FISHERIES AND OCEANS
CANADIAN ENVIRONMENTAL ASSESSMENT ACT (CEAA)
SCREENING REPORT

GENERAL INFORMATION

1. EA Title: Fraser River Gravel Removal 2009, Tranmer Bar and Little Big Bar

2. Proponent:

Emergency Management British Columbia (EMBC)
Ann Griffin, Manager Strategic Mitigation Programs
Ministry of Public Safety and Solicitor General
2nd Floor 525 Fort Street
Victoria, BC V8W 9J1
(250) 953-4098

3. Other Contacts (Other Proponent, Consultant or Contractor):	**4. Role:**
Scott Resource Services Inc. (SRS) 31856 Silverdale Avenue Mission, BC V2V 2K9 604-820-1415	Fisheries Consultant for EMBC
northwest hydraulic consultants (nhc) 30 Gostick Place North Vancouver, BC V7M 3G3 604-980-6011	Hydraulic Consultant for EMBC

5. Source: EMBC

6. EA Start Date: December 12, 2008

7. CEAR (or FEAI) No.: 08-01-44483

8. PATH No.: 08-HPAC-PA1-00009

9. DFO File No: PRHQ 5300-10-156

10. Provincial/Territorial File No.: BC Ministry of Environment, file A2005590

BACKGROUND

11. Background about Proposed Development (including a description of the proposed development):

EMBC is proposing to remove 186,000 m^3 of gravel from Tranmer Bar and 79,000 m^3 of gravel from Little Big Bar as part of their Flood Protection Program to reduce gravel accumulations in the Fraser River and mitigate flood risk.

Tranmer Bar is located approximately 4 km upstream of the Agassiz-Rosedale Bridge near the right bank of the Fraser River. The proposed excavation is located on the eastern bar edge through to the centre of lower Tranmer Bar. The site will be accessed via a temporary bridge constructed over the side channel that flows between Tranmer Bar and the northwest (right) bank of the Fraser River. Details of the proposed removal provided by EMBC are available in the following documents: "**Fraser River Gravel Removal Plan: Proposed Tranmer Bar Extraction – 2009**", prepared by EMBC, SRS and nhc and dated November 20, 2008 (**Appendix A**); letter correspondence to EMBC from nhc entitled "**Fraser River Gravel Management Tranmer Bar Hydraulic Assessment Letter Report**", dated December 2, 2008 (**Appendix B**); and temporary bridge design drawings prepared by AllNorth Consulting Engineers and Surveyors, signed on January 26, 2009 (**Appendix C**).

The proposed excavation on Tranmer Bar consists of two sites that connect via a lower elevation chute channel: the upper site is located on the eastern bar edge with an estimated footprint size of 100,000 m^2 and an average excavation depth of 1.25 m; the lower site is in the centre of lower Tranmer Bar and has an estimated footprint size of 50,000 m^2 and an average excavation depth of 1.3 m. Access to the site will be via a temporary bridge constructed in an easterly direction from the northern end of Spaeti's Bar, located on the right bank of the Fraser River, across to Tranmer Bar. This will involve pile driving in the wetted portion of the Tranmer side channel, with some causeway construction also likely to occur in the wetted portion of the channel, depending on the existing water level.

Little Big Bar is located approximately 1 km downstream from the Agassiz-Rosedale Bridge on the left bank of the

Fraser River, adjacent to Big Bar. The site will be accessed by constructing a temporary ramp from the adjacent dike road to the removal area. It is expected that the dike and point bar will be connected at the time of extraction facilitating a dry access route. Details of the proposed removal provided by EMBC are available within the following documents: "**Fraser River Gravel Removal Plan: Proposed Little Big Bar Extraction – 2009**", prepared by EMBC, nhc and SRS and dated November 24, 2008 (**Appendix D**); an addendum to the above report entitled "**Addendum to Application to Fisheries and Oceans Canada for Gravel Removal at Little Big Bar, Fraser River**" prepared by SRS and dated December 17, 2008 (**Appendix E**); and letter correspondence to DFO from SRS entitled "**Redd survey in the vicinity of two proposed access locations to Tranmer bar**", dated January 19, 2009 (**Appendix F**).

The proposed excavation on Little Big Bar will start approximately 110 m downstream of the bar head and extend to the bar tail, with an estimated footprint size of 36,350 m^2. Maximum depth of the excavation will be 1.5 m. The site will be accessed by constructing a temporary ramp from the adjacent dike road to the removal area at the upstream end of the bar. It is expected that the dike and point bar will be connected at the time of extraction facilitating a dry access route.

ENVIRONMENTAL ASSESSMENT

12. DFO Trigger(s):

The authorization of the harmful alteration, disruption or destruction (HADD) of fish habitat of the bed and channel of the Fraser River at Tranmer Bar and Little Big Bar.

13. Act & Section(s):

Subsection 35(2) and 32 of the *Fisheries Act*

14. Other RAs and RB(s):

Transport Canada

15. CEAA Trigger(s) of Other RA(s) and RB(s):

Section 5(1) of the Navigable Waters Protection Act for the temporary bridge crossing.

16. Lead RA:

Fisheries & Oceans Canada

17. Other Jurisdiction:

The BC Ministry of Environment provides expert advice to DFO on Fraser River gravel removal applications for provincial fisheries interests. Section 9 of the provincial Water Act requires that a person may only make "changes in and about a stream" under an Approval. Approvals are issued by the Water Stewardship Division of the Ministry of Environment. This permit is attached as **Appendix G**.

18. FEAC:

Fisheries & Oceans Canada

19. Rationale for FEAC:

Lead RA

20. Expert Federal Authority (ies):

Environment Canada
Phil Wong, Senior Environmental Assessment Engineer
200 – 401 Burrard Street
Vancouver, BC V6C 3S5
604-666-2699

21. Area(s) of Interest of Expert FA(s):

Wildlife and Wildlife Habitat

22. Other Contacts and Responses:

Fraser River Sturgeon Conservation Society
5th Floor – 520 West 6th Avenue
Vancouver, BC, V5Z 1A1
604-876-6800

The Fraser River Sturgeon Conservation Society (FRSCS) was requested by EMBC to provide input on the potential impacts of the proposed removal to white sturgeon and sturgeon habitat. A report entitled "**Assessment of Potential Impacts on White Sturgeon and their Habitat from Proposed Gravel Extraction in the Lower Fraser River during winter, 2009**" was prepared by LGL Limited on behalf of the FRSCS and submitted to EMBC on November 20, 2008 (**Appendix H**). The findings of this report have been incorporated into the environmental assessment and Screening Report.

The Fraser River Ad Hoc Stewardship Gravel Removal Committee also submitted email correspondence raising concerns about the flood protection benefits and potential impacts to fish habitat of the proposed 2009 winter gravel removal projects. This correspondence, dated December 7 and 16, 2008, is attached as **Appendix I**. Further email correspondence was subsequently submitted in relation to potential impacts of pile driving on fish, particularly alevins **Appendix J**. The flood protection benefits afforded by the proposed gravel removals are detailed in the proponent's hydraulic model for Tranmer Bar, attached as **Appendix B**, and confirmed in letters from EMBC dated January 27, 2009 (**Appendix K and L**).

A Traditional Ecological Knowledge (TEK) report, dated February 4, 2009, was also submitted by the Seabird Island First Nation, specifically relating to white sturgeon (**Appendix Q**).

23. Scope of project (details of the project subject to screening):

Fisheries & Oceans Canada's scope of the project for the environmental assessment conducted pursuant to the *Canadian Environmental Assessment Act* is the proposed removal of up to 186,000 cubic metres of gravel from Tranmer Bar and up to 79,000 cubic metres of gravel from Little Big Bar. The scope of the project also includes the construction of a temporary access bridge to Tranmer Bar and a temporary ramp on to the bar from the dike road adjacent to Little Big Bar. All gravel extraction activities will be isolated from flowing water in both locations during the entire work period.

Hereafter, the term "project" refers to the project as scoped in the preceding paragraph.

24. Location of project:

Tranmer Bar is located approximately 4 km upstream of the Agassiz-Rosedale Bridge near the right bank of the Fraser River.

UTM Zone 10U, N 5453645, E 593508

Latitude 49°13'42", Longitude 121°42'56"

Topographic Mapsheet: 092H04

Little Big Bar is located on the left bank of the Fraser River, adjacent to Big Bar, approximately 1 km downstream from the Agassiz-Rosedale Bridge.

UTM Zone 10U, N 5451726, E 586814

Latitude 49°12'44", Longitude 121°48'29"

Topographic Mapsheet: 092H04

25. Environment Description:

The proposed removals are situated within the "Fraser River Gravel Reach", an 80 km reach of river wherein coarse sediment (coarse sand, gravel and cobble) is deposited annually during spring flooding. Sediment deposition within the active channel creates a complex network of gravel bars and vegetated islands around which the river flows. The location and form of these bars and islands are constantly changing as a result of the river's natural erosion and deposition processes. Nevertheless the bars and islands are sites of high ecological productivity, representing valuable fish habitat that is used by at least 28 native fish species. Species of greatest cultural, commercial and/or recreational significance are chinook, chum, coho, pink and sockeye salmon, cutthroat, steelhead, and rainbow trout, white sturgeon and eulachon. All species of anadromous Pacific salmon utilize habitat within the reach to a varying degree for adult holding and migration to spawning grounds, smolt migration to the ocean, and rearing habitat for juveniles. Large numbers of chinook salmon rear in the Fraser River Gravel Reach for up to one year before ocean migration and significant numbers of pink salmon spawn within the main channel in odd-years. COSEWIC-listed white sturgeon reside in the gravel reach throughout the year and use side channels for spawning in June.

Sediment deposition in the gravel reach over time also raises bed elevation locally, placing pressure on the existing dike system during the spring flood. There is increasing concern for flood risk among local communities in the Fraser

Valley. Measures to increase flood protection over the past century have included diking and dike upgrades, flow control barriers at the mouth of sloughs, bank hardening using rip rap, and gravel removals from within the active channel. In-stream gravel mining has also been carried out historically for industrial and commercial purposes.

Further site-specific descriptions are provided below.

Tranmer Bar

A geomorphic assessment of Tranmer Bar, conducted by nhc, includes a detailed description of the erosional and depositional changes in the region of Tranmer Bar along with a series of georeferenced aerial photographs and orthophoto mosaics illustrating these changes over an 80-year period from 1928 to 2008 (**Appendix A**). The earliest photos reveal an established island (Herrling Island) on the east side of the Fraser River channel, with a sequence of adjacent smaller bars and islands forcing the current towards the right bank and the site of the contemporary Tranmer Bar. Photographs taken in 1949 show the establishment of Tranmer Bar as extensive lateral and mid-channel bars. Subsequent photographs show extensive additional deposition at the downstream end of the bar, while the upper end of the bar becomes progressively more vegetated, evidence of its increasing stability. The establishment of Tranmer Bar has forced as much as a kilometre of bank erosion at Herrling Island over the past 60 years, with the remaining thin strip (80 m) expected to be bisected within 1 or 2 years. This could initiate significant downstream changes.

A summary of past gravel extractions from Tranmer Bar is reported in the geomorphic assessment conducted by nhc (**Appendix A**). As documented in a report prepared by Hamish Weatherly and Michael Church (1999) entitled "**Gravel Extraction Inventory for Lower Fraser River (Mission to Hope) – 1964 to 1998**", Tranmer Bar is a private land holding that was mined in 1993, 1994 and 1995, with a total of 120,000 m^3 being extracted. Since these operations, 10,000 m^3 of gravel was extracted in 2001 and a further 5,000 m^3 in 2004 (see **Appendix A**).

Habitat mapping of the proposed excavation site was conducted by SRS at high discharge (5,600 m^3/s) on June 27, 2008 and low discharge (2,350 m^3/s) on September 18, 2008. An additional overflight conducted by nhc on August 15, 2008, allowed habitat interpretation at moderate discharge (3,500 m^3/s). Habitat features were mapped onto aerial photographs and are presented in **Appendix A**. At high flow, the proposed extraction area consisted of open water, bar edge habitat with flat to steep slopes, and shallow riffle over the submerged bar. The upstream extraction area was bounded by a forested island with steep bar edge habitat to the north, while to the south there was bar top habitat with bar head and flat bar edge habitat along its boundary. The bar top habitat to the south had some emergent riparian vegetation in the form of immature willows and other low growing shrubs. The downstream extraction area was partially exposed bar top habitat with a flat bar edge. At moderate flow, the proposed extraction area was mostly exposed bar top with a channel nook draining to the west. There was more bar top habitat exposed compared to high flow conditions, thereby increasing the area of bar edge habitat available to fish. At low flow, the majority of the proposed excavation site was exposed with flat bar edge habitat adjacent to the main channel, a series of strand pools remnant of the channel nook at moderate flow, and a bay at the downstream end.

Fish sampling was conducted on July 16-17, 2008 at a discharge rate of approximately 4,500 m^3/s, and on August 21, 2008 at a discharge rate of 3,500 m^3/s. The proposed extraction site was sampled along with a downstream reference site. Flat bar edge habitats were sampled at both sites. Three families of fish dominated the catch at Tranmer Bar: Cyprinidae, Salmonidae and Catostomidae. Cyprinids were the most numerous group captured, with leopard dace, longnose dace and northern pikeminnow being the most common species. The majority of salmonids were either chinook or coho salmon, with trace numbers of sockeye salmon and rainbow trout also captured. The most common catostomid captured was the blue-listed mountain sucker.

Overall catch-per-unit-effort (CPUE) was higher during the high flow sampling as a result of higher numbers of mountain sucker, leopard dace, longnose dace and coho salmon. However, species diversity in terms of species-per-unit-effort (SPUE), calculated as the number of species captured per m^2 of swept area, was similar between high and low flow samples. At low flow, the reference site had a significantly higher overall CPUE than the proposed extraction site, largely as a result of higher numbers of leopard dace, with other species numbers comparable between the two sites. In comparison to average CPUE results reported for flat bar edge habitat in Church *et al*. (2000), for which extensive sampling was conducted (n = 227), the results for flat bar edge habitat at Tranmer Bar are higher than average, especially for cyprinids. Detailed results from fish sampling conducted at the proposed excavation site are presented in **Appendix A**, along with sediment and benthic invertebrate sampling results that were collected by SRS in accordance with the 2004 LWBC/DFO Letter of Agreement.

Little Big Bar

A geomorphic assessment, similar to that for Tranmer Bar, was conducted for Little Big Bar and is included in the application material provided by EMBC (**Appendix D**). Georeferenced aerial photographs and orthophoto mosaics are provided for the period between 1971 and 2008. As the alluvial banks of the channel are largely protected by riprap in this area, temporal changes are relatively modest compared to wider sedimentation zones on the river. Nevertheless, the earliest photograph in 1971 illustrates the expansion of Big Bar relative to when it was first documented in 1962. By 1999, a number of major changes had occurred, including the emergence of Little Big Bar.

Other changes included additional deposition of material along the north side of Big Bar, which forced the majority of flow towards the right bank where there was extensive erosion of existing bar and island deposits. There were only modest changes by 2004, but these included an increase in flow down the side channel separating Big Bar and Little Big Bar. Changes between 2004 and 2008 amount to the amalgamation of the upper and lower sections of Big Bar and an increase in the size of Little Big Bar, despite the excavation of 55,000 m^3 from the lower end of Little Big Bar in 2004. This excavation represents the only gravel removal operation to have occurred on Little Big Bar. The recovery of Little Big Bar between 2004 and 2008 indicates that there is active sediment recruitment to the side channel between Big Bar and Little Big Bar.

Scott Resource Services mapped habitat features at the proposed excavation site onto aerial photographs taken at high discharge (5,600 m^3/s) on June 27, 2008; moderate discharge (2,350 m^3/s) on September 18, 2008; and low discharge (780 m^3/s) on April 12, 2008. Additional photographs taken at 5,500 m^3/s (July 13, 2008), 3,500 m^3/s (August 15, 2008) and 2,300 m^3/s (September 16, 2008) allow further comparison of the emergence of Little Big Bar under lowering summer flows (**Appendix D**). At high flow, the entirety of Little Big Bar was submerged, but two patches of riffle habitat were provided by the submerged bar top. The larger of the two patches was at the mid-point of the bar, while the smaller patch was located in the downstream third of the bar. At moderate flow, the north side of the bar is composed almost entirely of flat bar edge habitat, with bar head habitat at the upstream end and bar tail habitat at the downstream end. The south side of the bar consists of steep bar edge habitat with two open nooks and an eddy pool. At low flow experienced in winter, the northern perimeter of the bar consists of flat bar edge habitat, while the southern side of the bar forms an elongated channel nook.

Fish sampling was not conducted at the high flow rate (5,000 m^3/s) prescribed in the 2004 letter of agreement between LWBC and DFO (**Appendix M**), because the site was not identified as a potential gravel removal site until after this discharge rate had passed. Fish sampling therefore occurred at a discharge rate of 3,850 m^3/s on July 23 and 24, 2008, and again at a discharge rate of 3,100 m^3/s on August 18 and 19, 2008. Samples were collected from both the north and south sides of Little Big Bar, as well as reference sites on Big Bar. The same three families of fish captured at Tranmer Bar dominated the catch at Little Big Bar: Cyprinidae, Salmonidae and Catostomidae. Trace numbers of sculpins (Cottidae) were also captured. The most common species of cyprinid were leopard dace, longnose dace, redside shiner and northern pikeminnow. The salmonids captured were either chinook or coho parr, while the blue-listed mountain sucker was the most common sucker species captured. Species composition was comparable between high and low flow samples.

At 3,850 m^3/s, flat bar edge habitat was sampled on the north side of Little Big Bar, while steep bar edge habitat and open nooks were sampled on the south side. Flat bar edge and steep bar edge reference sites were also sampled on Big Bar. However, no suitable open nook reference sites were identified in the local area, so post-excavation data will be compared to results from extensive sampling reported in Church *et al*. (2000). Salmonid abundance did not differ significantly between sites; however, the abundance of suckers was significantly lower in the nooks on the south side of Little Big Bar than on the flat bar edge habitat on the north side.

At 3,100 m^3/s, the habitat sampled on the north side of Little Big Bar was similar to that sampled at the higher discharge rate, with the resulting overall CPUE and SPUE also similar. However, CPUE for cyprinids increased, while CPUE for suckers decreased. On the south side of Little Big Bar the open nooks sampled at the higher discharge rate were no longer functional, so the habitats sampled were steep bar edge and eddy pool. More salmonids were captured in these habitat types than on the flat bar edge habitat on the north side. The flat bar edge reference site supported a similar abundance and diversity of fishes as the flat bar edge habitat on Little Big Bar. The steep bar edge reference site had a higher CPUE for all species combined, and a higher CPUE for salmonids and cyprinids than the comparable habitat sampled on the south side of Little Big Bar. However, there was a high variability in catch between seine sets and the resulting differences were not significant.

Overall CPUE results for Little Big Bar are comparable with those reported for the same habitat types in Church *et al*. (2000). Juvenile chinook CPUE at Little Big Bar was comparable in flat bar edge habitat, but higher than that reported in Church *et al*. (2000) for open nooks and steep bar edge habitat. However, as described above, there was a high degree of variability in catch between seine sets in the steep bar edge habitat at both excavation and reference sites. Detailed results from fish sampling are presented in **Appendix D**, along with sediment and benthic invertebrate sampling results that were collected by SRS in accordance with the 2004 LWBC/DFO Letter of Agreement (**Appendix M**).

26. Factors and Scope of Factors Considered:

Factors considered in the environmental assessment, pursuant to Section 16 of CEAA, are as follows:

- The environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in conjunction with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- The significance of the environmental effects referred to above;
- Comments from the public that are received in accordance with CEAA and the regulations;

- Measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and
- The need for, and the requirements of, any follow-up program in respect of the project.

Environmental components potentially affected by the project, as scoped by DFO, include:

- Surface water quality;
- Hydraulics;
- Vegetation resources;
- Fish and fish habitat; and
- Wildlife.

The assessment of potential effects of malfunctions or accidents included:

- fuel spills from machinery used to construct, operate and decommission the project; and
- harmful alteration disruption or destruction of fish habitat or destruction of fish due to inappropriate machinery or equipment operation.

The assessment of potential effects of the environment on the project, as scoped by DFO, included:

- extreme weather events; and
- artificially increased flow (e.g., upstream dam release) in the Fraser River that would result in a sudden increase in water level.

The assessment of cumulative effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out included:

- prior gravel extractions at the project locations and proposed future extractions within the Fraser River gravel reach.

27. Environmental Effects:

Surface Water Quality

The potential effect to surface water quality during the project is elevated turbidity, which will occur during pile driving in the wetted portion of the Tranmer side channel, and may also result if machinery accidentally enters the river while gaining access or during the excavation. Elevated turbidity will also occur when the access and excavated sites become inundated with flowing water during spring flooding in 2009.

Hydraulics

Gravel extraction from the riverbed will alter local flow patterns in the vicinity of Tranmer Bar, with increased flow conveyance through the extraction area. Excavation at Little Big Bar is not expected to increase flows within the side channel, or initiate any downstream morphologic changes.

Vegetation Resources

Riparian vegetation will need to be cleared during construction to gain access to the gravel bars from the adjacent dike roads. Additional riparian habitat will be removed during gravel excavation at the Tranmer Bar site.

Fish and Fish Habitat

Potential impacts to the fisheries and aquatic resources resulting from the project are: alteration of the microhabitat near the streambed leading to changes in habitat quality for benthic invertebrates, rearing juvenile chinook and coho salmon, and migrating chum and pink salmon fry; reduction in the quality of habitat for egg and larval stages of white sturgeon; loss of high-elevation, refuge habitat during spring floods; loss of high-elevation, summer rearing habitat; alteration of downstream habitats used by white sturgeon and other species year-round through the introduction of fine sediment and deleterious substances to the Fraser River; and noise disturbance to migrating adult salmon and resident fish.

Wildlife

Effects of the project on wildlife, waterfowl and migratory birds are possible by way of disturbance to riparian areas in proximity of the project.

Navigable Waters

Approvals under NWPA sections 5.(1)(a), 6.(4), 16, and 20 trigger the need for an EA under the CEAA. However, environmental effects of the project on navigation are taken into consideration as part of the environmental assessment only when the effects are indirect, i.e. resulting from a change in the environment affecting navigation. Direct effects on navigation are not considered in the environmental assessment, but any measures necessary to mitigate direct effects will be included as conditions of the *Navigable Waters Protection Act* approval.

The temporary bridge crossing requires an Approval under the NWPA.

☒ Only direct effects of the project on navigation were identified; therefore the effects of the project on navigation are not addressed in this environmental assessment.

☐ Indirect effects on navigation (i.e. effects of the project on the environment that affect navigation) were identified and have been addressed in this environmental assessment.

Malfunctions or Accidents

Possible malfunctions or accidents during construction, operation and de-commissioning of the project that could adversely affect fish and fish habitat include the release of toxic/hazardous materials causing the harmful alteration, disruption or destruction of fish habitat or destruction of fish.

Effects of the Environment on the Project

Potential effects of the environment on the project include extreme weather events that may raise the water level and inundate the removal site during the excavation.

Cumulative Effects

Cumulative effects of the project may arise from future gravel extractions upstream of Tranmer Bar and Little Big Bar that capture sediment and thereby reduce available sediment for habitat recovery at the project site, as well as additional extractions in the gravel reach that reduce the overall volume of sediment available for maintenance and renewal of fish habitat.

28. Mitigation Measures:

Surface Water Quality

The potential impact to surface water quality during the project is elevated turbidity. Turbidity will be elevated during pile installation and removal in the wetted portion of the Tranmer side channel; however, these effects are expected to be localized and minor. Environmental monitors will measure turbidity during pile installation and removal at Tranmer Bar to ensure compliance with BC approved water quality guidelines for the protection of aquatic life (limit of 8 NTU in 24 hours when background is ≤ 8 NTU; limit of 8 NTU increase when background is between 8 and 80 NTU; limit of 10% increase when background ≥ 80 NTU) (MELP 2006). Sediment control measures, such as silt curtains and/or modification of installation and removal techniques, will be employed to ensure compliance with these water quality guidelines. Heavy equipment used for pile driving will not be stationed in the wetted portion of the Tranmer side channel.

During gravel extraction, the proponent has committed to extraction only from the dry bar surface and will retain a minimum 1 m buffer between the extraction boundary and any nearby waterbody. Environmental monitors will be on-site at all times to ensure these conditions are met. After the project, elevated turbidity may occur as water inundates the excavated site. This effect is expected to be temporary, localized, and during a period of naturally increased turbidity in the Fraser River.

Hydraulics

The proponent's hydraulic analysis for Tranmer Bar is presented as a letter report from northwest hydraulic consultants to EMBC dated December 2, 2008 (**Appendix B**). The analysis used the River2D model to assess changes in hydraulic conditions following excavation. Velocity through the excavation is expected to increase under moderate flows as the excavated channel will be wetted, whereas the existing channel is generally dry under moderate flows. Under flood flows, velocities in the excavated channel are expected to be similar to the pre-excavated state. Indeed, model results for the 2-year flood suggests velocities will be slightly lower than existing conditions, as the increase in discharge does not overtake the increase in conveyance capacity (i.e. depth and width of flow). Flow depths are expected to increase under all flow conditions within the excavated channel. The increased discharge through the channel is not expected to initiate headcutting or additional scour. It is expected that the upstream portion of the excavation will refill with future deposition of gravel and sand, thus helping to account for the ongoing gravel deposition throughout the reach.

No specific hydraulic assessment was performed for the Little Big Bar extraction. However, the geomorphic assessment conducted by nhc (**Appendix D**), indicates that the extraction would not increase flows within the side channel or initiate any downstream morphologic changes. Habitat features to be constructed at both sites to mitigate disturbance to fish habitat are detailed below.

DFO also received the following advice from EMBC in relation to the removal projects, in letters dated January 27th, 2009 and attached in Appendices K&L. "It is the Province's opinion that the information collected to date provides us with adequate information to determine that the gravel and sediment removal project at Tranmer Bar [and Little Big Bar} will result in flood protection benefits for the citizens of British Columbia in the Lower Fraser Valley."

Vegetation Resources

An estimated 120 m^2 of riparian habitat will need to be cleared at each site, for a total of 240 m^2, in order to gain access to gravel bars from the adjacent dike roads (**Appendix N**). The on-site environmental monitor will ensure that the clearing of vegetation is kept to the minimum amount required to allow access. The environmental monitor will subsequently replant the areas disturbed for access purposes with live willow sticks once the project is complete. No significant impact to vegetation resources is anticipated from this clearing due to the temporary nature of the disturbance, and the presence of similar habitat nearby.

Additional riparian habitat will be lost on Tranmer Bar as the proposed excavation area overlaps an area occupied by immature willows and other low growing shrubs that are less than 5 years in age. The total area of vegetation to be disturbed is 13,037 m^2 (**Appendix N**). The majority of this (9,724 m^2) occurs at the southern end of the upper extraction area, with the rest occurring in two patches in the lower extraction area. During freshet, these areas are inundated and therefore may provide refuge for fish. To the extent possible, disturbance to riparian habitat will be minimized through minor changes in the extraction boundary. However, to ensure the desired conveyance of flow through the excavated channel some riparian habitat will need to be disturbed, particularly in the upper extraction area. The environmental monitor will measure the amount of riparian habitat disturbed and document the type of habitat loss through photographs. Given that the riparian habitat is only functional during freshet flows, and the area to be disturbed represents just 6% of the total area of the vegetated patches (**Appendix N**), these impacts are not expected to be significant.

Fish and Fish Habitat

Potential impacts to fish and fish habitat as a result of this project are mitigated through measures itemized below:

- All work will be conducted in the winter fisheries window between January 1 and March 15.
- Pile driving at Tranmer Bar will be monitored to ensure that sound pressures greater than 30 kPa do not occur (BC Marine and Pile Driving Contractors Association 2003).
- Should shock waves in excess of 30 kPa occur, or a fish kill is observed, contractors will be responsible for introducing effective means of reducing the level of shock waves, such as bubble curtains, or will introduce measures that will prevent fish from entering the potentially harmful shock wave area (BC MPDCA 2003).
- If, despite the introduction of preventive measures, further visual/hydrophone monitoring reveals unacceptable conditions (fish kill or sound pressure over 30 kPa), then the work will stop immediately and the methods will be reviewed and corrected through consultation with DFO (BC MPDCA 2003).
- All gravel extraction will be conducted a minimum of 1 m from the wetted channel edge. Sound levels will be monitored periodically in the wetted channel nearest to excavation activities to ensure that noise levels do not exceed the 194 dB sound exposure level (SEL) recommended by Hastings and Popper (2005).
- All project activities, other than pile driving and causeway construction, will take place on dry sediment isolated from the river flow in order to protect the aquatic environment, fish and fish habitat.
- Culverts will be installed in the access causeway at Tranmer Bar to ensure the conveyance of sufficient flow to downstream habitats that may support salmonid redds. The final number of culverts will be determined by suitably qualified on-site personnel and will be dependent on existing and potential flow conditions. Flow will be continuously monitored at the access location to ensure that there is no dewatering of downstream habitat that would not naturally occur.
- Construction of the access ramp to Little Big Bar is expected to occur in the dry. If conditions are such that a portion of the access route is wetted, culverts will be installed to maintain conveyance of flow. Flow conditions will be monitored continuously, irrespective of access ramp design, to ensure that there is no dewatering of downstream habitat that would not naturally occur.
- If significant subsurface flows are encountered during gravel extraction, temporary berms will be left across the excavation channel to maintain isolation from downstream habitat.
- The excavation designs at both Tranmer and Little Big Bar include features to provide additional habitat complexity to benefit rearing juvenile fish during elevated summer flow levels. At Tranmer Bar, these include constructed nooks along the north and south edges of the extraction, and a stepped invert within the upper extraction area. At Little Big Bar, four open nooks will be constructed along the south side of the excavation, while more flat bar edge habitat will be created on the north side.
- Grading of the upper extraction area on Tranmer Bar will provide positive drainage to the existing stand pools, thus reducing the likelihood of fish stranding on the receding limb of the hydrograph in summer. Similarly, the lower extraction area on Tranmer Bar will be graded to direct the over-bar flow back towards the main channel and provide connectivity with bay habitat present under low flows. The excavation will thus extend the period

- All equipment and machinery will be power-washed and in good operating condition. Refueling and lubrication of equipment will occur outside of the active channel and will require spill containment in place.
- The environmental monitor and contractor will tally the daily extraction volume and the stockpiled material will be surveyed on a regular basis during the excavation to ensure the maximum allowable removal volumes of 186,000 m^3 from Tranmer Bar and 79,000 m^3 from Little Big Bar are not exceeded.
- The haul road across the gravel bar surface at both sites will be de-commissioned by scarifying with an excavator.
- Any stockpiling of excavated material will occur off-site and outside the active channel of the Fraser River. Similarly, any screening, crushing or washing of gravel will be conducted off-site by the contractor.
- A biophysical monitoring program (the "Monitoring Program"), as specified in the 2004 Letter of Agreement, will be carried out by EMBC to monitor effects of the project on fish and fish habitat. The Monitoring Program includes pre-project sampling (already completed) and post-project sampling for up to three years or until a major freshet exceeding 8,766 m^3/s peak flow. The Monitoring Program consists of:
  - topographic surveys to assess the volume of gravel removed and rate of sediment replenishment;
  - surface sediment sampling to assess the change in sediment texture due to the removal;
  - juvenile fish sampling to assess fish utilization of the habitat before and after excavation
  - benthic macroinvertebrate sampling to evaluate ecological productivity, fish food availability and habitat conditions at the site before and after the excavation in comparison to designated reference sites; and
  - habitat mapping to compare the type and extent of available habitat over a range of flows before and after the excavation.

Despite the adoption of these mitigation measures, some residual adverse environmental effects will occur given the nature of the project. A description of these residual effects is provided here, with the assessment of whether these represent significant adverse environmental effects provided in Section 29.

Temporal Context

As previously reported in "**The Harrison Bar Gravel Removal Experiment: Final Report**" by Laura Rempel and Michael Church (Rempel and Church 2003), gravel extractions can result in a temporary change in substrate conditions. Coarse material that acts as an armour layer is removed and replaced by an unconsolidated mix of fine gravel and sand. This change in substrate can lead to a decrease in the habitat quality for certain common invertebrate taxa because higher sediment transport rates discourage settlement. Habitat quality for juvenile salmonids, as well as sturgeon eggs and larvae, is also likely to be reduced both directly, due to a decrease in the amount of cover available, and indirectly, because a decrease in the number of invertebrates reduces the local food supply. However, these disruptions to fish habitat are temporary and occur immediately prior to natural disturbance of the substrate layer during freshet flows. In response to the report entitled "**Assessment of Potential Impacts on White Sturgeon and their Habitat from Proposed Gravel Extraction in the Lower Fraser River during winter, 2009**" submitted on behalf of the Fraser River Sturgeon Conservation Society (**Appendix H**), Vic Galay, a hydraulic engineer with nhc consultants, describes the natural disturbance of the substrate layer as follows: "an early freshet flow in May will remove most of the sand and pebbles from the interstitial spaces and as the flow increases the larger gravel will also be entrained by the flow. Subsequently, during the reduction in flow, the larger gravel will again armour the bed. The armoured bed may, however, be on top of the refilled or partially refilled excavation. Therefore, when the sturgeon spawn during the post-freshet there will be a newly re-formed armour layer with newly formed interstitial spaces." The full email response from Vic Galay, along with comments from Jim Scott of Scott Resources, was submitted to DFO by EMBC on November 28, 2008 and is included as **Appendix O**.

Further evidence of the temporary nature of the disturbance with respect to substrate texture is found in Rempel and Church (2003) and post-extraction monitoring studies carried out following gravel extractions in 2005 and 2006. Rempel and Church (2003) report that the scalped surface of Harrison Bar regained topographic complexity after one freshet event, except for along the water's edge where the average size of coarse particles remained lower than prior to excavation. The return of textural complexity was confirmed by the fact that all impacts associated with the invertebrate community were also short-lived, lasting only through the first freshet. Impacts on invertebrate abundance were evident in April 2000, immediately after gravel extraction, but not in August 2000.

Monitoring studies carried out under the 2004 LWBC/DFO agreement (**Appendix M**) on four excavations in the Gill Island and Big Bar complexes show mixed results with respect to changes in substrate composition. Results were reviewed for a 20,000 m^3 extraction from Gill Central (SRS 2008a), a 45,000 m^3 extraction from Gill East (SRS 2008b), a 50,820 m^3 extraction from Gill West (SRS 2008c), and a 47,500 m^3 extraction from Big Bar (SRS 2008d). All extractions were conducted in the 2006 winter fisheries window except for Gill West, which was excavated in

March 2005. Contrary to the results of Rempel and Church (2003), three of the four sites showed no significant change in substrate size between pre-extraction and immediately post-extraction. The exception to this was Gill East, for which there were significant decreases in each of the size categories monitored: fine (D_5), median (D_{50}), coarse (D_{95}) and mean stone size. These decreases were also evident following the first freshet after excavation, but not after the second freshet, which was classified as a major freshet (>8,766 m^3/s). The other three sites showed variable responses following the first freshet: at Gill Central there were no significant differences between pre-extraction and post-freshet substrate samples; at Gill West, D_5, D_{50} and mean stone size increased between pre-extraction and post-freshet sampling periods; while at Big Bar, D_{95} significantly decreased between pre-extraction and post-freshet, but there were no significant differences in D_5, D_{50} and mean stone size.

Invertebrate responses to the gravel extractions in the Gill Island and Big Bar complexes also show no clear relationships between extraction activities and invertebrate abundance and diversity. Although significant decreases in invertebrate abundance and diversity were reported following extraction at some sites, these were more often than not mirrored by similar decreases at undisturbed reference sites. Seasonal variation in abundance and diversity of the invertebrate population was recorded at all sites, with no evidence that extraction activities caused impacts outside the bounds of natural variation. Given the temporary nature of the disturbance to substrate texture and invertebrate populations (Rempel and Church 2003), and the natural variation witnessed during monitoring studies at both excavation and reference sites, any short-term impacts to rearing fish populations as a result of changes to invertebrate populations are not expected to be significant.

Spatial Context

In addition to the temporary nature of the disturbance, it is appropriate to consider the spatial context within which the proposed extraction occurs. Two recent PhD theses by Darren Ham (2005) and Laura Rempel (2004) describe the geomorphic and ecological context of the 80 km Fraser River gravel reach, which is characterized by a complex network of gravel bars and vegetated islands that undergoes regular changes as a result of the transfer of coarse alluvial sediments (coarse sand, gravel and cobble) during spring flooding. The 80 km reach can be divided into five sub-reaches of distinct morphological character based on channel gradient, riverbed sediment size and sediment transport regime (Rempel 2004). These sub-reaches are also characterized by different invertebrate and fish communities, with invertebrate community structure dissimilar between sub-reaches but similar in gravel bar sites within a sub-reach. Fish community structure also differed in secondary channels within different sub-reaches. These sub-reaches therefore provide a reasonable ecological context for examining the impacts of gravel extraction.

Tranmer Bar occurs in the lower third of the Cheam sub-reach that extends from the Agassiz-Rosedale bridge upstream to the upper end of Wahleach Island. Based on bar surface areas listed in the report entitled "**Morphological and Habitat Classification of the Lower Fraser River Gravel-Bed Reach**" (Church *et al*. 2000), the proposed footprint of the gravel extraction represents 6.7% of the bar habitat available on Tranmer Bar, but just 1.2% of gravel bar habitat within the Cheam sub-reach.

Little Big Bar is associated with Big Bar in Church *et al*. (2000), with the Big Bar complex representing the upstream end of the Rosedale sub-reach that extends downstream to the confluence with the Harrison River. The proposed footprint of the gravel extraction represents 2.5% of gravel bar habitat within the Big Bar complex, and 0.4% of bar habitat in the Rosedale sub-reach.

Morphological Changes to Fish Habitat

Morphological changes to fish habitat on Tranmer Bar and Little Big Bar will result from gravel extraction. However, the loss of high-elevation rearing habitat at Tranmer Bar is offset through the inclusion of open nooks and a stepped invert designed to provide habitat complexity, while the grading of the extraction will extend the period of time that fish have access to bar edge habitat in the area during receding flows. Indeed, the River 2D hydraulic habitat model run by nhc consultants indicates that the amount of useable habitat for juvenile chinook salmon at the excavation site will increase by 14% under 2-year flow conditions and 600% under mean annual flow conditions (**Appendix B**). The six-fold increase at mean annual flow is a result of increasing the wetted area and providing suitable depth and velocities under these flow conditions. The amount of useable habitat for juvenile coho is also predicted to increase, by 39% at mean annual flow and 57% at 2-year flow conditions. These effects, while positive in nature, are local, and are thus not expected to impact populations of chinook and coho salmon of the lower Fraser River because of the small percentage of habitat modelled within the Cheam sub-reach.

A primary concern of the Fraser River Ad Hoc Stewardship Gravel Removal Committee, expressed in email correspondence from Marvin Rosenau dated December 16, 2008 (**Appendix I**), is the disturbance of a large amount of rearing habitat for a number of fish species, particularly juvenile chinook salmon. Of specific concern was the proposed extraction at Tranmer Bar, which is described in **Appendix I** as being particularly productive rearing habitat. Pre-extraction monitoring results collected by SRS support this assertion (**Appendix A**). CPUE results obtained in flat bar edge habitat for all species, and for juvenile chinook, were higher than the averages for that habitat type reported in Church *et al*. (2000). However, CPUE results were also higher than average for the nearby reference site that will remain undisturbed by the proposed extraction. Indeed, at both high and low flow, CPUE for all species was higher at the reference site than at the proposed extraction site, although the difference was only significant at low flow. Average CPUE for salmonids was comparable between the excavation and reference sites. Even supposing that the remaining bar edge habitat to be disturbed, i.e. habitat not sampled by SRS, offered habitat of twice the value of other habitat available on Tranmer Bar and within the Cheam sub-reach, the relative percentage of bar habitat impacted would be 13.5% of that on Tranmer Bar, and 2.5% of that within the Cheam sub-reach. Given these percentages, it is unlikely that there would be a significant negative impact on the overall populations of lower Fraser River chinook and coho, even if impacts to habitat were negative, rather than the positive effects predicted by the hydraulic model (**Appendix B**). Furthermore, the morphological impacts to high-elevation rearing habitat will recover over time, with the excavation expected to refill within a decade (**Appendix A**).

The loss of high-elevation rearing habitat at Little Big Bar will also be mitigated by the construction of four open nooks to provide increased habitat complexity at the site. The nook habitat is different than the high bar habitat that will be affected by gravel extraction. Although the open nooks are intended to provide preferred rearing habitat along the steep bar edge on the south side of the extraction area, there is uncertainty that these habitats can provide equivalent habitat under the flow conditions when high bar habitat is most valuable.

In addition to impacts on rearing habitat, there is the potential for the gravel extractions to impact salmon spawning habitat. However, the potential for impacts to spawning habitat is minimized by conducting gravel extraction in the winter, during a low flow period, which maximizes the distance of planned extractions from flowing water and potential viable redds. Extraction at both sites will be set back from the water's edge so that no viable redds will be expected within the extraction perimeter. Impacts to pink salmon are not expected during the current work window, as there will be few, if any, pink salmon redds at Tranmer Bar or Little Big Bar in early 2009. Potential impacts to chum and chinook redds present in the Tranmer side channel during construction of site access to Tranmer Bar will be assessed below.

The extraction at Little Big Bar is not expected to have significant impacts on viable redds. A recent survey conducted by SRS indicates that the extraction site did not appear to be heavily spawned (**Appendix N**). There were several depressions noted that had the potential to be redds, although there was also evidence that these were scour holes produced by root wads. Future spawning at Little Big Bar may be impacted as the extraction will decrease the elevation of the lower two thirds of the bar. However, depending on the impact to substrate composition at the site, and the extent of recovery of textural complexity during the 2009 freshet, the extraction may increase the amount of spawning habitat available by increasing the amount of habitat submerged during winter low flows. Past surveys have found that the upstream portion of Little Big Bar was the most heavily spawned (**Appendix E**). This area will not be impacted under the current extraction proposal.

The elevational changes to fish habitat are more long-lasting than the textural substrate changes that are generally reversed following one freshet, with the recovery rate dependent on local sediment deposition rates. On Tranmer Bar, there has been a net deposition of 163,000 m^3 within the footprint of the proposed excavation in the past decade, although no deposition since 2003 (**Appendix A**). Given these local deposition rates, the excavation at Tranmer Bar is expected to take a decade or more to refill in the absence of a major flood event (**Appendix A**). In comparison, the Little Big Bar extraction is expected to refill in two to three years, based on an annual local recruitment rate of 28,000 m^3 from 2003 to 2008 (Darren Ham, nhc, *pers. comm.*, **Appendix E**). This recovery rate is supported by the fact that in 2008 there was no evidence of the 55,000 m^3 extraction that occurred on Little Big Bar in 2004.

Potential Impacts to White Sturgeon

As indicated in the LGL report (**Appendix H**), egg and larval stages are the most likely to be impacted by gravel extraction if eggs are deposited on sandy, as opposed to gravel substrates. The concern over potential impacts to white sturgeon recruitment was affirmed in email correspondence from the Fraser River Ad Hoc Stewardship Gravel Removal Committee (**Appendix I**). Several potential sites suitable for white sturgeon egg and larval stages were identified by SRS. The lower end of the planned excavation at Tranmer Bar may serve as a suitable site for eggs drifting downstream through the lateral channel that bisects Tranmer Bar (**Appendix A**). However, the Tranmer Bar extraction site is not considered an important spawning location in the Traditional Ecological Knowledge report of the Seabird First Nation (**Appendix Q**): "The Tranmer Bar extraction plan does not pose a threat to current sturgeon habitat or to available spawning habitat for sturgeon. The area of extraction does not affect traditional spawning or rearing areas for sturgeon and the removal of gravel in this location will help to create a greater diversity of habitat for a greater diversity of fish and fish life-cycle activity." No monitoring was conducted in Little Big Bar side channel during the study by Perrin *et al*. (2003).

There remains uncertainty with respect to the potential impacts of gravel extraction on sturgeon. On the one hand, significant changes to substrate composition immediately following excavation but prior to inundation, which may impact sturgeon egg and larval survival, were only reported in two of five extractions for which monitoring reports are available (Rempel and Church 2003, SRS 2008a, SRS 2008b, SRS 2008c, SRS 2008d). Furthermore, the majority of sediment transport and bar surface disturbance is believed to occur with the onset of freshet and cease shortly after peak flows are reached (**Appendix O**). Therefore, if significant changes do occur during excavation, the excavated bar surface is expected to stabilize and regain topographic complexity within one freshet event (Rempel and Church 2003).

However, there is uncertainty over the exact timing of sediment mobilization and sturgeon spawning, thus impacts may occur through the deposition of eggs on disturbed sandy substrates that have not yet regained textural complexity. The timing of sturgeon spawning in the Fraser has been estimated as early as June 18 (Perrin et al. 2003), but may vary between years, as does the peak of the Fraser River freshet. Freshet flow in the Fraser River at Hope (08MF005) peaks in mid June based on the historic period of record, but occurred on May 24 in 2008 (http://scitech.pyr.ec.gc.ca/waterweb/fullgraph.asp). Furthermore, significant changes in sediment grain size were still apparent after one freshet at the Gill East gravel extraction (SRS 2008b), and along the water's edge at Harrison Bar (Rempel and Church 2003). Also, despite the findings of Perrin *et al.* (2003) who found sturgeon eggs and larvae in side channels but rarely in main channels, there remains uncertainty over the habitat requirements and critical locations of white sturgeon spawning.

Despite these uncertainties, MOE has proceeded with the issuance of a Section 9 Water Act Approval, with the following rationale: "This decision to issue an Approval was intended to apply a reasonable degree of precaution to the objective of maintaining the flood profile without contributing an unacceptable level of harm and destruction to the environment. The Approval contains a condition requiring the collection of information intended to contribute to our knowledge of sturgeon activity at this location."

Potential Impacts during Access Construction

Impacts to fish will occur during construction of the access road to Tranmer Bar as a temporary bridge is required to span the Tranmer side channel, which acts as a spawning area for chum and chinook salmon (**Appendix J**). Impacts will arise from the construction of a causeway in the wetted channel and from mechanical impact and noise effects during pile-driving. In an email dated January 21, 2009, Jim Scott of SRS explains how existing water conditions at the site suggest that the northern of the two proposed crossings would have less impact to fisheries resources (**Appendix P**). In this same email, the contractor estimates encroachment of the causeway into the wetted channel at this site would be 10 m on the west side of the crossing, with no encroachment anticipated on the east side. However, the most recent bridge design drawings dated January 26, 2009 (**Appendix C**) suggest there would be no encroachment into the wetted portion of the channel. Irrespective of whether there is encroachment into the wetted channel, there is a risk of some mortality in redds due to gravel compaction and causeway construction on the shoreline of the bar where intra-gravel flow may maintain some viable eggs and alevins. To be conservative, the footprint impact size is estimated to be a total of 400 m^2 of wetted habitat (10 m long by 20 m wide on both sides of the channel).

Construction of the temporary bridge involves the installation of four 16" piles into dry gravel bar habitat on the east and west shores, and four 18" piles into the wetted portion of the Tranmer side channel. Installation of 16" piles into gravel and cobble substrate on the Yakima River produced peak sound pressure levels of 173 dB (432 Pa) recorded at 30 feet (WSDOT 2003), while installation of 16" piles during the Spring Bar gravel excavation did not exceed 300 Pa, recorded at a distance of 20 m (NPE 2008). Peak sound pressure levels during installation of 16" piles are therefore not expected to exceed the guideline of 30 kPa (210 dB) (BC MPDCA 2003). No hydrophone monitoring results for the installation of 18" steel piles could be found, but peak sound pressure levels attained during pile driving of 24" steel pipes in the Port of Vancouver were recorded as being between 201 and 214 dB. Given that peak sound pressure levels for the installation of 18" steel piles are more likely to be similar to those produced during installation of 16" rather than 24" piles, it is anticipated that pile driving for the project will not exceed the guideline of 30 kPa. However, pile-driving sound pressures vary depending on a number of factors including water depth, substrate type, and attenuation properties of the environment, therefore hydrophone monitoring of pile installation will be required to ensure that guidelines are not exceeded. Should sound pressure levels exceed the prescribed guideline of 30 kPa, or 210 dB, mitigation measures such as the use of a bubble curtain, use of a smaller hammer, or reducing the force of the hammer blow through use of a hydraulic hammer will be employed. If after employment of these mitigation techniques, sound pressure levels still exceed guideline levels, other mitigation will be required through consultation with DFO.

Even if peak sound pressure levels do not exceed guidelines, impacts to salmonid eggs and alevins may still occur should pile driving occur directly on top of a redd. The extent of these impacts cannot be determined with certainty, as studies conducted to date on the effects of sound on eggs, larvae and fry were insufficient in concluding how sound would affect survival, particularly in reference to the potential effects of pile driving (Hastings and Popper 2005). At a minimum, the impacted area will equate to the footprint of the piles. Since the four 16" piles will be driven into dry bar habitat, the chances of viable redds being impacted by the installation of these piles is reduced. The estimated impact area from pile driving is therefore 1.17 m^2, or 0.16 m^2 for each 18" pile and 0.13 m^2 for each 16" pile.

To determine the potential impact to chinook and chum redds from pile driving and causeway construction, optimal redd sizes for the two species were used. In the case of chinook, the area required for stream-type chinook (16 m^2)

was used rather than the area required for ocean-type chinook (24 m^2) (Burner 1951), in order to obtain an estimate of the maximum potential impact. The optimum redd density for chum salmon is 1.7 m^2/female (Schroder 1973). The driving of each pile therefore has the potential to disturb a portion of one redd, with the percentage disturbed dependent on the species. For the purposes of this analysis, pile driving is therefore assumed to disturb eight redds. Meanwhile, the potential number of redds disturbed during causeway construction and decommissioning is 235 chum redds and 25 chinook redds. This is expected to be an overestimate of the number of redds to be disturbed given that the numbers are calculated on optimum redd size, with optimal conditions unlikely to occur at the proposed crossing location based on a description of the spawning habitat (**Appendix F**) and more suitable habitat located upstream (**Appendix J**). While further impacts may accrue from pile driving, these effects are not expected to be significant in the context of the chum and chinook populations of the reach because: a) peak sound pressure levels are not expected to exceed guidelines, b) sound pressure levels are expected to attenuate faster in the substrate than in the water, and c) effects will be limited to a small portion of the Tranmer side channel. Impacts from causeway construction will also be minimized as much as possible by inspecting the shoreline prior to commencing the work and fine-tuning the location of the bridge to avoid potential and confirmed redds. Encroachment into the wetted portion of the channel will also be restricted wherever feasible.

Sediment Load

The disturbance to downstream habitats through the erosion of sand from the excavated surfaces of Tranmer Bar and Little Big Bar is expected to be inconsequential given the natural suspended sand load in the Fraser River. As outlined in email correspondence by Vic Galay (**Appendix O**), the suspended sand load in the Fraser River is approximately 5.5 million tonnes per year, with sand from the exposed surface of any excavation area representing an immeasurable fraction of this overall sediment load.

Wildlife

Effects to wildlife, waterfowl and birds as a result of gravel extraction are a concern when impacts to riparian vegetation occur. Riparian habitat disturbance at the access locations will be kept to a minimum through supervision of the environmental monitor, and will be replanted using willow sticks on project completion. The disturbance anticipated from the clearing of the access sites is therefore temporary and minor given the presence of similar, established riparian habitat nearby.

Riparian habitat loss on Tranmer Bar amounts to an estimated area of 13,037 m^2 (**Appendix N**). While disturbance to riparian habitat will be minimized wherever possible through minor changes in the extraction boundary, the majority of the disturbance (9,724 m^2) occurs at the southern end of the upper extraction area, which must be excavated to have the desired hydraulic effect of conveying flow through the excavated channel. The riparian habitat in this area consists of immature willows and other low growing shrubs less than five years in age. The environmental monitor will measure the amount of riparian habitat disturbed and document the type of habitat loss through photographs. The fact that the area to be disturbed represents just 6% of the total area of the vegetated patches to be impacted (**Appendix N**), and a much smaller proportion of the vegetated area of Tranmer Bar, effects to wildlife are expected to be minor.

Environment Canada has confirmed that there are no significant concerns related to wildlife arising from the proposed project (**Appendix R**).

Malfunctions or Accidents

Standard spill prevention best practices are required during the project. All machinery used on-site will be in good working condition and appropriate storage and refuelling locations for machinery will be identified to prohibit fuels and lubricants from entering the Fraser River. These sites must be outside of the active channel of the Fraser River and be a minimum of 30 m from any watercourse or surface water drainage. The contractor must have spill containment kits on-site with a sufficient quantity of absorbent material along with personnel trained in spill clean-up. In the event of a spill, it is expected that prompt clean-up will occur and that volumes will be small, local, and on a dry gravel surface. Construction waste or any miscellaneous unused materials for bridge building will be recovered for either disposal in a designated facility or placed in storage.

Environmental monitors on-site at all times during the project will ensure the appropriate operation of all equipment and machinery and have the authority to halt the project if potential impacts to fish or fish habitat are identified.

Effects of the Environment on the Project

Environmental monitors on-site at all times have the authority to halt the project if weather conditions or water level pose an environmental risk to the project.

Cumulative Effects

Several recent reports examine the fluvial geomorphology of the Fraser River gravel reach, including a report entitled "**Gravel Management in the Fraser River**", by Michael Church, Darren Ham and Hamish Weatherly and dated December 12, 2001 (Church *et al*. 2001); a follow up report dated October 20, 2003 entitled "**The sediment budget in**

the gravel-bed reach of Fraser River: 2003 revision" by Darren Ham and Michael Church (Ham and Church 2003); and Darren Ham's PhD dated July 2005 and titled "**Morphodynamics and sediment transport in a wandering gravel-bed channel: Fraser River, British Columbia**" (Ham 2005). These reports examine the annual sediment influx to the Fraser River gravel reach and present sediment management recommendations to preserve its morphological integrity and habitat characteristics.

A gravel extraction on Harrison Bar has already been approved for winter 2009 (CEAR No. 08-01-44436). The approved amount of gravel removal is 155,000 m^3, with an estimated footprint size of 96,000 m^2. Harrison Bar occurs in the same sub-reach as Little Big Bar, with the extractions planned from these two bars representing 1.5% of the bar habitat present in the Rosedale sub-reach. Tranmer Bar occurs in the Cheam sub-reach, located upstream of Rosedale. The proposed extraction from Tranmer Bar represents 1.2% of the bar habitat within the Cheam sub-reach. In total, the three extractions represent 1.3% of the bar habitat present in the Rosedale and Cheam sub-reaches, and 0.8% of the bar habitat available in the entire Fraser River gravel reach.

Gravel extractions in future years are also likely to occur within these sub-reaches. However, adverse environmental effects from gravel extractions are for the most part short-lived, due in large part to the natural transport and deposition of sediment in the gravel reach. Effects on juvenile salmon not immediately reversed are mitigated by the creation of other productive fish habitat. In consideration of local geomorphic assessments and calculations of the annual sediment influx to the Fraser River gravel reach, and with the implementation of mitigation measures outlined in this Screening Report, cumulative effects are expected to be avoided.

29. Significance of Adverse Environmental Effects:

The determination of whether the project is likely to lead to significant adverse environmental effects was based on the Canadian Environmental Assessment Agency reference guide entitled "Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects", and the Environmental Effects and Proposed Mitigation as described in Section 27 and Section 28 of this Screening Report. As outlined in the CEAA guidance document, the significance of adverse environmental effects is based on the following criteria:

- Magnitude of the adverse environmental effect
- Geographic extent of the adverse environmental effect
- Duration and frequency of the adverse environmental effect
- Degree to which adverse environmental effects are reversible or irreversible
- Ecological context

In the context of the Cheam and Rosedale sub-reaches, and particularly the Fraser River gravel reach as a whole, the magnitude of any environmental effects of the project is expected to be minor. Many of the adverse effects are short-lived, with microhabitat features relating to substrate texture being restored to pre-excavation conditions following the first freshet. Impacts to the morphology of fish habitat, although not immediately reversed, do recover over time, and are mitigated in the interim by the provision of other productive types of fish habitat. The Fraser River's natural tendency for sediment transport and deposition in the gravel reach provides the ecological context for the project, as is illustrated in the morphological transformations evident in historical photographs of Tranmer Bar (**Appendix A**) and Little Big Bar (**Appendix D**). These conditions represent the environment to which aquatic species in the Fraser River are adapted. Potential impacts to salmonid redds in the Tranmer side channel during temporary bridge construction and decommissioning are not expected to be significant given the localized nature of the effects. In light of these considerations, and taking into account the proposed mitigation measures, DFO and Transport Canada conclude that the project as scoped in Section 23 of this Screening Report is not likely to result in significant adverse environmental effects.

30. Public Participation in Screening under Subsection 18(3) of CEAA:

Was it considered appropriate in the circumstances? Yes ☐ No X

Explain why public participation was or was not considered appropriate.

In accordance with the *Canadian Environmental Assessment Act*, the Notice of Commencement notified the public that the review of the project commenced, outlined the federal scope of the project and established the public registry for the project at www.ceaa.gc.ca. Through this process the public may request documents from the public registry and comments from the public pertaining to environmental effects may be considered as part of the environmental assessment.

As a result, public participation in Screening under Subsection 18(3) was not invoked.

31. Summary of Public Comments and Concerns Related to Screening under Subsection 18(3):

Subsection 18(3) of CEAA was not invoked.

32. Follow-up Program:

Was it considered appropriate in the circumstances? Yes ☐ No X

Explain why a follow-up program was or was not considered appropriate.

The Monitoring Program, described in Section 28 of this Screening Report, will be carried out for up to three years post-removal. No additional follow-up program was considered necessary because the project does not involve technology or mitigation measures that are new or unproven and it is anticipated that the proposed mitigation measures, as well as the Fraser River's natural tendency for sediment transport and deposition in the gravel reach, will address the predicted environmental effects within the timeframe of the Monitoring Program.

33. Other Monitoring and Compliance Requirements:

Implementation of all mitigation measures will be monitored under approvals or permits from government agencies and departments. Environmental monitors on contract to EMBC will be on-site during all phases of the project. Additional site visits, inspections or reporting will be conducted by EMBC or consultants working on behalf of the proponent and results of these will be provided to the appropriate government agencies or departments. This will include mitigation and monitoring to ensure compliance with Subsection 35(2) *Fisheries Act* Authorizations.

SCREENING CONCLUSION

34. Conclusion on Significance of Adverse Environmental Effects:

Fisheries and Oceans Canada and Transport Canada have completed the screening of the project under the CEAA. DFO and Transport Canada have determined, taking into account the implementation of the proposed mitigation measures, that the project is not likely to cause significant adverse environmental effects.

35. Confirmation by Proponent

I, GLEN THOMPSON, having the authority to commit funds and activities on behalf of EMBC have read and understood the above material outlining conditions for the above project. I confirm that EMBC will undertake all of the mitigation conditions outlined in this environmental screening report and any additional measures necessary to ensure protection of the environment and compliance with environmental regulations during the operation, maintenance and decommissioning of this project.

Signed by: [signature] **Date:** FEB 12/09.

Title: DIRECTOR

36. CEAA Decision Approved by: R. Sisler **37. Date:** Feb. 13/09

38. Name: Robert Sisler

39. Title: Regional Manager, Environmental Services, Transport Canada

40. CEAA Decision Approved by: [signature] **41. Date:** Feb 13/09

42. Name: Adam Silverstein

43. Title: Manager, Major Projects Review Unit

COURSE OF ACTION DECISION

44. Course of Action Decision: (under Section 20 of CEAA)

- X DFO and TC may exercise its power, duty or function, i.e. may issue the authorization - where the project is not likely to cause significant adverse environmental effects. Confirm below the specific power, duty or function that may be exercised.
  - X DFO to issue *Fisheries Act* Authorization or Approval
  - X TC to issue *Navigable Waters Protection Act* Approval as appropriate
  - ☐ DFO to recommend to Governor in Council to exercise power, duty or function
  - ☐ DFO to proceed with project (as proponent)
  - ☐ DFO to provide financial assistance for project to proceed
  - ☐ DFO to provide federal land for project to proceed

- ☐ DFO and TC may not exercise their power, duty or function - the project is likely to cause significant adverse environmental effects that cannot be justified in the circumstances.

- ☐ DFO and TC shall refer the project to the Minister of the Environment for referral to a mediator or review panel if it is uncertain whether the project is likely to cause significant adverse environmental effects.

- ☐ DFO and TC shall refer the project to the Minister of the Environment for referral to a mediator or panel - the project is likely to cause significant adverse environmental effects that may be justified in the circumstances.

- ☐ DFO and TC shall refer the project to the Minister of the Environment for referral to a mediator or review panel - public concerns warrant a reference to a mediator or review panel.

45. References:

BC MPDCA. 2003. **Best Management Practices for Pile Driving and Related Operations**. Prepared by the B.C. Marine and Pile Driving Contractors Association. November 2003.

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