sea water intakes, outfalls, etc.)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
A-11	<p><i>Case 1: Presence of infrastructures in the vicinity.</i></p> <p>a) <u>Disturbance due to turbidity caused by the dredging operations</u> The dredging of sediments in the vicinity of sea water intakes could have effects on the quality of the water taken in. In most cases, however, the impact will be considered negligible.</p> <p>b) <u>Fouling or burial of infrastructures</u> The displacement of dredged sediments by currents could affect intakes or outfalls due to burial or fouling. Given the small volumes generally involved, the impact will in most cases be negligible.</p> <p><i>Case 2: There are no infrastructures in the vicinity.</i> The dredging operations will not be carried out near intakes or outfalls. No</p>	--	<ul style="list-style-type: none"> Inform owners of water intakes prior to the commencement of dredging activities. In cases where significant impacts are anticipated, limit the activities to certain points in the tidal cycle or hydrological regime (low flows or floods). In cases where significant impacts are anticipated, use protective barriers at sensitive sites. Take measures to protect and to monitor changes in water quality at water intakes.
			N/A

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
	impacts are anticipated on this element.		

Risk of spills

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
A-12	<p>The handling (refueling) and storage of hazardous materials (petroleum products, oils and grease, etc.) on the dredging site are likely to cause a spill.</p> <p>Moreover, improper disposal of these substances may pose a risk to the environment.</p> <p>However, given the small quantities involved, the mechanisms in place to mitigate potential spills and the short time for which they are present at the dredging site, the impact can be considered negligible, particularly since handling, re-fueling, storage and disposal are carried out in a safe manner in proper locations.</p>	--	<ul style="list-style-type: none"> • Adopt prevention and safety measures for the use, handling, storage and disposal of hazardous materials. • Be familiar with the emergency plans in force at the dock used. • In the event of a spill, immediately advice the responsible authorities of the situation. • Re-fuel vehicles and machinery in safe locations far from the shore in order to avoid spilled materials from reaching sensitive zones. • In the event of a spill, respond quickly to contain the substances in question. • Carry out activities involving hazardous materials at proper locations. • Maintain equipment and machinery to prevent any leaks related to poor adjustments.

PHASE B IMPACTS OF THE TRANSPORTATION⁵ OF DREDGED SEDIMENTS

On hydrodynamics

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
N/A	The transportation of sediments to the disposal site is not likely to affect the hydrodynamic or sedimentological conditions.	--	N/A

On the characteristics and quality of the ocean floor

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
N/A	The transportation of sediments to the disposal site is not likely to affect the characteristics or quality of the ocean floor.	--	N/A

On water quality

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
N/A	The transportation of sediments to the disposal site is not likely to affect the water quality.	--	N/A

On terrestrial flora and fauna

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
N/A	The transportation of sediments is not likely to affect the terrestrial flora or fauna, since the sediments are transported by water only.	--	N/A

5 Given that the source of the sediments is dredging operations, “transportation” covers water transportation only.

On marine wildlife and habitats

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
B-1a	<p>a) <u>Disturbance of marine mammals</u> Water transportation of sediments to the disposal site could disturb marine mammals (whales or seals in the area, seal haulouts). However, However, given that marine mammals can avoid the disturbed areas and that the transportation of sediments requires few, infrequent trips, this impact will generally be negligible.</p>	Potential 4.03	<ul style="list-style-type: none"> As a precaution, if marine mammals are observed in the vicinity, reduce the speed of the ship or delay the trip by a few minutes.
B-1b	<p>b) <u>Effects on fish and marine habitats</u> The transportation of sediments by boat is not likely to affect fish or marine habitat.</p>	--	N/A

On birds and coastal habitat (or riparian habitat)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
B-2	<p><u>Disturbance of birds by noise and traffic</u> During transportation of sediments to the ocean disposal site, birds (gatherings or colonies) may be disturbed by the vessel or barge traffic or by the noise of the engines.</p> <p><i>Case 1: There are important staging areas on the route taken.</i> The transportation equipment may disturb marine birds (e.g., colonies, rafts of male eider ducks in summer). However, the impact will be minor to negligible, given the short-term nature and infrequency of the disturbances.</p> <p><i>Case 2: There are no bird staging areas in the vicinity.</i> There are no particular bird staging areas or habitats in the vicinity or on the route taken by the equipment to the disposal site. No impact is anticipated.</p>	Potential 5.02	<ul style="list-style-type: none"> Avoid marine bird staging areas or periods.
		--	N/A

On recreational activities (swimming, water sports, sport fishing, hunting, etc.)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
B-3	<p><u>Disturbance of recreational activities</u> <i>Case 1: Activities are carried out in the vicinity of the site.</i> The noise and congestion created by the transportation equipment may disturb activities carried out in the vicinity (water sports, diving, swimming, etc.). The impact will generally be minor, even negligible, given the short-term nature of the transportation activities and the fact that they will be carried out in designated areas usually used for this purpose.</p> <p><i>Case 2: No activities are carried out in the vicinity.</i> No impact is anticipated on these elements.</p>	<p>Potential 6.01</p> <p>--</p>	<ul style="list-style-type: none"> • Avoid areas and periods of heavy recreational use. • Publish a notice for boaters. <p>N/A</p>

On commercial activities (fishing, navigation and aquaculture)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
B-4	<p><u>Disturbance of commercial activities</u> The presence and operation of the equipment (barges, ships) could temporarily hinder navigation and commercial fishing. The impact will generally be negligible, since the transportation of sediments involves few, infrequent trips, which are carried out in sectors designated for navigation.</p>	<p>Potential 7.01, 7.02</p>	<ul style="list-style-type: none"> • Avoid sites or periods of intensive commercial activities. • Inform users of the dock and its approaches of the date and extent of the activities. • In cases where the disturbance of fishing or aquacultural activities are inevitable, give the individuals concerned prior notice of the activities. • Publish a notice for navigators.

On heritage and protected areas

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
N/A	<p>Sediment transportation activities are not likely to affect heritage resources or protected spaces.</p>	<p>--</p>	<p>N/A</p>

On aesthetic and scenic resources

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
B-5	Sediment transportation activities are not likely to have a significant impact on aesthetic or scenic resources because they are short-term, involve little equipment and are carried out in areas designed for this type of activity.	--	N/A

On quality of life

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
B-6	<u>Disturbance of residents by noise</u> The transportation of sediments is likely to affect the quality of life of residents in the vicinity, due to the noise of the equipment. However, given the small number of trips involved, this impact may be considered negligible, particularly since the work will be carried out in locations where there is already some degree of activity.	--	N/A

On existing infrastructure (sea water intakes, outfalls, etc.)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
B-7	The equipment will not go near intakes or drainage channels. No impact is anticipated on this elements.	--	N/A

Risk of accidental spills

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
B-8	During loading and transportation, it is likely that leaks, equipment breakdowns (trucks, barges, ships, etc.) or accidents will occur, resulting in a hazardous materials spill (petroleum products, fuel, oil, etc.). However, given the small number and limited scope of the trips, the impact can be considered negligible. Through rigorous, frequent maintenance of the equipment used, it will be possible to keep these risks at a minimum.	--	<ul style="list-style-type: none"> • Where a spill occurs or is foreseeable, immediately report the situation to the responsible authorities. • Properly maintain equipment and machinery.

PHASE C IMPACTS OF THE DISPOSAL AND PRESENCE OF SEDIMENTS

On hydrodynamics, ice and sedimentology

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
C-1	<p>a) <u>Modification of the bathymetric profile</u> The disposal of sediments is likely to affect the bathymetric, hydrodynamic and sedimentological conditions at the disposal site.</p> <p><i>Case 1: The dumped materials consist of fine sediments.</i> The impact will generally be minimal given the limited extent of the modifications, which will be very localized and, in most cases, more or less imperceptible. In addition, the modifications will disappear over time, since the sediments will be transported by currents. Their persistence at the site will depend on the velocity of the current and the nature and volume of the materials dumped, with fine sediments being more easily dispersed.</p> <p><i>Case 2: The materials consist of boulders or coarse sediments.</i> The disposal of this type of materials may give rise to local changes in erosion or sedimentation patterns, which will be more pronounced in shallows waters. However, these changes will be short-term.</p> <p>b) <u>Modification of the ice regime</u> The disposal of sediments in shallow waters could result in very localized short-term changes in the ice regime (freeze-up period, thickness, area of ice cover).</p> <p><i>Case 1: The dumped materials consist of fine sediments.</i> If the dumped materials consist of fine sediments, the impact will be negligible because they will be quickly dispersed by currents, waves and ice.</p> <p><i>Case 2: The materials consist of boulders or coarse sediments.</i> The scope of the impact will depend on the disposal site, the volume and type of sediments dumped, and the general form of the disposal site.</p>	<p>Potential 1.01</p> <p>Potential 1.01, 2.01</p> <p>--</p> <p>Potential 1.01</p>	<p>No particular measures.</p> <p>No particular measures.</p> <p>N/A</p> <p>No particular measures.</p>

On the characteristics and quality of the ocean floor

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
C-2	a) <u>Modification of the characteristics of the ocean floor associated with the presence of sediments</u> The presence of sediments will modify the characteristics of the ocean floor. The modification will be limited to the actual area covered. (During disposal, fine sediments can sometimes be dispersed over large distances, depending on the water depth and current velocity.) <i>Case 1: The dumped sediments are different from those at the site.</i> The disposal of sediments will result in changes in the nature of sediments (texture and particle size) at the disposal site and at the sites at which sediments transported by currents are deposited. In most cases, the impact will be negligible. <i>Case 2: The dumped sediments are similar to those at the site.</i> The materials at the disposal site have the same particle size as the materials that will be dumped. As a result, no modifications are anticipated.	Potential 2.01	<ul style="list-style-type: none"> In the selection of the disposal site, take account of the sediment characteristics and quality (texture and particle size) and the stability of the site. Consider sites that have been proposed and found to be adequate for previous ocean disposal operations.
		Potential 2.01	
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		--	
	b) <u>Modification of the chemical characteristics of the ocean floor</u> The chemical characteristics of the sediments to be dumped is comparable to that of the sediments at the disposal site and are environmentally acceptable. As a result, no modifications are anticipated in terms of the chemical characteristics of sediments at the disposal site.	--	N/A

On water quality

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
C-3	<u>Disturbance by increase in turbidity</u> When dumped, some sediments may be dispersed by currents. The quantity will depend on the duration of the disposal operation, the proportion of fine sediments, the water depth and the current velocity. The persistence of turbidity will depend on the currents and the particle size of sediments transported by currents.	--	No particular measures.

On water quality (cont'd)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
	<p><i>Case 1: The natural turbidity in the sector is low.</i> The water quality will be affected by the increase in turbidity. The significance of the impact will depend on the scope and duration of the phenomenon.</p>	Potential 3.01	<ul style="list-style-type: none"> Carry out the sediment disposal operations very quickly in order to maximize the phenomenon of entrainment, which contributes to ensuring the rapid descent of the materials to the ocean floor and minimizing re-suspension.
	<p><i>Case 2: The natural turbidity in the sector is often high.</i> The quantity that will re-suspended in the hours or days during which the disposal operations will be carried out appears to be minimal given the natural turbidity associated with the mixing and re-suspension phenomena caused by wave action and tides in this sector.</p>	--	No particular measures.

On marine wildlife and habitats

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
C-4a	<p>a) <u>Direct effects on organisms</u> The disposal of sediments is likely to affect organisms by covering them: benthic organisms (molluscs, sponges, coelenterates, etc.), fish eggs and larvae and other). There may also be mortality caused by smothering, delay or prevention of fixation by molluscs, etc., which lead to overall changes in the composition of biological communities and a dominance of tolerant species. In fish, the disposal could disturb spawning, nursery activities, etc.</p>	Potential 4.02	<ul style="list-style-type: none"> In carrying out the operations, avoid or take account of activities of importance to mobile aquatic organisms (e.g., spawning and nursery areas and periods).
C-4b	<p>b) <u>Disturbance of habitats by the presence of sediments</u> The disposal of sediments may result in the loss of habitats due to encroachment or in the modification of habitats used by fish and other aquatic organisms for breeding or foraging. This loss of habitat varies depending on the importance, type and quality of the initial habitat. It is important to note, however, that it is likely that the site will be colonized by benthic organisms from surrounding areas. In assessing the impacts of disposal on habitat loss, it is important to take into account the area of the site and the volume and quality of the sediments dumped.</p>	Potential 4.01, 1.03	<ul style="list-style-type: none"> In selecting sites, avoid preferred habitats. Locate the disposal site in an unproductive sector. In the case of disposal in shallow water, spread the materials as much as possible in order to promote colonization by benthic organisms.

On marine wildlife and habitats (cont'd)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
C-4c	<p>c) <u>Impact of the increased turbidity on habitats</u> The increase in turbidity associated with the disposal of the dredged materials can have an impact on aquatic organisms (fish, filter feeders, etc.) in the sector. However, the phenomenon will generally be very limited in time and space, particularly in the natural turbidity is already high.</p>	Potential 4.02	<ul style="list-style-type: none"> Carry out the sediment disposal operations very quickly in order to maximize the phenomenon of entrainment, which contributes to ensuring rapid transport of the materials from the surface to the ocean floor and to minimizing re-suspension. Use protective barriers (impermeable membranes) at the disposal site or in sensitive areas.

On terrestrial flora and fauna

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
N/A	The disposal of sediments will have no impact on terrestrial flora or fauna.	--	N/A

On birds and coastal habitat

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
C-5	<p><u>Habitat loss or modification</u> The principal potential impacts on birds are concerned with the loss or modification of habitats linked directly to the disposal of sediments in aquatic environments, specifically marshes.</p>	Potential 5.01	<ul style="list-style-type: none"> Avoid discharging in sensitive habitats.

On recreational activities (swimming, water sports, sport fishing, hunting, etc.)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
C-6	The disposal of sediments will likely have no adverse effects on the recreational activities carried out in the sector given the short-term nature of the disposal operations and the small area affected.	--	<ul style="list-style-type: none"> Avoid areas and periods of intensive [heavy] activity. Inform boaters who use the sector.

On commercial activities (fishing, navigation and aquaculture)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
C-7	a) <u>Disturbances during disposal due to the presence of equipment</u> The physical presence of equipment stationed at the disposal site may temporarily hinder commercial activities (e.g., hauling in of fishing gear, aquacultural activities, etc.). The impact will be minimal and short-term.	--	<ul style="list-style-type: none"> Inform users of the port of the scope and duration of the operations.
	b) <u>Disturbances during disposal due to the deposition of sediments</u> Depending on the location of the disposal site, the disposal of sediments is likely to affect fixed-gear fishing and aquacultural activities due to the deposition of sediments on the ocean floor.	Potential 7.01, 7.02	<ul style="list-style-type: none"> Avoid areas and periods of intensive commercial activity (e.g., lobster fishing season, etc.). Where disturbances of fishing or aquacultural activities are inevitable, inform the individuals concerned of the operations beforehand.
	c) <u>Disturbance during disposal due to the increase in turbidity</u> Depending on the location of the disposal site, the disposal of sediments is likely to affect fishing and aquacultural activities due to the impact on water quality.	Potential 7.02	<ul style="list-style-type: none"> Avoid areas and periods of intensive commercial activity (e.g., lobster fishing season, etc.). Where disturbances of particular fishing or aquacultural activities are inevitable, inform the individuals concerned of the operations beforehand. Locate the disposal site at a distance that will not result in the disturbance of aquacultural activities.

On heritage and protected spaces

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
C-8	<u>Release of sediments in a protected area</u> The disposal of sediments could have an impact on protected species if the disposal site is located in heritage areas: modification of local marine fauna and flora and indirect effects created by recreational or commercial activities resulting from the presence of the dumped sediments.	Potential 8.01	<ul style="list-style-type: none"> Avoid carrying out disposal operations in protected areas.

On aesthetic and scenic resources

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
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N/A	The presence of the dumped sediments is not likely to have an impact on aesthetic or scenic resources.	--	N/A
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On quality of life

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
N/A	The disposal and presence of sediments are not likely to have an impact on the quality of life.	--	N/A

On existing infrastructure (sea water intakes, outfalls, etc.)

Ref.	POTENTIAL IMPACTS	CUMULATIVE	MITIGATION MEASURES
C-9	a) <u>Disturbance due to turbidity created during disposal</u> The disposal of sediments near sea water intakes could have an impact on the quality of the water taken in. In most cases, however, the impact will be negligible.	--	<ul style="list-style-type: none"> • Locate the disposal site so as to avoid infrastructures such as sea water intakes, outfalls, etc.
	b) <u>Fouling or burial of infrastructures</u> The disposal of sediments or the re-suspension of disposed sediments by currents could result in the burial or fouling of intakes or outfalls. Given the small volumes generally involved, the impact would, in most cases, be negligible.	--	<ul style="list-style-type: none"> • Locate the disposal site so as to avoid infrastructures such as sea water intakes, outfalls, etc.

POTENTIAL CUMULATIVE IMPACTS

Where it is indicated that there are potential cumulative impacts, it is important to evaluate the possibility that other activities associated with the project or with other projects will have similar impacts or impacts affecting the same resource or the same component of the environment. An impact considered minor within the framework of a project may become more significant if the analysis of the other activities carried out in the sector indicates that the resource or element in question is already affected in different ways.

1. Changes in bathymetry

- 1.01** If the disposal site is used on a continuing basis, a considerable volume of sediments could accumulate, which would result in a gradual change in the bathymetry.
- 1.02** In the long term, the accumulation of sediments could hinder navigation by creating shoals, which could require alteration of the navigation channels usually used. Even though the disposal sites selected are generally located outside the main navigation channels, it is important to bear in mind that smaller vessels may use secondary channels.
- 1.03** The migratory routes of marine resources could be disturbed by the accumulation of obstacles (see fisheries resources).

2. Impact on the characteristics of the ocean floor

- 2.01** The disposal of sediments from different dredging sites (different particle size and texture) at the same disposal site on an ongoing basis could result in gradual changes in the characteristics of the ocean floor. Even though the dumped sediments should, in principle, be similar to those at the disposal site, there may be, over time, a shift in particle size distributions and physico-chemical properties.
- 2.02** In the long term, the modification of the ocean floor could affect marine resources and force them to find more favourable sites in order to meet their life cycle requirements (breeding, foraging, etc.).

3. Impact on water quality

- 3.01** The degradation of water quality is often attributed to several concurrent factors. In the case of cumulative impacts, these factors can include industrial effluent, spills of hazardous materials, re-suspension of existing contaminants, etc.

4. Marine wildlife and habitats

Loss of habitat

4.01 The main potential impacts of dredging on fisheries resources involve the loss or modification of habitats. These losses may be in addition to the losses attributable to other activities carried out in the area. The existence of several sources of impacts in the environment can exacerbate the overall effect on biological resources. A seemingly innocuous loss associated with a small dredging project may be more significant if it affects one of the few remaining sites still intact in the sector. The uniqueness and value of habitats are important elements to consider in the evaluation of the significance of cumulative effects.

Valued sites include habitats used by fish and other aquatic organisms for breeding or foraging (benthos and plankton). The loss of habitat varies depending on the importance, type and quality of the initial habitat. In evaluating the impacts of dredging on the loss of habitat, it is important to take account of the area of the site and the volume and quality of the dredged sediments.

Direct effects on organisms

4.02 Living organisms may be exposed to various stresses due to the degradation of environmental conditions. However, when several sources of physiological stress are combined, a seemingly innocuous effect may have more serious consequences than anticipated.

Disturbance of marine mammals

4.03 Given their mobility, marine mammals can avoid disturbances of the environment. However, when their movements are hindered by several factors, they may be prevented from feeding properly.

5. Impacts on birds

Effects on habitats

5.01 The potential impacts on birds include the loss or modification of habitats, particularly in marshes. The loss of several highly valued and relatively scarce habitats can have very adverse effects on bird populations.

Disturbance of birds

5.02 Birds leave their habitat as soon as it is disturbed. They return soon after the disturbance and generally suffer no effects. However, if they are disturbed repeatedly by various factors, they may be prevented from feeding properly (particularly since repeated displacements require additional energy) or their reproductive success may be affected (e.g., when females abandon their nest momentarily, there is an increased risk of predation, or when females are disturbed too often during nest building, they may abandon the breeding site for good).

6. Impact of recreational activities

6.01 The disturbance of recreational activities is an impact that is likely to be cumulative. It is important to evaluate multiple disturbances that can make an activity unattractive to users. Recreational activities that are carried out in aquatic environments are often limited in space and time (short period of the year), which makes the impact more significant, even though it covers a short period of time or affects a small area.

7. Disturbance of fishing or aquacultural activities

7.01 The disturbance of fishing activities could combine with other conditions that are unfavourable to fishing activities or to the resource. Fishermen who are affected by several types of disturbances may see a decline in their catch and the profitability of their operations could be significantly affected. It is important to bear in mind that fishing seasons are very short.

7.02 The success of aquacultural activities is often random and depends on a combination of factors specific to the natural environment; the adverse effects of disturbances caused by human activities in the sector may sometimes be more significant than anticipated. Filter feeders that cannot properly filter for several days during the dredging or disposal of sediments may also be unable to feed in the days that follow due to other operations planned in the sector, unfavourable weather conditions, etc. These factors may have a significant impact on aquacultural facilities.

8. Modification of protected areas

8.01 The modification of protected areas, regardless of how minor, contributes to the gradual degradation of the natural environment.

REFERENCES

Environment Canada (1994). *Environmental Impacts of Dredging and Sediment Disposal*. Prepared by Les Consultants Jacques Bérubé inc. for the Technology Development Section. Environmental Protection Branch, Quebec and Ontario Regions. 97 pp.

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