

5.0 PROJECT DESCRIPTION

5.1 PROJECT SITE INFORMATION

5.1.1 *EXISTING DISRAELI FREEWAY*

The Disraeli Freeway was completed in 1960 to connect downtown Winnipeg and the northeast area of the city. The freeway is a vital transportation corridor that consists of level roads, an overpass crossing the Canadian Pacific Railway Limited (CPR) mainline, and a bridge over the Red River. After 50 years, the river bridge has reached the end of its service life and requires replacement.

The Project includes the construction and operation of a new river bridge. The existing river bridge is 319 m long by 19 m wide, including 1.8 m wide sidewalks on both sides, and crosses the Red River as well as Gladstone Street, Rover Avenue, and Midwinter Avenue. The 10 bridge spans are supported on five upland piers on the west bank, three river piers, and three upland piers on the east bank. The navigation channel at the existing river bridge is located in the middle of the river channel between the two central piers.

5.1.2 *HISTORIC CONTAMINATION*

The neighbourhoods surrounding the Disraeli Bridges Project have a history of mixed land use, combining both light and heavy manufacturing with residential areas. In particular, the Point Douglas South neighbourhood has a history of industrial activities and includes several known or suspect contaminated properties (Dillon 2009).

5.1.2.1 *BACKGROUND*

A former Manufactured Gas Plant (MGP) was operated at 35 - 38 Sutherland Avenue, immediately to the east and upstream of the existing Disraeli Bridge (Figure 1.1). The MGP operated from 1883 to 1957 providing manufactured gas for street lighting, cooking, and heating to customers within a 25 km radius of the plant. Major by-products of the MGP operations included coke, tar, sulphur, ammonia, tar liquors, clinkers, ash, fixed cyanide, oil sludge, and gas condensates. Products that were produced in insufficient quantities to be sold or had limited market value were likely disposed of locally. Effluent water from the plant was ultimately discharged into the Red River.

Following cessation of the MGP operation in 1957, the first phase of site decommissioning occurred during 1959 and 1960 and includes demolition of a large portion of the MPG facilities and infrastructure. In 1969, the final decommissioning phase occurred with demolition of remaining structures and foundations. The site was eventually redeveloped with Centra Gas Manitoba Inc. as the occupant. In 1999, Manitoba Hydro acquired Centra Gas Manitoba.

5.1.2.2 *INVESTIGATIONS*

During a building upgrade in 1994, contaminated soil was encountered on the site. Investigations, beginning in the same year, eventually delineated an area of soil and groundwater contamination around the former MGP facilities and in the adjacent Red River sediments (Figure 5.1). The Sutherland site and surrounding area (contaminated soil and sediment in the riverbank and river) has since been designated as contaminated under the Manitoba *Contaminated Sites Remediation Act*. There have been extensive investigations of the soil, groundwater, and riverbed sediments at the former MGP from 1994 to present, including:

- Phase I & II Environmental Site Assessments – CH2M Hill, 1994 & 1995;
- Phase IIB: Off-site Soil Gas Survey – CH2M Hill, 1995;
- Phase IIB: Biological Impact Assessment – CH2M Hill and Agassiz North Associates Ltd., 1996;
- Surficial Sediment Plume Studies – Agassiz North Associates Ltd., 1997-2000;
- Closure Report – AMEC Earth and Environmental Ltd., 2000;
- ESA: Red River Bank adjacent to the former Sutherland Ave. MGP – Morrow Environmental Consultants, 2001;
- Assessment of Contaminant Risks to Aquatic Life - North South Consultants, 2003;
- Supplemental Environmental Site Investigation - UMA Engineering Ltd., 2003;
- Toxicity Test of Groundwater Entering the Red River - UMA, 2005 & 2007;
- Comprehensive Environmental Management Plan - UMA, 2006 & 2008;
- Remedial Monitoring Program: River Sediment and Surface Water Monitoring – UMA, 2007; and
- Preliminary Assessment of PAH Bioavailability and Toxicity in Sediments – ENSR, 2007.

The investigations identified polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene and xylenes (BTEX), total volatile hydrocarbons (TVH) and total extractable hydrocarbons (TEH) at concentrations exceeding the relevant Canadian Council of Ministers of the Environment (CCME) guidelines for soil, groundwater and sediment. The most significant impacts appear to be concentrated at the south end of the former MGP site; the west side of the north parking lot of the former MGP site; along the riverbank between Rover Avenue and the river and immediately east and west of the Disraeli Bridge; and within the river channel from the former MGP site to approximately 500 m downstream (Figure 5.1).



FIGURE 5.1
DISRAELI BRIDGES PROJECT
SUTHERLAND FORMER MANUFACTURED GAS PLANT
EXTENT OF SOIL AND SEDIMENT CONTAMINATION

5.1.2.3

COMPREHENSIVE ENVIRONMENTAL MANAGEMENT PLAN

UMA Engineering Ltd. (UMA) was retained by Manitoba Hydro to develop a Comprehensive Environmental Management Plan (CEMP) for dealing with residual contaminants associated with the operations of the former MGP (UMA 2006). Based on UMA's assessment of the site conditions and evaluation of human health and environmental risks, it was concluded that:

- There is no unacceptable risk to human health;
- There is not a significant source of contaminants beneath the former MGP site, nor is there a significant source of offsite contaminant migration; and
- The ecological health of the riverine environment adjacent to the former MGP site compares well to the rest of the urban Red River.

As such, a monitoring strategy was proposed as the management plan. The proposed monitoring strategy considered both human health and the physical environment. The monitoring program included:

- Monitoring of subsurface vapour concentrations along the east and west boundaries of the former MGP site, as well as selected on-site locations
- Annual monitoring of the spatial extent and concentrations of PAHs in the riverbed sediment to confirm the lateral extent of the contaminant plume;
- The monitoring is to include sampling of the upper 10 cm to 30 cm of sediment for analysis of PAHs;
- Monitoring of the benthic community is proposed to be conducted every five years;
- Annual monitoring of the groundwater wells for PAHs. Monitoring will also include measurements of depth to water, depth free phase product (if any), and combustible vapours; and
- Annual reporting to document the results of the monitoring program in comparison to the original site characterization.

The CEMP is currently under consideration by the Technical Advisory Committee (TAC) established by Manitoba Conservation. It is expected that final comments on the TAC review will be compiled and provided to Manitoba Hydro in the coming months and that a final decision on the proposed CEMP will be made by the end of 2010.

5.1.3

LAND OWNERSHIP AND LAND USE DESIGNATION

The Project components will be on property owned by the City and compatible with all permitted land use and zoning restrictions in the study area.

5.2 RIVER BRIDGE PROJECT COMPONENTS

The proposed Disraeli Bridges Project is a multiphase Project that is comprised of the construction of a new bridge over the Red River.

5.2.1 OVERVIEW AND SCOPE

A new river bridge crossing the Red River will be constructed west (downstream) of and immediately adjacent to the existing river bridge (Figure 5.2). The new river bridge will be of similar height and length but with fewer piers than the existing river bridge. As well, the vehicle traffic lanes will be wider than the existing lanes to improve safety for vehicles. The new river bridge will be 382 m long by 20 m wide, including a 1.8 m wide sidewalk on the east side, and will span over Rover and Midwinter avenues. The nine bridge spans will be supported on eight piers, three upland piers on the west bank, three river piers, and two upland piers on the east bank, and two abutments (Figure 5.2). Rock armouring will be placed around the main river piers to provide stability and reduce the potential effects of scour. The new river bridge is designed to accommodate future expansion to six lanes within the right-of-way.

Temporary rock work bridges will be required to install the river piers and lift structural steel into place (Figure 5.2). Work bridge installation will begin during the annual Red River water level reduction in October 2011 and removed before spring freshet the following year (April). The work bridges will be installed by pushing large diameter clean limestone rock out from the opposing banks to create a work platform approximately one metre above the river ice surrounding the central river piers. A channel will be left open between the work bridges to carry the river flows. Channel capacity has been designed to accommodate the potential for winter flooding (Appendix D). The work bridges will be removed immediately following the erection of the structural steel.

An analysis of the east bank of the Red River in the vicinity of the bridge indicates that the bank has failed and does not meet the current accepted City standard for short-term and long-term safety factors for slope stability in its existing configuration. There are pre-existing slope failures that cut through Midwinter Avenue just to the east of the existing river bridge that confirm the analysis. The proposed river bridge works have provided an opportunity to conduct the stabilization works without disruption to traffic on the Disraeli Freeway while realizing environmental and economic efficiencies. Similar works were undertaken by the City in 2005 at the Elwood Cemetery located at 88 Hespeler Avenue, west of the existing river bridge. The works will be conducted in three phases and consist of installing approximately 103 (2.1 m dia) compacted rock columns mid-bank to provide the required slope stability to ensure long-term protection to the river bank (Figure 5.2).

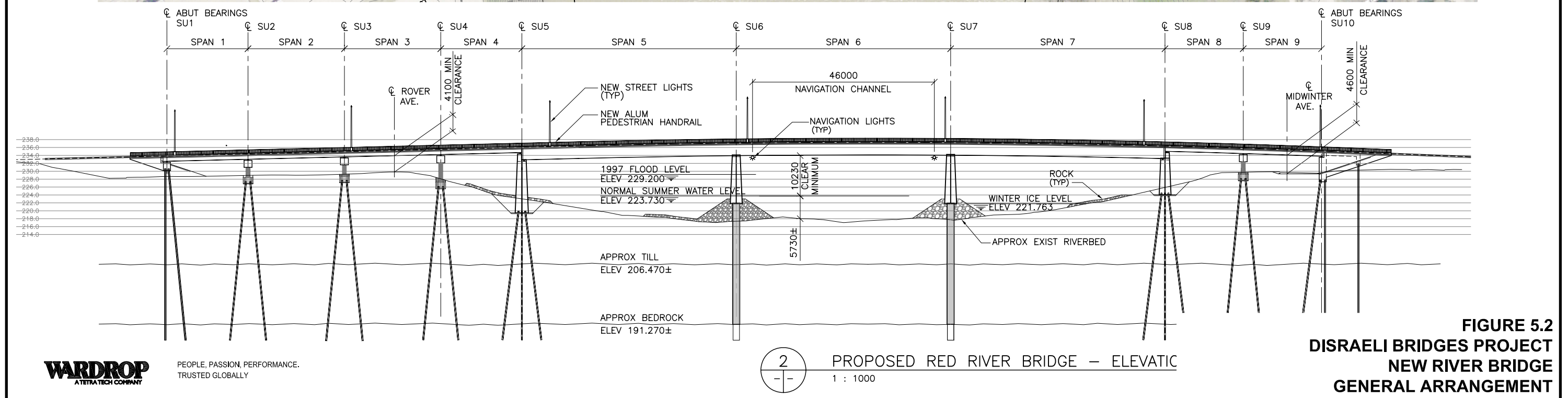
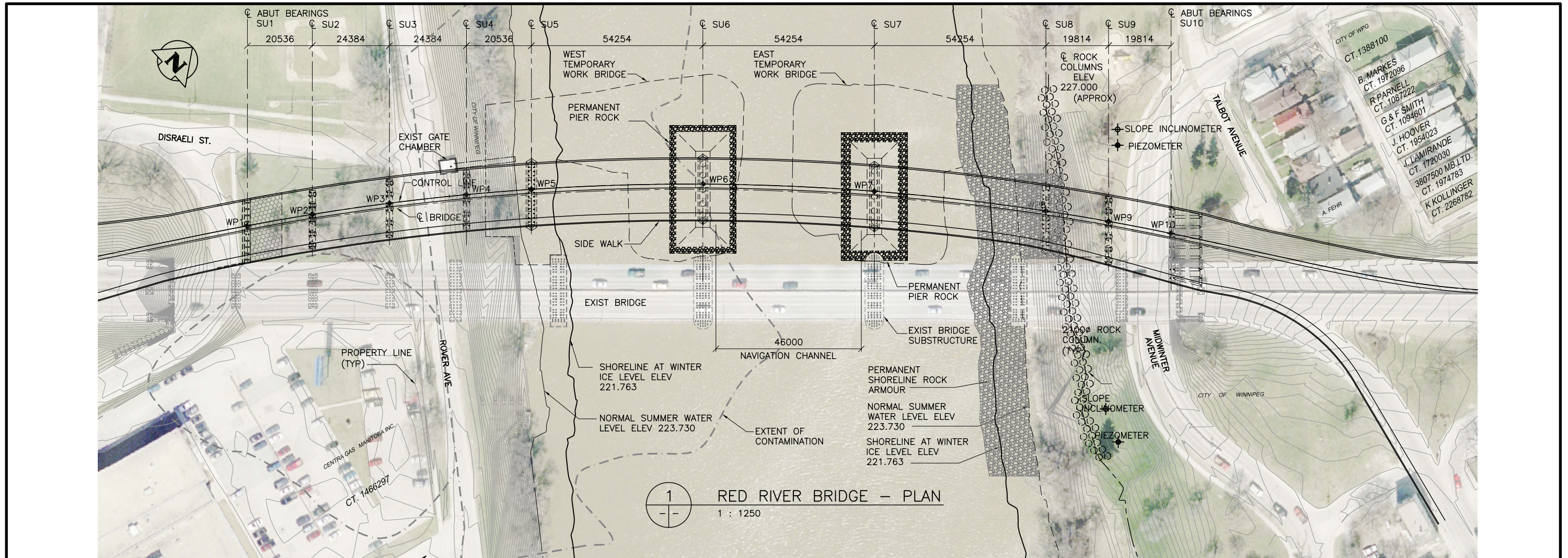


FIGURE 5.2
DISRAELI BRIDGES PROJECT
NEW RIVER BRIDGE
GENERAL ARRANGEMENT

5.2.2 *STANDARDS AND SPECIFICATIONS*

The design for the new river bridge will be 62.5 tonnes as per the CHBDC and have a lifespan of 75 years.

5.2.3 *GEOTECHNICAL CONSIDERATIONS*

Geotechnical design for the new river bridge is based on recommendations and information in the following documents:

- Blatz, J. 2009. Direct shear and hydraulic conductivity testing. Prepared by the Department of Civil Engineering Geotechnical Group, University of Manitoba for Wardrop Engineering Inc., July, 2009;
- Dyregrov. 2009b. Disraeli Freeway Reconstruction River Approach Spans, Foundations. Letter report prepared by Dyregrov Consultants for Wardrop Engineering Inc., April, 2009;
- Dyregrov. 2009c. Disraeli Bridge River Crossing Bedrock Exploration. Letter report prepared by Dyregrov Consultants for Wardrop Engineering Inc., March, 2009;
- Earth Tech AECOM and Dillon. 2008. 2008 Preliminary Design Report: Disraeli Bridges Rehabilitation. Prepared by Earth Tech AECOM and Dillon Consulting Engineers for the City, December, 2008;
- Klohn Leonoff. 1975. Riverbank stability at Midwinter Avenue. Prepared by Klohn Leonoff Consultants Ltd. for the City, November, 1975; and
- Trek Geotechnical. 2010. Disraeli Bridge Reconstruction: Phase I Riverbank Stabilization Works – Riverbank Stability Report. Prepared by Trek Geotechnical Inc. for Wardrop Engineering Inc., February, 2010.

5.2.4 *NAVIGATIONAL CLEARANCES*

The new river bridge will exceed the vertical navigation channel clearances of the existing bridges immediately upstream and downstream of the Project site (Louise Bridge and Redwood Bridge, respectively; Table 5.1). The vertical clearance from the bottom of the bridge deck at mid-span to the NSWL of 223.73 m will be 10.23 m and 4.76 m at the high water elevation of 229.20 m (1997 flood level). The two central river piers will be in-line with the existing bridge piers, therefore there will be no reduction in the existing navigation channel width. There will be no interruption or impingement on the navigation channel during bridge construction as all in-channel works will be conducted during the winter months, outside of the navigation season (15 May to 15 October). Navigation lights will be placed under the deck of the bridge on the east and west side of the navigation channel.

Table 5.1 Vertical navigation clearances of the proposed and existing Disraeli Bridges as well as the bridges immediately upstream and downstream of the Project site

Bridge	NSWL Elevation (m)	Elevation of Low Point on Structure in Navigation Channel (m)	Clearance (m)
Proposed River Bridge	223.73	233.96	10.23
Existing Disraeli Bridge	223.73	234.72	10.99
Louise Bridge (570 m upstream)	223.73	230.37	6.64
Redwood Bridge (595 m downstream)	223.73	230.34	6.61

5.2.5 *CONTAMINATED SOIL AND SEDIMENT*

Contaminated soils and sediment are expected to be encountered on the west approach, west bank, and in the adjacent river channel (Figure 5.1). Preventative measures have been included in the design and construction of the new river bridge. A remedial action plan (RAP) has been prepared to address any contaminated soils encountered within the Project area. The provincial EIS and subsequent Manitoba Environment Act License will address contaminated sediments encountered during the in-water works. The purpose of the RAP and relevant sections of the Environment Act License are only to address contaminated soil and sediment that may be excavated during the Project works and not to remediate any contaminated soil or sediment beyond the excavation limits. Mitigation measures are described in more detail below.

5.2.6 *MISCELLANEOUS UTILITY WORKS*

Conduits for affected utilities will be accommodated on the new river bridge. Conduits (125 mm dia) will be suspended beneath the deck soffit. In total, 22 conduits will be provided: 16 for Manitoba Hydro and six for Manitoba Telecom Systems (MTS). Separate 50 mm diameter conduits will be run in the exterior barriers for any street and pedestrian lighting. Any under bridge, pier, and navigation lighting will be serviced from conduits embedded in the bridge deck. The Manitoba Hydro and Manitoba Telecom Services physical plants on the existing river bridge will be relocated to the new river bridge during the construction.

5.2.7 *DRAINAGE*

Drainage from the bridge will continue to be handled through the existing drainage system. Sedimentation and erosion control and other waterway protective measures will be implemented during construction.

5.2.8 AESTHETICS

The Disraeli Bridges Project has been designed to complement the City's vision of Winnipeg as a vibrant and healthy city. Aesthetic improvements include:

- Gateways and public art features will enhance the Project and entryways to adjacent communities.
- Lighting and attractive banners will run the length of the new river bridge.
- While separate structures, the vehicular and AT bridges will be architecturally and aesthetically harmonious.
- Landscaping at the Elmwood landing and the Point Douglas landing

5.2.9 LANDSCAPING

Attractive landscaping forms an integral part of the Disraeli Bridges Project at four locations: the Elmwood and Point Douglas landings. Landscaping treatments will:

- Create a more residential feel for adjoining neighbourhoods and a convenient park-like haven for residents, pedestrians and cyclists.
- Enhance the safety of those using these areas by providing well lit and open spaces.
- Buffer the sight and sound of the Freeway.
- Improve the aesthetic appeal of the green spaces with trees, shrubs, grass, attractive benches and other furnishings.
- Ensure more plantings and green space will be visible for those crossing the new river bridge by car, bicycle or on foot.

5.3 CONSTRUCTION ACTIVITIES

5.3.1 PRECONSTRUCTION ACTIVITIES

Preconstruction activities include all the activities leading up to the main on-site construction works.

5.3.1.1 UTILITIES AND SERVICE PROVIDERS

There are numerous utilities and services along or in close proximity to the right-of-way of the Project. PRW has initiated proper and ongoing coordination and communication with all affected parties prior to construction.

Affected utilities and service providers include:

- Manitoba Hydro:
 - natural gas
 - power distribution
- MTS (telephone)
- Shaw (cable TV)
- The City:
 - Waste and Water Department
 - Waterways Branch
 - Transit
 - Traffic signals

PRW's continuing Project site evaluation includes:

- Obtaining underground service plans of existing services for potentially affected areas from utilities/service providers or relevant public registries.
- Obtaining information, design, and construction requirements from utility and service providers.
- Confirming alignments as required.
- Identifying crossing locations and potential impacts to both the Project and the utility/service (if any).
- Developing options to avoid, manage, and mitigate potential conflicts.
- Evaluating options with affected utilities and service providers, selecting and finalizing the preferred approaches (e.g. protection, relocation, avoidance), and incorporating feedback from the applicable utilities and service providers.
- Preparing and submitting plans to responsible utility or service authority for final review and signoff.

5.3.1.2 *SITE SURVEYS*

Initial site surveys were conducted during the preliminary Project design. More detailed surveys will be conducted as the start date approaches.

5.3.1.3 *STAGING*

The activities which will occur prior to work beginning are:

- Temporary power installations will be setup at each end of the bridge;

- Temporary river access roads will be constructed to access the river channel during winter construction works;
- Construction offices and lunchrooms will be placed at each end of the bridge;
- Chain-link fence enclosures will be installed around building components to exclude public; and
- Mobile sanitation facilities will be located at each end of the bridge.

5.3.2 *BRIDGE CONSTRUCTION*

The new river bridge works will be comprised of upland works and in-water works. The upland works will be comprised of the construction of approaches and abutments, construction of land-based piers, and installation of bridge superstructure (Figure 5.2). The in-water works will consist of construction and removal of temporary rock work bridges, construction of river piers, and installation of bridge superstructure (Figure 5.2). Concurrent works will be undertaken to stabilize the failed east bank of the river.

Upland works and two river piers will be installed within the zone of contamination associated with the Sutherland former MGP (Figure 5.2). Mitigation measures have been incorporated into the works planned within the zone of contamination and are described within the appropriate sections below. Handling of potentially contaminated materials encountered at the upland work sites is described in Appendix E.

The new river bridge will be constructed along the following sequence:

- Construction of abutments and land-based piers;
- Construction of river pier SU5;
- Installation of temporary work bridges;
- Construction of river piers SU6 and SU7;
- Installation of structural steel;
- Recovery of temporary work bridges;
- Pour and form bridge deck;
- Bridge finishing; and
- Transfer traffic from existing river bridge to the new river bridge.

5.3.2.1 *ABUTMENTS AND LAND PIERS*

The west abutment of the new river bridge will consist of a reinforced concrete bearing seat that is supported on precast concrete piles driven to refusal in the underlying dense glacial till. Due to the large fill and proximity to Midwinter Avenue, the east abutment will be a box style constructed out of reinforced concrete. This will off-load the

riverbank and provide better stability to the slope. Steel H-piles will be driven to refusal in the underlying bedrock to provide the necessary support.

The land piers will be bents style and constructed from reinforced concrete. The foundations will be comprised of steel H-piles driven to refusal in the underlying bedrock. Circular pile caps will be utilized to minimize the amount of excavation and disturbance in the upland contamination zones. Handling and treatment/disposal protocols have been developed for the contaminated excavated soil are under review by Manitoba Conservation (Appendix E).

5.3.2.2 *PIER SU5 CONSTRUCTION*

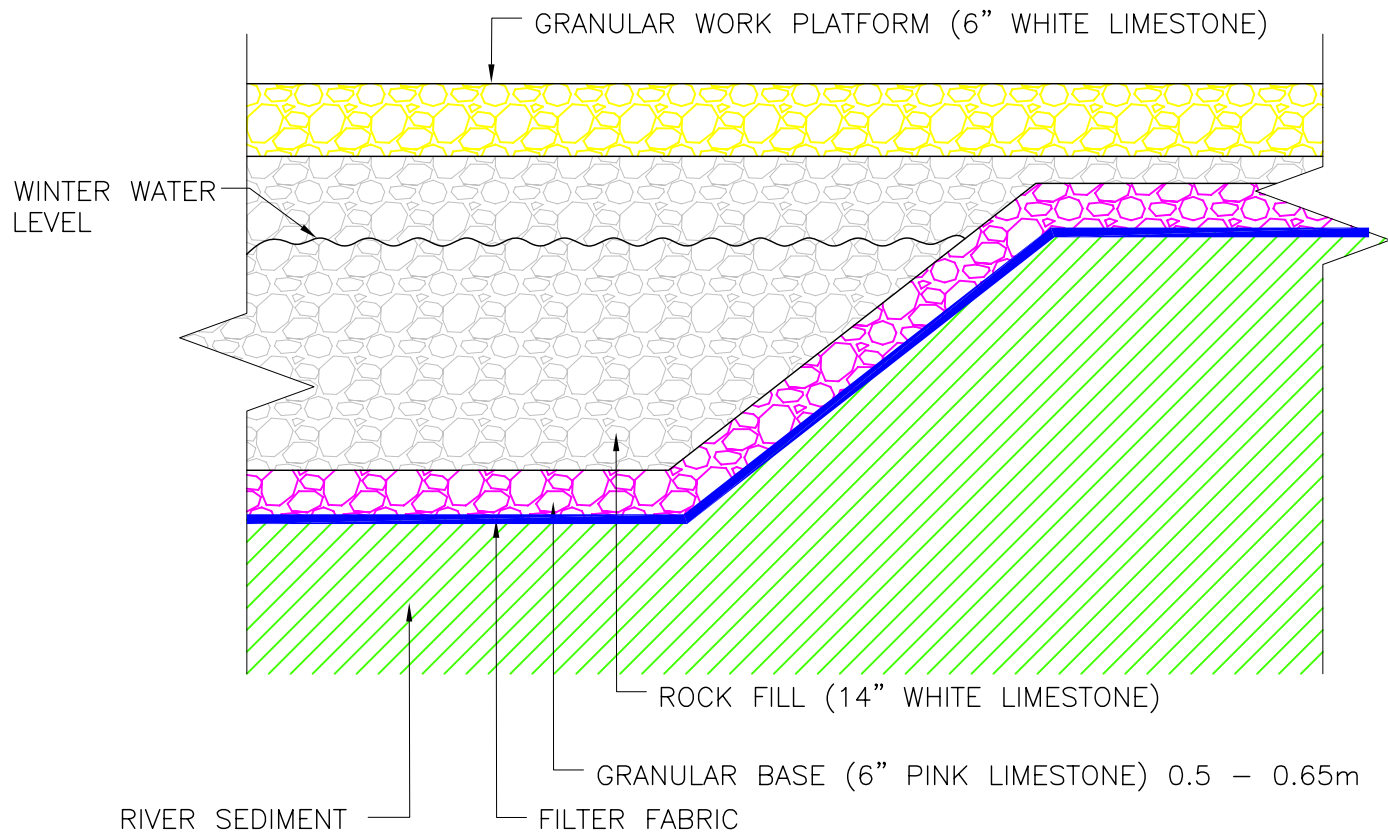
The proposed pier SU5 location lies between the NSWL and the winter ice surface level. A ramp and work pad will be installed on the west bank of the river to access the work site. Sheet piling will be temporarily installed to isolate the pier footprint. Five steel H-piles will be driven into the bedrock in an offset pattern to form the pier foundations. A steel reinforced concrete pier will then be formed on top of the H-piles. Rock armouring will be placed around the completed pier base.

5.3.2.3 *TEMPORARY WORK BRIDGES*

Temporary rock work bridges will be required to provide a platform for pier construction and as a foundation for the cranes erecting structural steel onto the piers (Figure 5.2). The work bridges will be constructed into the Red River channel from the west and east banks to access the work sites for piers SU6 and SU7, respectively. A central channel will be left open between the work bridges with sufficient capacity to maintain Red River flows. Construction of the work bridge ramps will follow the declining water levels as the curtains are raised at the St. Andrews lock and dam on 14 October, 2011. Only clean, non-acid generating rock will be used in the work bridges. A slot within the work bridge outline will be left open and clear of material through which the riverbed will be assessed and the pier footings installed.

The east work bridge will be constructed by placing a 0.65 m layer of 150 mm base rock directly on the river bottom using a backhoe to minimize the risk of sediment resuspension. Once a band of base rock has been placed, a layer of 350 mm rock fill will be placed on top of the base rock. A layer of 150 mm rock will then be placed on the rock fill to provide a smooth working surface. This process will be repeated until the work bridge is completed. The working surface of the work bridges will be 1 m above the ice surface (Figure 5.3). Once the structural steel has been lifted onto the piers, the work bridges will be removed. Work bridge recovery will be completed by 31 March, 2012.

The west work bridge will be constructed and recovered following the sequence and methods used on for the east work bridge. However, because of the presence of contaminated sediments along the west bank and within the river channel, additional mitigation measures will be used to minimize disturbance to the sediments. A geotextile will be placed on the riverbed prior to the placement of the base rock layer (Figure 5.3). The intent of the geotextile will be to stabilize the riverbed surface and minimize sediment disturbance during construction. Different colour limestone will be used for the base and fill layers. The difference in colour will provide an additional guide to the equipment operator in order to avoid cutting into the filter fabric and underlying sediments during work bridge recovery. The work bridge base layer and filter fabric will be left in place on the riverbed. The edges of the permanent base layer will be contoured to present a hydrodynamic profile and to mitigate current vortices and scour. During work bridge installation, it is expected there will be some sediment consolidation beneath the rock work bridge. The base layer is not anticipated to extend beyond 0.4 m above the surrounding riverbed following work bridge recovery.



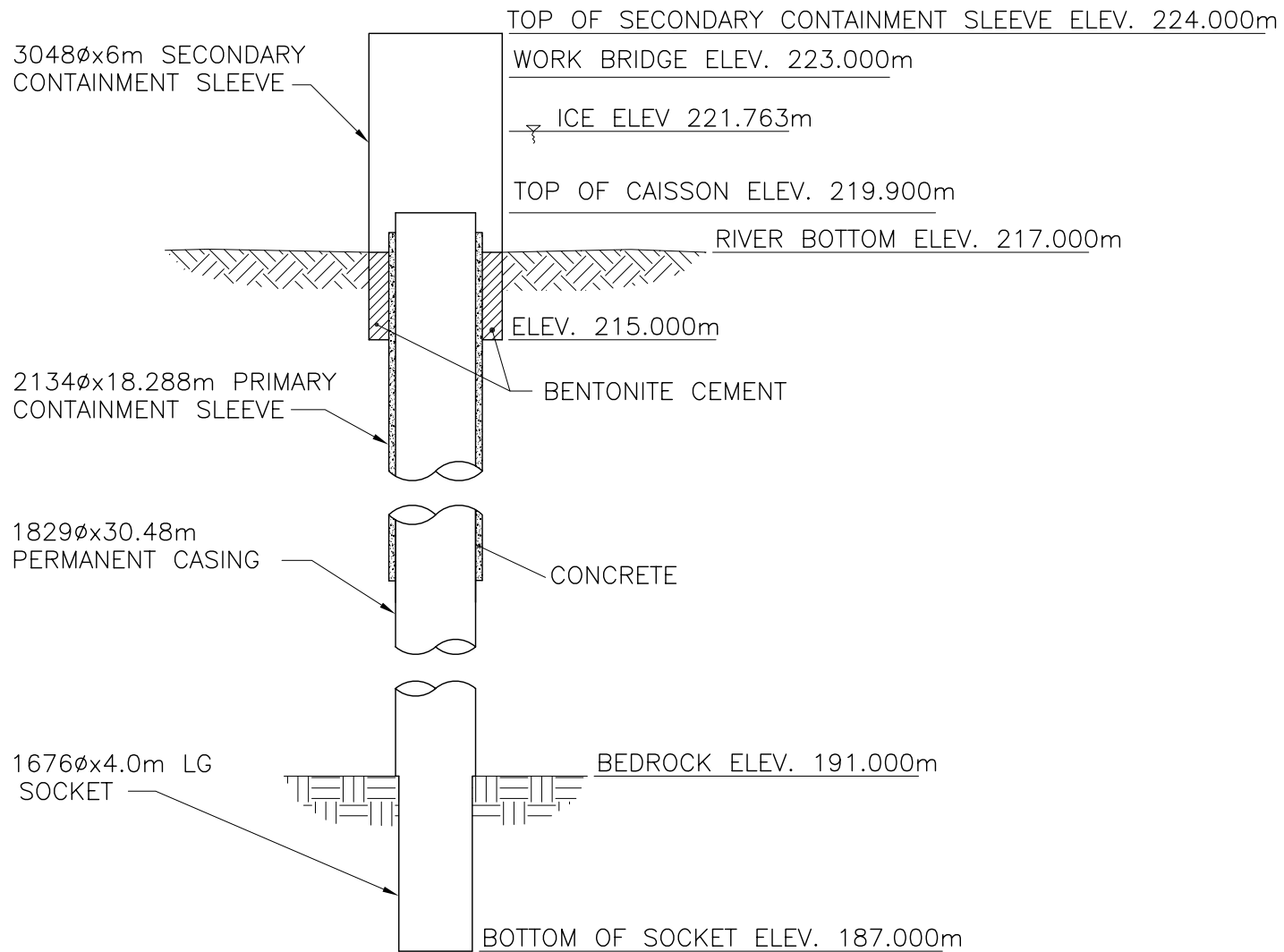
1. INSTALL FILTER FABRIC ON TOP OF RIVER BED
2. INSTALL LAYER OF GRANULAR BASE (6" PINK LIMESTONE)
3. INSTALL ROCKFILL (14" WHITE LIMESTONE)
4. INSTALL GRANULAR WORK PLATFORM (6" WHITE LIMESTONE)
5. CONSTRUCTION WORK IS PERFORMED WHILE PLATFORM IS IN PLACE
6. REMOVE GRANULAR WORK PLATFORM AND ROCK FILL
7. LEAVE GRANULAR BASE (6" PINK LIMESTONE) AND FILTER FABRIC ON RIVER SEDIMENT

5.3.2.4 PIERS SU6 AND SU7 CONSTRUCTION

The central river piers will each be supported on five caissons that will extend into the underlying bedrock. Construction will begin once the temporary work bridges are in place. Construction methods will be the same for both piers. Pier SU6, however, will be constructed through potentially contaminated sediment therefore the spoils and water encountered during construction will be treated as contaminated material. Handling and treatment/disposal protocols have been developed for the contaminated sediments and water and are presented in section 5.3.3 (Caisson Remedial Action Plan) below.

The construction of each caisson will commence with the setting of a 3 m diameter steel secondary containment sleeve (secondary sleeve) on the bottom of the river (Figure 5.4). The sleeve will be positioned from the rock work bridge and pushed through the sediment to a depth of approximately 2 m below the riverbed surface. Potentially contaminated sediments within the sleeve will be excavated to the bottom elevation of the can. The volume of sediment to be excavated from within each sleeve is estimated to be 14 m³. Water inside the can will be maintained at the same level as the river to minimize the potential for river water to seep into the can. During excavation, water from the sediments in each grab will be allowed to drain into the can before the grab is placed in a water-tight spoils bucket. Once filled, the spoils bucket will be transferred to shore where the sediment will be inspected and assessed for disposal. Contaminated sediments will be segregated, securely stored, and transferred to the MidCanada Environmental Services treatment facility in Ile des Chenes, Manitoba for disposal.

Upon completion of excavation of the sediments from within the secondary sleeve, a bentonite cement mixture will be placed on the bottom using the tremie method. The tremie method involves placing a pipe at the base of the work space, injecting the bentonite cement mixture, and filling the space from the bottom upwards. By maintaining the injection pipe end submerged in the bentonite cement mixture, water in the can is displaced while the bentonite cement mixture is not diluted. The base of the secondary sleeve will be covered, forming a plug 2 m thick and level with the riverbed surface (Figure 5.4). Once the bentonite cement has cured, the water inside the secondary sleeve will be removed, assessed, and treated, if necessary. The appropriate disposal method will be determined following the receipt of analytical results. Caisson drilling will proceed through the bentonite cement plug in the bottom of the secondary sleeve. A permanent 2.1 m diameter steel primary containment sleeve (primary sleeve) will be advanced during drilling (Figure 5.4). The primary sleeve will extend to the top of the till at approximately 17 m below the riverbed surface. The purpose of the primary containment will be to mitigate the possibility of contaminant migration along the caissons during installation. Inside the primary sleeve, a permanent 1.8 m diameter casing will be extended to and socketed into the bedrock at approximately 30 m below the river bottom (Figure 5.4).



N.T.S

The space between the primary sleeve and the permanent caisson casing will then be filled with concrete. Concrete for the caisson will be placed using the tremie method. The secondary sleeve will then be filled with crushed limestone and removed. This process will be repeated for each caisson for each pier. Once all caissons have been installed, a steel-reinforced concrete pier will then be poured around the tops of the caissons to form the final pier. A protective rock apron will be contoured around the piers during the recovery of the work bridges.

All spoils from the caisson drilling will be transferred to shore where the soil will be inspected and assessed for disposal. Groundwater is expected to rise in the caisson during installation but will be contained within the secondary containment. Based on the geotechnical investigations at site, the groundwater level inside the secondary containment sleeve is not expected to rise above the river water level. Groundwater displaced by the tremied concrete will be assessed, treated to remove suspended solids, and then discharged to the river.

The construction of the caissons for pier SU7 will be similar to that of pier SU6; however, investigations to date have not indicated that the sediments are impacted at the east pier location. Thus, the sediments and water will not require special handling or disposal.

5.3.2.5 *SUPERSTRUCTURE*

Once the river piers have been installed, the structural steel will be lifted onto the piers using cranes stationed on the temporary work bridges. Deck construction will be conducted on top of the structural steel and will not require the work bridges.

5.3.3 *CONTAMINATED SOIL AND SEDIMENT*

Any contaminated soil or sediment excavated during the Project works will be contained, assessed, and disposed. UMA (2006) provided a detailed map of the degree, extent, and type of contaminants in the soils and sediments within the Project area.

5.3.3.1 *SOIL REMEDIAL ACTION PLAN*

A Remedial Action Plan (RAP) has been prepared to address the contaminated upland soils encountered within the Project area (Appendix E). The purpose of the RAP is only to address contaminated soil that may be excavated during the Project works and not to remediate any contaminated soil beyond the excavation limits. The remedial action consists of the following:

- Excavation of potentially contaminated soil at the five upland pier locations (SU1 – SU5) and the abutment adjacent to Disraeli Street and Rover Avenue;

- Offsite disposal of contaminated soils with concentrations exceeding the applicable Canadian Council of Ministers of the Environment (CCME) guidelines; and
- Backfilling around the substructures with compacted, clean excavated material and/or imported clean backfill.

5.3.3.2 *SEDIMENT REMEDIAL ACTION PLAN*

Project Description

The Disraeli Bridges Project includes the construction of a new river bridge adjacent to and west of the existing bridge over the Red River. The bridge will include two central river piers; SU6 and SU7. Each pier will be supported on five caissons that extend to the underlying bedrock. Pier SU6 will be constructed in the proximity of the potentially contaminated river sediments. The caisson construction for piers SU6 and SU7 will be similar however the methodology for SU6 will minimize the disturbance of the potentially contaminated sediments and provide for the handling and disposal of sediments and water.

Site Investigations

In February and March 2010, AECOM conducted a sediment sampling program as part of Manitoba Hydro's 2009/2010 Sutherland Environmental Management Plan. The sampling program included the mechanical advancement of a borehole to a depth of approximately 1.8 m below the river bottom adjacent to the proposed location of pier SU6. Further characterization of the sediments at each caisson location will be conducted by Wardrop in the fall of 2010.

Overview of Contaminated Sediment

The results of the investigation conducted by AECOM in February and March 2010 in the area of the proposed pier SU6 can be summarized as follows:

- The sample collected from borehole TH10-02 at 0 m to 0.10 m below grade exhibited an acenaphthene concentration of 0.127 mg/kg.
- The sample collected from borehole TH10-02 at 6.9 m to 7.3 m below the river ice (i.e., approximately 1.1 m to 1.5 m below the river bottom) exhibited a benzene concentration of 1.19 mg/kg and PAHs including a naphthalene concentration of 25.2 mg/kg and a benzo(a)pyrene concentration of 0.936 mg/kg.
- Excerpts from the AECOM analytical tables are presented in Table 5.2.

Caisson Construction

The construction of each of the five caissons for pier SU6 will commence with the setting of a 3 m diameter steel sleeve on the bottom of the river as secondary containment (Figure 5.4). The sleeve will be positioned from the rock work bridge. The steel sleeve will be pushed through the contaminated sediments to a depth of approximately 2 m below the river bottom. Sediments within the secondary containment will be excavated to approximately the bottom of the steel sleeve. The volume of sediment to be excavated from within each steel sleeve is estimated to be 14 m³. During excavation, water from the sediments will be allowed to drain into the secondary containment sleeve. Water inside the secondary containment sleeve will be maintained at the same level as the water outside of the secondary containment to minimize the potential for river water to seep into the secondary containment sleeve. Once drained, the sediment will be transferred to shore in a water-tight spoils bucket. Based on field inspection and existing analytical results, the sediment will be assessed for disposal.

Excavated sediment assessed in the field to be contaminated (i.e. visual evidence of contaminants, noticeable odours, and/or existing analytical results) will be loaded directly onto trucks or into roll-off bins for offsite disposal. In the event that trucks are not immediately available, the sediments will be temporarily stored in roll-off bins or within a lined containment cell. The bin or containment cell will be covered with polyethylene sheeting until it is removed for offsite disposal. The bin or containment cell will be located within a fenced area accessible only to authorized personnel.

Table 5.2 Laboratory analytical results for sediment samples collected in February and March, 2010 at the proposed pier SU6 location for the Disraeli Bridges Project (data provided by AECOM)

Station	TH10-02			
	Sampling Date	03-Feb-10	03-Feb-10	24-Feb-10
Sample Depth (m)	0 - 0.1 ²	0.1 - 0.3 ²	6.3 - 6.9 ³	6.9 - 7.3 ³
% Sand Content	25	12	86	7
% Silt Content	30	42	5	45
% Clay Content	45	46	9	47
FOC	--	--	0.0021	0.0183
Total Organic Carbon	--	--	0.21	1.83
Benzene	--	--	<0.0050	1.19
Toluene	--	--	<0.010	0.016
Ethylbenzene	--	--	<0.010	1.18
Xylenes	--	--	<0.030	0.194
Naphthalene	<0.010	<0.010	0.04	25.2¹
2-Methyl Naphthalene	<0.010	<0.010	<0.010	1.15
1-Methyl Naphthalene	<0.010	<0.010	<0.010	1.08
Acenaphthylene	<0.010	<0.010	<0.010	0.068
Acenaphthene	0.127	<0.010	<0.010	0.353
Fluorene	0.02	<0.010	<0.010	0.631
Phenanthrene	0.045	<0.010	<0.010	1.34
Anthracene	0.025	<0.010	<0.010	0.677
Fluoranthene	0.063	<0.010	<0.010	1.42
Pyrene	0.065	<0.010	<0.010	0.867
Benzo(a)anthracene	0.058	<0.010	<0.010	0.878
Chrysene	0.033	<0.010	<0.010	0.666
Benzo(b&j)fluoranthene	0.029	<0.010	<0.010	0.973
Benzo(k)fluoranthene	0.011	<0.010	<0.010	0.581
Benzo(a)pyrene	0.029	<0.010	<0.010	0.936
Indeno(1,2,3-cd)pyrene	0.018	<0.010	<0.010	0.789
Dibenzo(a,h)anthracene	<0.010	<0.010	<0.010	0.122
Benzo(g,h,i)perylene	0.012	<0.010	<0.010	0.661
Quinoline	<0.050	<0.050	<0.050	<0.050
Acridine	<0.050	<0.050	<0.050	<0.050
Total PAH ₁₆	0.565	0.16	0.19	36.162

Notes:

CCME, Interim Sediment Quality Guidelines (PEL) for Freshwater, Update 2007.

All concentrations in mg/kg

BOLD indicates exceeded guideline value presented by AECOM

¹ - MDL adjusted for required dilution

² - depth below grade

³ - depth below top of river ice

All analytical results provided to Wardrop by AECOM

Upon completion of excavation of the sediments from within the secondary containment sleeve, a bentonite cement mixture will be placed on the bottom of the steel sleeve using the tremie method. The tremie method will allow the bentonite cement to be placed below the water level in the secondary containment sleeve to a depth approximately equivalent to the river bottom.

When the bentonite cement on the bottom of the secondary containment sleeve has cured, the water inside the can will be removed. Based on confirmatory analytical results, the appropriate disposal of the water will be assessed. If analyte concentrations are less than the guidelines for the protection aquatic life presented in Canadian Council of Ministers of the Environment (CCME) document entitled *Canadian Environmental Quality Guidelines* (CEQG) (2007), the water will be discharged to the river. In the event that analyte concentrations exceed the CCME CEQG (2007) guidelines, the water will be treated and analyzed prior to discharge to the river.

Drilling of the caisson will proceed through the bottom of the secondary containment. A permanent 2.1 m diameter steel containment sleeve will be advanced as primary containment during drilling (Figure 5.4). The containment sleeve will extend to the top of the till at approximately 17 m below the river bottom. A permanent 1.8 m diameter casing will be extended to, and be socketed into, the bedrock at approximately 30 m below the river bottom. The annulus between the containment sleeve and the casing will be filled with concrete.

Groundwater is expected to rise in the casing, but will not discharge directly into the river. The groundwater will be contained within the secondary containment sleeve. Saline groundwater is not expected to be encountered.

Concrete for the caisson will be placed using the tremie method. Groundwater in the casing and containment sleeves will be displaced as the concrete is poured. The water will be treated to remove suspended solids and then discharged to the river. The solids from the drilling process will be hauled from the site for disposal as fill material.

At the conclusion of the caisson construction, the 3 m diameter steel secondary containment sleeve will be filled with crushed limestone. The secondary containment sleeve will then be removed from the river and the caisson installation will be complete.

The construction of the caissons for pier SU7 will be similar to that of pier SU6 however investigations to date have not indicated presence of contaminated sediments at the pier SU7 location. Sediment and water at pier SU7 will therefore not require special handling or disposal.

Off-Site Disposal

Based on the results of the AECOM 2010 investigation, the excavated potentially contaminated sediments will be suitable for disposal at MidCanada Environmental Services treatment facility in Ill des Chenes, Manitoba. Disposal of the contaminated sediment at MidCanada will require approval from the Director of Manitoba Conservation.

Equipment Decontamination

Equipment that comes in contact with contaminated sediment will be decontaminated prior to that equipment leaving the site. Loose or visible sediment will be scraped or brushed off the equipment and contained. The equipment will then be pressured washed. The wash water will be collected on the site for subsequent disposal pending analytical results. Sediment and solids from the decontamination process will be disposed at the MidCanada facility.

5.3.4 SECURITY

Site security measures during construction will include:

- Site fencing, constructed of 1.8 m high chain-link fencing and installed by qualified installers, will enclose all areas of construction for the bridge.
- During construction hours, security will be provided by PCL or a subcontractor's workforce.
- Schedule and secure smaller, manageable, and specific areas of construction.
- Closed-circuit TV and/or drive by security for after hours and unattended site protection.
- Fall protection physical barriers that exist for worker protection will be maintained after hours.
- All temporary road access will be secured with temporary construction fencing or signage when not in use.
- Temporary snow fencing will be installed on the frozen river ice to secure work areas.

5.3.5 TRAFFIC MANAGEMENT

A Traffic Management Plan will be developed prior to the initiation of any works. The goal of the Traffic Management Plan will be to identify the best possible traffic diversion routes, optimize the safety and efficiency for traffic along the routes, and minimize the impact that construction activities may have on travelers, residents, businesses, emergency services and the environment.

5.3.5.1 ROAD CLOSURES

A minimum of four lanes of traffic will remain open on the existing river bridge at peak travel times (Monday to Friday 6 A.M to 6 P.M) throughout construction. Lane closures will be limited to off hour periods on a limited basis and will allow work to safely proceed for demolition, erection, and construction of overhead work, as well as for the transition and tie-in of the road works to the new river bridge.

5.3.5.2 VEHICLE TRAFFIC

Throughout the construction period, several transportation network elements may be revised to ensure safe and efficient passage to the travelling public during the construction period:

- Lane width reductions;
- Speed reductions; and
- Temporary access restrictions.

5.3.6 NAVIGATION MANAGEMENT

5.3.6.1 NAVIGATIONAL USES

The Red River is typically used for recreational purposes such as boating, canoeing, rowing and fishing. Some organized users include the:

1. Winnipeg Rowing Club
2. Redboine Boating Club
3. Royal Manitoba Yacht Club
4. Winnipeg Canoe and Kayak Center

Additionally, the river is used by commercial operations, including:

5. Paddle Wheel River Boats Ltd. (<http://www.paddlewheelcruises.com>). The paddlewheel boats provide sight-seeing tours and host special events. These are the largest vessels operating on the Red River and the tour route includes passing under the Disraeli Bridge. This company operates a fleet of two paddlewheel boats on the Red River.
 - a. M.S. Paddlewheel Queen:
 - i. 375 passenger;
 - ii. LxWxH = 42.67 m x 9.75 m x 6.4 m; and
 - iii. Draft = 1.22 m.

- b. M.S. Paddlewheel Princess:
 - i. 175 passenger;
 - ii. LxWxH = 24.38 m x 6.71 m x 6.4 m; and
 - iii. Draft = 1.22 m.

6. Splash Dash Water Bus Service (<http://www.splashdash.ca/>). This company operates several pontoon boats for tours of downtown Winnipeg as well as providing a taxi service along the Red and Assiniboine rivers. These boats are not typically operated near the Disraeli Bridge.

5.3.6.2 SAFETY MARKINGS

In-water works will be conducted outside of the navigation season. Some overhead works such as deck installation, finishing, and existing bridge superstructure demolition will occur during the navigation season. However, navigation will be maintained during construction, reconstruction, and operation of the bridges. Temporary navigation lights and markers will be installed to mark the navigation channel during construction. Lights and markers will be checked on a daily basis. Permanent navigation lights will be installed to mark the navigation channel during operation.

5.3.7 SAFETY

Safety is of the utmost importance to the City. The bridge has been designed and will be constructed and maintained in a manner that secures the safety of the travelling public, adjacent property owners and occupants. The City will also ensure that safe working conditions are maintained for all Project personnel.

5.3.7.1 SAFETY AUDIT PLAN

Safety audits will be performed at various stages of the Project to determine, from the perspective of the road user, the potential for the geometry and operation features to contribute to collisions. There will be three stages of audits, including: (i) prior to completion of Project drawings, (ii) after completion of Project drawings, and (iii) an extensive field review of the Project prior to opening for use by the public.

5.3.7.2 SIGNAGE

Signage regarding lane closures will be performed by qualified personnel to allow construction to proceed safely.

5.3.7.3 TRAFFIC SAFETY DURING CONSTRUCTION

Traffic barriers (temporary and permanent), if required, will be in accordance to standard City practices using concrete F-shape barriers. Aluminum traffic rails will be used on all the outside traffic barriers.

5.4 CONSTRUCTION SCHEDULE

The Project construction schedule is presented in Table 1.1. Works will begin 1 November, 2010, and will be completed by 19 October, 2012.

The construction schedule for the new river bridge upland works is presented in Table 5.3 and the in-channel works are presented in Table 5.4.

Table 5.3 Schedule for the new river bridge upland works

Start Date	End Date	Construction Activity
1 Nov, 2010	13 Jun, 2011	Site preparation/mobilization
6 Jan, 2011	3 May, 2011	Construct east land-based piers
4 Mar, 2011	20 May, 2011	Construct east abutment
4 Apr, 2011	4 Jul, 2011	Construct west land-based piers
4 Apr, 2011	6 Sep, 2012	Construct west abutment

Table 5.4 Construction schedule for the new river bridge in-channel works

Start Date	End Date	Construction Activity
15 Jun, 2011	31 Mar, 2012	Install and remove temporary access roads
29 Jun, 2011	27 Sep, 2011	Construct river pier SU5
1 Oct, 2011	31 Mar, 2012	Install and remove temporary work bridges
8 Nov, 2011	3 Feb, 2012	Construct river piers SU6 and SU7
6 Feb, 2012	14 Mar, 2012	Install structural steel
15 Mar, 2012	18 Oct, 2012	Install deck and finishing
	19 Oct, 2012	Traffic transferred to new river bridge

5.5 HEALTH, SAFETY AND ENVIRONMENT PLAN

The Health, Safety and Environment Plan (HSEP) is being developed concurrent with the design and construction planning. The HSEP will be based on the technical results of the EIS and permitting processes. The HSEP will also be dynamic and will evolve

throughout the construction period through continual updating to ensure the HSEP incorporates all environmental best practices.

The HSEP will:

- Set appropriate environmental objectives and targets.
- Develop and document the design and construction practices, procedures and/or policies to achieve the objectives and targets.
- Develop and implement environmental protection procedures within the environmental construction plans.
- Develop and implement contingency and emergency response plans for dealing with unplanned events.
- Develop and implement a compliance monitoring/auditing program to demonstrate that environmental protection measures are properly implemented and maintained.

5.6 OPERATION AND MAINTENANCE

PRW will be responsible for the operation and maintenance of the Disraeli Freeway during the construction period and for a period of 30 years after construction. PRW will establish an Operational Maintenance and Response Team (OMRT) to provide or otherwise procure all inspection and maintenance responsibilities. The OMRT will be a front-line, truck-based team responsible for all operational and preventative maintenance functions for bridge infrastructure. The OMRT will form teams or subcontract larger repairs, rehabilitative maintenance and renewal work. Operational maintenance will include:

- Minor repairs and maintenance;
- Clean-up duties (i.e. litter clean up, spring and summer cleanups, street sweeping, graffiti removal);
- Maintain vegetation/litter collection in right-of-way and drainage system;
- Winter snow removal and de-icing/grit;
- Lighting;
- Pavement markings;
- Regular bridge patrols to monitor current status and identify maintenance issues;
- Bridge inspections; and
- Larger repairs, rehabilitative maintenance, renewal work based on engineering reports on lifecycle performance of major bridge infrastructure and damage reports.

5.6.1 *ROAD WEATHER INFORMATION SYSTEM*

A road weather information system (RWIS) will be incorporated into the river bridge to assist the maintenance team in the decisions to apply de-icing or grit to the Disraeli Bridges corridor as required, minimizing the potential for ice build-up. Weather will be monitored continuously using a remote outstation that will contain a data logger which will record wind speed and direction, air temperature, humidity, dew point, surface wetness, rain, and snow accumulation.