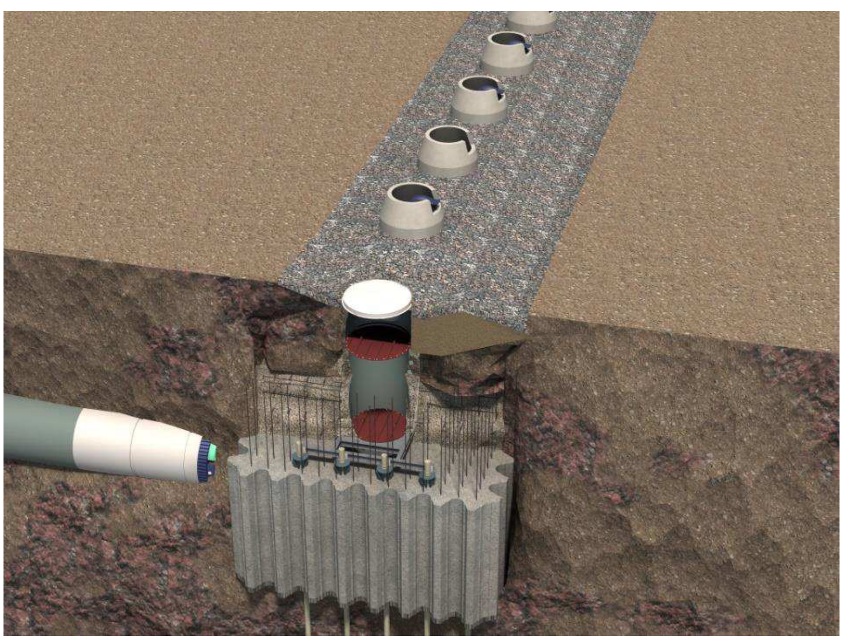
APPENDIX G
DREDGING STUDIES

G.1: Fish Related Dredging Impacts and Mitigation

Annacis Island WWTP New Outfall System

Vancouver Fraser Port Authority
Project and Environmental Review Application



metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

CDM Smith

Golder Associates

envirowest

This page intentionally left blank

FISH RELATED DREDGING IMPACTS AND MITIGATION
VFPA PROJECT AND ENVIROMENTAL REVIEW

ANNACIS ISLAND WASTEWATER TREATMENT PLANT
NEW OUTFALL - ANNIEVILLE CHANNEL, FRASER RIVER

METRO VANCOUVER
4330 KINGSWAY
BURNABY, BC V5H 4G8

December 22, 2017

CDM SMITH CANADA ULC
SUITE 1001 4710 KINGSWAY
BURNABY, BC V5H 4M2

ENVIROWEST CONSULTANTS INC.
SUITE 101 1515 BROADWAY STREET
PORT COQUITLAM, BC V3C 6M2

This page intentionally left blank.

Fish Related Dredging Impacts and Mitigation

Proposed Dredging

Construction of the Diffuser Manifold for the Annacis Island Waste Water Treatment Plant New Outfall System will require: 1) dredging a temporary trench in the riverbed to about 5 meters below the navigation channel dredge depth; 2) installing a large diameter (2.5 metre) pipeline with vertical risers within the trench, and 3) backfilling the trench to the navigation channel dredge depth with native sand covered with armor rock. The estimated dredge area is 12,750 m2 assuming a dredge slope of 6 horizontal to 1 vertical on the navigation channel side of the excavation and the use of temporary shoring on the shoreline side as necessary control the dredging and limit the dredge slope from extending further toward the shore. Dredging volume is estimated to be less than 35,000 m3.

Dredging will be conducted using a clamshell dredge (i.e. a crane equipped with a clamshell bucket). A clamshell dredge was selected, in part, due to its ability to precisely excavate to the limits delineated by the design and limit impacts on the river bed associated with construction. Clamshell dredging is mechanical dredging and is effective in minimizing induced turbidity, as opposed to the hydraulic dredging. Hydraulic dredges, such as cutterhead suction and hopper dredges, tend to over-excavate, especially where sand is the dominant sediment.

The crane with bucket would be operated from a floating spud-derrick. The bucket is operated through a series of cables fitted to the crane. Dredged material is deposited onto a barge. It is anticipated that a portion of the dredged material would be utilized to restore the river bottom (sediment and elevation) upon completion of the installation of the manifold. Dredged material not used to restore the river bed at and about the riser and diffuser manifold would be disposed at sea (Disposal-at-Sea Permit) or unloaded from barges at an off-loading facility and disposed at a permitted upland site.

Timing of Dredging in Relation to Fisheries Sensitive Periods

Dredging will be conducted during the timing window for inwater works of least risk to fish (June 16 through to February 28) (Fisheries and Oceans Canada 2017). The inwater timing window is specific to the mitigation of impacts to downstream migrating juvenile salmonids. Incidentally, the work window also protects upstream migrating eulachon; this species is typically migrating through Annieville Channel from March through to May. Likewise, late juvenile and adult white sturgeon feeding upon eulachon during spring and summer (April 01-August 01; Fisheries and Oceans Canada 2014) are also protected.

Adult salmon, Dolly Varden char and bull trout will be in the river during the inwater work window. Upstream migrating adult salmon move through the main channel. Since the location of the dredge area is along the northern margin of the main channel, there is limited potential for interaction with upstream migrating adult salmon.

Adult white sturgeon may occur at and about the location of the dredge area during the inwater work window. Juvenile sturgeon may occur intermittently at and about the location of dredge area; however, during low flows within the Fraser River that occur during the timing window, the salt wedge will commonly engage the location of works, pre-empting juvenile white sturgeon.

Potential Impacts to Fish and Fish Habitat

Turbidity

Elevated turbidity and total suspended solids associated with sediment plumes are typically transitory and temporary (Water and Land Use Committee 2006). If juvenile salmon encounter a sediment plume, they will express avoidance behaviour (see ECORP Consulting, Inc. 2009). Prospective impacts to juvenile salmon are mitigated through restriction of dredging to the inwater work window (Water and Land Use Committee 2006).

Mechanical Dredging

It is anticipated that salmon and char will express avoidance behaviour in response to the operation of the clamshell. However, dredging with a clamshell has the potential to strike or entrain adult and juvenile white sturgeon as they predominantly reside on the river bottom. The prospective impacts of dredging on all species of sturgeon, let alone white sturgeon, have been poorly studied. When such studies have been conducted, the focus has been upon the potential impacts of hydraulic dredging. The impacts of mechanical dredging, as represented by clamshell dredging, have not been studied in the Fraser River.

A perspective regarding the risk of harm or death of white sturgeon due to mechanical dredging may be derived from data pertaining to interactions between dredging and other species of sturgeon. Data pertaining to mortalities attributable to entrainment by mechanical dredging are provided by the US Army Corps of Engineers Sea Turtle Data Warehouse (2013) for the Atlantic and Gulf coasts. The data spans 18 years, from 1995 to 2013. Forty-two (42) sturgeon (3 Gulf sturgeon (A. oxyrinchus desotoi), 11 shortnose sturgeon (A. brevirostrum), and 34 Atlantic sturgeon (A. oxyrinchus oxyrinchus)) were taken during dredging. Five sturgeon survived their encounters with the dredges (2 shortnose sturgeon and 3 Atlantic sturgeon). The majority of mortalities were associated with hopper dredging (3 Gulf sturgeon, 5 shortnose sturgeon and 24 Atlantic sturgeon). Four (4) sturgeon (1 shortnose and 3 Atlantic sturgeon) were entrained by mechanical dredging; or 0.2 sturgeon per year. The Atlantic Sturgeon Status Review Team calculated a minimum entrainment of 0.6 Atlantic sturgeon per year, based strictly on hopper dredging operations and an assumption that dredging efforts were relatively similar among years (US Army Corps of Engineers Sea Turtle Data Warehouse 2006). As can be deduced from the US Army Corps of Engineers Sea Turtle Data Warehouse (2013) data, the rate of sturgeon entrainment by mechanical dredging appears to be substantively less than entrainment associated with hopper dredging.

COSEWIC (2012) does not identify dredging as a threat to sturgeon in terms of mortalities induced by the act of dredging. In this regard, and in consideration of US Army Corps of Engineers Sea Turtle Data Warehouse (2013) data and the scale and scope of dredging, it is unlikely that dredging would result in the death of white sturgeon. As such, potential of serious harm to white sturgeon is low.

Residual Impacts

The maximum design impact on the river bottom attributable to the diffuser manifold is 4100 m^2. This is largely attributable to the conversion of surficial substrates from sand to large riprap. It is anticipated that the maximum design impact will not be realized as sand will be deposited upon and bury some of the riprap associated with the manifold.

Dredging beyond the design footprint of the diffuser manifold is mitigated by the restoration of the affected river bed, outside of the design impact of the outfall, to the pre-impact condition (sediment and elevation). Temporary disturbance of sediments would be further mitigated by the annual deposition of sediments associated with freshet. As such, the duration of temporary disturbance of sediments will be less than one year.

References

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012b. COSEWIC assessment and status report on the White Sturgeon *Acipenser transmontanus* in Canada. Ottawa, ON. xxvii + 75p. Available: http://www.sararegistry.gc.ca/default.asp?lang=En&n=B2E66909-1 (02/15/2017).

ECORP Consulting, Inc. 2009. Literature Review (for studies conducted prior to 2008): Fish Behaviour in Response to Dredging and Dredged Material Placement Activities (Contract No.W912P7-07-0079). Prepared for: US Army Corps of Engineers, San Francisco, CA. 48p + tables.

Fisheries and Oceans Canada. 2017. British Columbia Marine/Estuarine Timing Windows for the Protection of Fish and Fish Habitat – South Coast and Lower Fraser Areas. http://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/bc-s-eng.html#area-28 (05/12/2017).

Fisheries and Oceans Canada. 2014. Recovery Strategy for White Sturgeon (*Acipenser transmontanus*) in Canada [Final]. In Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. 252p.

US Army Corps of Engineers Sea Turtle Data Warehouse. 2006. http://el.usace.army.army.mil/seaturtles/takes.cfm?Type=Cubic. Cited in: Atlantic Sturgeon Status Review Team: Status Review of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007. Gloucester, MA. 174p.

US Army Corps of Engineers Sea Turtle Data Warehouse. 2013. http://el.erdc.usace.army.mil/seaturtles. Cited in: Reine, K., D. Clarke, M.Balzik, S. O'Haire, C. Dickerson, C. Frederickson, G. Garman, C. Hager, A. Spells, and C. Turner. 2014. Assessing Impacts of Navigation Dredging on Atlantic Sturgeon (*Acipenser oxyrinchus*). ERDC/EL TR-14-12. US Army Corps of Engineers, Environmental Laboratory. Vicksburg, MS. 40p.

Water and Land Use Committee. 2006. Environmental Management Strategy for Dredging in the Fraser River Estuary. Fraser River Estuary Management Program, Burnaby, BC. 47p.

cdmsmith.com