EXHIBITION AND MIDWAY DEVELOPMENT IN FORT EDMONTON PARK SERVICING ASSESSMENT REPORT

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EXHIBITION AND MIDWAY – FORT EDMONTON PARK
Servicing Assessment Report

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SECTION 1.0
CURRENT SITUATION ASSESSMENT

1.0 INTRODUCTION

It is proposed to construct a 1920s historic Exhibition and Midway in the north half of the farm field immediately to the west of the Train Station and main entrance to Fort Edmonton Park. Refer to HIP Architects January 9, 2004 report titled "Fort Edmonton Park – 1920's Midway Site Plan for a complete description of the proposed development.

The footprint of the Midway plus the Exhibition Building and the new service road for this development occupies approximately 1.28 Hectares. Refer to the HIP Architects January, 2004 Option 2 Site Plan for the proposed arrangement of facilities, which will include the following major elements:

- A new **service road** for the Exhibition and Midway, which parallels the railway tracks, and has connections to 1920 Street at the south end and to the Service Road via the Blatchford Hangar access/parking area at the northwest end. The intent is to hard surface this service road. We note that it includes some 20 parking stalls for service vehicles, EMS vehicles and Handicapped persons vehicles.

- An extension of the **boardwalk** northward from the existing east-west boardwalk to the Midway entry gate.

- A **midway** which includes a covered carousel, an airplane ride, a ferris wheel, games tents, sideshows tents and exhibition tents. The midway has two entry gates, one on the east side for the general public, and one on the north side for service vehicles and staff.

- An **Exhibits Building**. This will be a "U" shaped building with equal legs of approximately 50' x 150' with a closing end. It is located adjacent to, but is not directly connected to the covered carousel. The Exhibits building will be accessible at the back to the service road and parking area.

- A **fence** around the entire development for security and safety purposes.

2.1 STUDY SCOPE

The scope of this study is limited to sanitary sewerage, stormwater drainage, domestic water and fire protection systems required to support the development of the 1920's Midway and Exhibition in Fort Edmonton Park.

The Objectives of the Servicing Assessment include:

- Review the water and sewer servicing requirements for the proposed development and compare to the existing services at Fort Edmonton Park as a whole. Include discussions with Park operational staff, utility managers and Midway proponents.
- Assess the effect of the Midway development on the water, sewer and drainage systems for Fort Edmonton Park, and assess the adequacy of these systems to support the Midway.
- Propose a suitable sanitary sewage storage chamber to accommodate both the Selkirk Hotel and the Midway plus any other contemplated imminent development in Fort Edmonton Park.
- Recommend, where warranted, any other measures to resolve identified utilities systems deficiencies.

1.2 STUDY METHODOLOGY

This study has been completed by Brian F. Thompson, P.Eng., as a Subconsultant to Gibbs and Brown Landscape Architects Ltd. Gibbs and Brown are acting on behalf of the City of Edmonton Community Services Department and are responsible for an environmental review of the project, which review includes a transportation / parking review and a review of the water and sewer servicing requirements.

2.1 ASSESSMENT OF SANITARY SEWERAGE

2.2.1 Description of Existing System

There is an existing 250 mm (10") diameter gravity sewer along 1920 Street, which drains westerly along 1920 Street past the Motordrome and the AGT Building. This sewer is then drained by a 250 mm diameter pipe flowing south to a sewage lift station located beside the J. B. Little building.

The sewage lift station is a Wet Well / Dry Well type with two sewage pumps located in the Dry Well. The pumps discharge sewage via a 150 mm (6") forcemain up the slope of the North Saskatchewan River Valley where it discharges into an existing 250 mm gravity sewer in Brander Gardens (Riverbend) subdivision.

The lift station has overflow protection via a connection to an adjacent storm sewer, plus an overflow storage tank. The function of the overflow storage tank is to reduce the likelihood of the lift station overflowing into the storm system during storm events or power outages, because that storm sewer would convey the raw sewage directly to the river.

2.2.2 Sanitary Sewer System Capacities

A 250 mm diameter gravity sewer at a minimum slope of 0.28% has a flow capacity of 0.031 cubic meters per second (cms).

The proposed Exhibits building will have public restroom facilities, so it will require a connection to the existing 250 mm sewer in 1920 Street. At this time, there is no definition of the number of toilets and/or urinals which will be included in the Exhibits Building restrooms, so it is not possible to quantify the sewage flow from this facility. However, normally, a building like this would have a 150 mm diameter sanitary sewer service connection at a minimum slope of 1.0%, and it can be generally stated that the 250 mm sewer in 1920 Street will have adequate capacity to accommodate the additional flows from the Exibits Building restrooms.

The sewage lift station (City Station 101) has a wet well inside diameter of 6.5 feet or 1.981 meters. The lead pump turns on at a 5 foot depth and shuts off at a 3 foot depth. In 1991, this lift station was upgraded by replacing the original Smart Turner pumps with new Flygt pumps. This replacement was likely a result of a 1986 incidence of the pumps being flooded and hence out of service for some time. Since the system depends upon the pumps being able to cycle on and off in accordance with the volume of sewage entering the system, Fort Edmonton Park facilities would have to be shut

down during any prolonged period of pump failure. In 2000, the lift station was once again upgraded by replacing most of the valves and piping in the station.

Each of the Flygt Model CT3170 pumps has a capacity of 190 USGPM (0.012 cms) at 136 foot (41.5 m) total dynamic head, and each is powered by a 30 HP electric motor.

The volume of sewage discharged by the pump can therefore be calculated to be 1.88 cubic meters or 66.33 cubic feet if there was no inflow to the lift station during the period, and the pump would be on for about 2.6 minutes if it discharges at 0.012 cms.

If the 250 mm pipe coming in to the lift station was flowing full (but not surcharged) in a wet weather situation, then .031 cms would be entering the station. Since this exceeds the pump output capacity of .012 cms, then the level in the station wet well would continue to rise. This would, at a depth of 5.1 feet, trigger the second sewage pump to turn on, and both pumps would work together to pump sewage up the hill to the Brander Gardens system. The second pump would shut off when the level in the wet well was pumped down to a 3.2 foot depth.

If the inflow was such that both pumps could not keep up (a severe storm), or if one or more pumps was out of service during a storm event, then the level in the wet well and the adjacent 43.5 cubic meter storage tank might continue to rise to the 8 foot depth, at which time it would overflow into the nearby storm sewer.

2.2.3 Quantity of Sewage

The information presented in this section is substantially repeated from that given in a previous report related to the proposed development of the Selkirk Hotel. Since there have been no substantial changes to the sanitary system at Fort Edmonton Park since the year 2002 when that previous report was prepared, the information is still relevant.

Attendance and function booking records for Fort Edmonton Park show that park visitors peak during July and August weekends. Often the May long weekend and Harvest Fair weekend produce the highest daily attendance for the year:

Table 1-1

RECORDED PEAK DAILY ATTENDANCE AT FORT EDMONTON PARK

YEAR	MAY LONG WEEKEND	HARVEST FAIR
1999	7,508	6,244
2000	5,991	4,339
2001	7,367	7,802
2002		
2003		

Functions at various facilities in Fort Edmonton Park are usually in the evenings, and the busiest time of the year is the November – December Christmas party season, although there can be functions in the Park at any time. During this heavy-use period, there could be 2,000 persons in the park at one time.

Water use by attendees at functions, or park users in general, will be in washrooms. In order to estimate the amount of water used and sewage generated by the various types of park users, we have examined the relationships between pump clock readings, park attendance records and water use records.

The park attendance records show users in three categories, and we have examined the numbers for 1999, 2000 and 2001:

- Gate – Paid attendance by those passing through the Railway Station entrance varies from zero in the winter months to a peak of around 37,000 in July and August. Total average annual number of Gate users for the three-year period was approximately 127,500.
- Program – Attendance by program users (schools, etc.) varies throughout the year with monthly figures ranging from 100 to 4,000. Total average annual number of Program users for the three-year period was approximately 15,100.

- Rental – Attendance at rental facilities within the Park (Egges Barn, Blatchford Hangar, etc.) varies with monthly figures as low as 1,500 and as high as 11,800. Total average annual number of Rental users for the three-year period was approximately 61,100

Actual water use data for Fort Edmonton Park was only available for study purposes for the year 2000. The following table illustrates the relationship between water use, attendance and sewage pump output for 2000:

Table 1-2

Water Use, Attendance and Sewage Pumping Relationships

Month	Litres of Water Used	Total Attendance	Litres Per Capita	Pump Clock Hrs.	Discharge Rate L/s
January	600,000	2,713	221	10.125	16.5
February	410,000	4,534	90	10.533	10.8
March	399,000	3,346	119	12.666	8.8
April	411,000	7,244	57	12.167	9.4
May	771,000	19,847	39	20.686	10.4
Month	**Litres of Water Used**	**Total Attendance**	**Litres Per Capita**	**Pump Clock Hrs.**	**Discharge Rate L/s**
June	1,693,000	38,775	44	22.171	21.2
July	1,787,000	48,630	37	24.490	20.3
August	1,988,000	43,430	46	27.618	20
September	842,000	13,474	62	22.171	10.5
October	533,000	9,758	55	13.692	10.8
November	431,000	2,850	151	12.036	9.9
December	422,000	10,860	39	10.962	10.7
Totals	10,287,000	205,461	50	199.317	14.3

The January and November calculated L/cap numbers are higher than would be expected. One possible reason for some of the variations, both high and low, would be due to the fact that water meter readings are not taken at the end of each month, in fact they are likely taken every second month and estimated every second month.

We know that the rated capacity of each sewage pump is 12 L/s, which indicates that the calculated pump discharge rate for January, June, July and August are much higher than would be expected. In the case of the January number, it is likely that the meter

reading actually includes water used in the previous December where there is typically high attendance at functions in the park. In the case of the June, July and August numbers, we suspect that outdoor uses such as watering flower beds, gardens and some lawns should be subtracted from the water use because it does not go into the sewer and through the lift station. Note that we did exclude water used by the steam engine at the water tower in the tabulated water use numbers for that same reason.

If we make the simplified assumption that the sewage pump puts out 158 IGPM or 12 L/s. when it is running, then it is possible to convert the monthly pump clock readings to sewage flow, and then sewage flow can be related to monthly attendance records. The following table illustrates these relationships:

Table 1-3

Attendance and Sewage Pump Relationships

Month	Pump Clock Hours	Total Litres Pumped	Total Avge. Attendance	Approximate Litres/capita
January	9.1875	396,900	3,211	124
February	9.9567	430,132	4,901	88
March *	14.2043	613,624	3,223	190
April	12.4129	536,626	7,125	75
May	17.3490	749,479	19,399	39
June	21.0533	909,504	36,780	25
July	25.1881	1,088,125	43,701	25
August	27.5653	1,190,823	45,331	26
September	20.1679	871,251	15,878	55
October	13.6917	591,480	9,081	65
November **	14	604,800	4,741	128
December	15.3484	663,051	10,445	63
Totals		8,645,795	203,816	42

* Note that the March number for litres pumped per capita is high. This may be due to inflow into sewers during spring melt period.

** Note that pump readings were not reliable in November, 2001, and so this number is an estimate of a realistic pump clock number for that month. However, it produces a per capita number which is suspect on the high side.

It becomes clear that there is a large difference in per capita sewage flow between summer and winter months. In the summer months, the dominant attendance (up to 85%) is through the gate. In the winter months, the dominant attendance (up to 80%) is in the rental facilities. It is likely that the different types of Park users use the washroom facilities in very different ways. It is also likely that children make up a significant number of the Gate users, whereas almost no children would be among the Rental facility users. Program users are likely to be students at the Junior High level.

The following table illustrates a possible, but not the only, scenario of the various contribution rates:

Table 1-4

Breakdown of Sewage Contributions by User Types

Month	Gate Visitors @ 8.5 L/cap	Program @ 80 L/cap	Rental @ 100 L/cap	Total Litres	Approximate Litres/capita
January	0	52,960	254,900	307,860	96
February	13,334	65,973	250,733	330,040	67
March	17	103,493	192,767	296,277	92
April	28,339	127,747	225,667	376,752	53
May	104,159	151,893	524,667	780,719	40
June	204,544	274,720	928,200	1,407,464	38
July	313,695	44,667	623,733	982,095	23
August	306,448	53,573	860,900	1,220,921	27
September	69,442	43,680	716,267	829,389	52
October	36,267	105,547	349,467	491,280	54
November	0	92,560	358,367	450,927	95
December	7,817	98,000	830,033	935,851	90

Note that the approximate L/cap numbers in this table correspond fairly well with the approximate L/cap numbers in the previous table, with a tendency to be slightly lower. They are lower, because the previous table, based on pump clock readings, would include inflow and infiltration into the sewer system, plus the contribution of any leaking toilets and faucets, or any faucets left in the open position.

2.2.4 Historical Performance of Existing System

In our discussions with City of Edmonton Drainage Services personnel, who are charged with the responsibility of operating this system, we learned the following:

- There have been no recorded incidents of surcharging in the Brander Gardens sewage system, nor does the computer model indicate any problems in this system even under the most extreme recorded wet weather conditions.

- There have been several recorded incidents of the Fort Edmonton Park sewage lift station overflowing into the storm system and the river at Outfall #14 during wet weather events. These incidents resulted in the overflow storage tank being built beside the lift station in 1989. Since that tank was constructed, the station has overflowed in only the most severe storms.

- The dry weather performance of the system is good, and the anticipated contribution of the Selkirk Hotel should be well within the existing capacity of the Fort Edmonton Park lift station. For example, the anticipated average daily flows from the fully-occupied hotel could be pumped by one of the two pumps in a 44 minute period.

- Because the historical problems with the system have been related to wet weather flows, it would be prudent to focus on the elimination of situations where surface runoff might be able to enter the sanitary sewer system. That focus leads to an assessment of the stormwater drainage system.

2.2.5 Condition of Approval for Selkirk Hotel Development Permit

When the Development Permit for the Selkirk Hotel was approved, Drainage Services requested that additional storage be added to the Lift Station to provide for shutdowns and emergencies equivalent to a volume of 4 hours peak dry flow from the Hotel. That volume was determined to be approximately 5 cubic meters of additional storage.

A 1500 mm diameter manhole could be constructed beside the existing storage chamber with its floor at the same elevation as the floor of the existing chamber (621.50), and with a 300 mm interconnecting pipe between the two chambers. This manhole or chamber would provide the required additional storage.

2.2.6 1920's Midway Impact Mitigation

The requested additional storage chamber has not yet been constructed. Instead of constructing a 1500 mm diameter storage chamber, the diameter could be increased to say 2400 mm, and the additional storage volume provided would be approximately 13

cubic meters. This chamber would provide sanitary system mitigation for both the Selkirk Hotel and the 1920's Midway, and perhaps even other future developments within Fort Edmonton Park.

1.4 ASSESSMENT OF STORMWATER DRAINAGE

While the majority of the area occupied by Fort Edmonton Park is served by a surface drainage system consisting of swales, ditches and natural sloughs or ponds, the developed portions of the site are served by underground storm sewers. One system serves the area from the west end of 1885 Street to the John Janzen Nature Centre. This system has pipes ranging in size from 200 mm to 1050 mm at the outlet to the North Saskatchewan River north of the Fire Hall.

As part of this system there is an 825 mm storm sewer along 1920 Street in the section near the Motordrome, which drains in a westerly direction into a 900 mm storm sewer, and which leads to Outfall # 14 to the North Saskatchewan River. There is a catchbasin in the south perimeter of the farm field which is connected to this storm sewer. The entire proposed development area for the Exhibition and Midway would currently drain towards this catchbasin.

The overflow from the sewage lift station and storage tank are connected to the 900 mm storm sewer via a 600 mm connection. Since this piping arrangement will convey raw sewage directly to the North Saskatchewan River, at a point which is located upstream from the intake to the Rossdale Water Treatment Plant, it is desirable to minimize or eliminate the lift station overflow events, hence the importance of the proposed storage chamber (see section 2.3.6 above).

The existing ground at the proposed location of the Midway and Exhibition is quite flat, in the range of elevation 627.7 to elevation 626.7. The general slope of the ground is towards a trapped low point, which is directly west of the Train Station. If the trapped low ever filled during a major storm event, it would overflow to the catchbasin, which is connected to the 825 mm storm sewer. We believe the elevation of the rim of the catchbasin is at 626.92, but the trapped low is surrounded by a 627 contour.

The existing catchbasin, the 825 mm storm sewer, and the trapped low are potential recipients for stormwater discharges from the new Midway and Exhibition development. There is also some potential for draining portions of the development site via culverts under the railway tracks to connect with a surface drainage system serving the main service road parallel to the North Saskatchewan River.

Because the 1920's Midway development will have a surface which is less impervious than the current farm field, it will increase the quantity and rate of runoff from the approximately 1.28 hectare area occupied by the new development. Potential methods of mitigating the impact of this development on the stormwater system include the following:

- Ensure that a large proportion of the runoff from the 1920's Midway and Exhibition surface is directed towards the existing trapped low, and utilize that trapped low as a retention basin.

- If possible, equip the catchbasins located within the Midway site with orifices which will limit the outflow to the equivalent of the pre-development outflow rates. Because of the use of tents for sideshows and exhibits, and the likely need of electrical power in those tents, ponding of runoff water on the midway surface may be very limited.

- Ensure that some portion of the surface of the developed Midway is actually drained by a system which directs the runoff under the railway tracks and towards the existing system of ditches and culverts which conveys runoff across the existing Service Road and River Valley Trail near the Guardhouse. If it is possible to so direct some of the Midway runoff, ensure that the existing 15" diameter culverts in the vicinity of the Guardhouse are cleaned out. They are currently plugged with leaves and other debris. It may also be possible to create a small retention basin north of the tracks and south of the existing Service road to mitigate the impact of the increased runoff on the existing culverts.

- If the surface of the Midway is to be constructed with permeable pavers, design the "pavement" surface so that the lowest possible runoff coefficient is achieved. This will reduce the impact of the new facility on the quantity and rate of runoff from the developed area.

1.5 ASSESSMENT OF WATER SYSTEM

The water system in Fort Edmonton Park consists of a 200 mm diameter looped watermain with fire hydrants. One end of this loop connects to the distribution system in Brander Gardens and the other end connects to the distribution system in Grandview Heights. Because the park is in the river valley, and is fed from the system at the top of the valley, pressures in this water loop are relatively high, in excess of 550 Kpa (80 psi). This pressure is sufficiently high as to require the service connection to the

Exhibits Building plumbing system to be protected by a pressure reducing valve. The mechanical designer for the building should take this matter into account and provide accordingly.

However, a 200 mm diameter main, which has a such a long length, has high friction losses when it is tasked to provide a fire flow. For example, the City of Edmonton design standards require a fire flow of 300 litres per second (4,755 USGPM) for high value properties (including school, institutional, commercial / industrial sites) and 180 litres per second (2,853 USGPM) for multi-family residential areas. The 300 L/s requirement could only be met with a flow of 150 L/s coming from either end of the 200 mm main, which would result in a velocity of 5 meters/second and head losses in the order of 100 meters per 1000 meters of main. This is not an achievable amount, and the velocities are too high to meet design standards. The 180 L/s requirement could theoretically be met with flows of 90 L/s coming from either end, which would result in a velocity of 3 m/s (acceptable) and friction losses of less than 50 meters per 1000 meters of pipe. This flow is considered to be achievable.

Information provided by EPCOR Water Services Inc. shows that a hydrant flow test in the Park (Hydrant #6401) with two – 2.5" nozzles flowing yielded 129 litres per second (2,045 USGPM) with a residual pressure of 400 Kpa (57 psi).

The Exibits Building will not be equipped with a sprinkler system, so any fire in this building must be extinguished by the Fire Deparment in response to an alarm.

A Fire Department pumper truck has a maximum output of 114 L/s (1,800 USGPM) and one aerial nozzle on a ladder truck has a capacity of 44 L/s (700 USGPM).

It would appear that the Fort Edmonton Park water system does generally have capacity to fight a fire in the building, as long as it does not get out of control. If the entire structure becomes engaged, then the system would be taxed to the maximum.

It should be noted that the 300 L/s standard would be applicable if there were other buildings immediately adjacent to the proposed Exhibit Building and Carousel. What this means is that if Fort Edmonton Park expands in a manner which places buildings very close to each other, then the fire protection system which currently exists in the park is deficient.

This deficiency in the Fort Edmonton Park water system is of long standing. The Fort Edmonton Park Master Plan sets out deficiencies in the fire protection system in Section 4 a) iv) Fire Protection Requirements. These documented deficiencies relate to hydrant accessibility, hydrant spacing and sprinkler systems in buildings.

A fire hydrants connected to the main on 1920 Street is located in the north boulevard of 1920 Street, adjacent to the existing boardwalk, near the catchbasin described in Section 1.4. The main runs east-west either under the existing gravel roadway, or under the existing streetcar tracks. Hydrants are also located near the Train Station and the John Janzen Nature Centre. The spacing of these hydrants exceeds the maximum allowable (City of Edmonton Design Standards) of 90 meters (300 ft.) for industrial/commercial areas.

As a result, this main and the hydrants cannot provide the level of fire protection that would be expected in the downtown area of the City, but an appropriate extension from this main, including a new hydrant or hydrants, can provide adequate protection to the proposed Exhibits Building and other Midway features if it is a stand-alone building with no other immediately adjacent buildings.

SECTION 2.0
RECOMMENDED SERVICING FOR 1920'S MIDWAY AND EXHIBITION DEVELOPMENT

2.1 INTRODUCTION

In Section 1, sewer, water and drainage servicing constraints relating to the potential development of the 1920's Exhibition and Midway in Fort Edmonton Park have been documented. Given those constraints, this Section sets out some alternatives for providing an appropriate level of service for this development.

2.2 SERVICING ALTERNATIVES

2.2.1 Sanitary Service Option #1 – Gravity Connection

A 150 mm diameter service connection could be installed across 1920 Street connecting directly into the existing 250 mm sanitary sewer. This connection would have to be installed partly under the streetcar tracks along the south edge of the street. In order to minimize disturbance to the existing surface and to Park operations and users, it would be appropriate to install this service connection by auguring or coring techniques. An excavated working pit would be required at the north side of the street. The main across the farm field could be installed by normal open trench methods.

2.2.2 Sanitary Service Option #2 – Pumped Connection

A small lift station could be built to provide sanitary service to the Exhibits building only. It could be located outside and beside the building, or it could be located in the crawl space under the building. Duplex pumps would pump hotel sewage across the field to the existing 250 mm sewer via a 100 mm forcemain connection. This connection would have to be partly installed by auguring or coring techniques similar to the gravity connection.

The wet well of this dedicated lift station could be sized to provide a certain amount of storage volume. This opportunity to store sewage could be used to advantage during wet weather events, which tend to overload the main lift station. This would be one way of ensuring that this development does not exacerbate an existing problem.

2.2.3 Storm Service Option #1 – Direct Connection to Storm Sewer

An appropriate diameter service connection (say 380 mm) could be installed across 1920 Street connecting directly into the existing 825 mm storm sewer. This connection would best be extended from the existing storm manhole immediately north of the streetcar tracks adjacent to the turn-around loop junction. This connection could be partly (under the roadway) installed by auguring or coring techniques similar to the gravity sanitary connection, but the pipe across the farm field could be installed by normal open trench methods.

2.2.4 Storm Service Option #2 – Surface Discharge

It is possible, that by carefully designing the grading of the area, some of the runoff from the Midway could be directed towards the North Service Road ditch/culvert system. This would reduce the quantity directed to the piped system. It is also possible, that by carefully designing the grading and surface of the Midway, some of the runoff could be directed towards the existing trapped low west of the Train Station. The trapped low would then function as a stormwater retention area. The existing catchbasin at the south edge of the farm field would serve as the outlet for any overflow from this trapped low retention area.

Note that it is likely that some combination of Options 1 and 2 will be required to handle the drainage aspect of the Midway.

2.2.5 Water Service Option #1 – Connection to Existing 1920 Street Main

The service connection to the Exhibits Building from the existing 200 mm watermain in 1920 Street will provide for both domestic supply and fire protection. The fire protection portion will be 150 mm in diameter if only 1 additional hydrant is provided, or it would be 200 mm diameter if 2 hydrants are required.

As mentioned earlier, due to the high pressures in the watermain in this area, the Mechanical Designers should give due consideration to the matter of providing a pressure reducing valve to protect the building plumbing from the high pressures.

In order to avoid having to construct adjacent to the streetcar tracks and across the road, the new service connection could be made by removing the existing hydrant, extending the main from that point, and re-locating or replacing the hydrant near its current location.