



# The City of Winnipeg

## Water And Waste Department

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### FLOOD PUMPING STATION CONDITION ASSESSMENT



APPENDIX B19  
LINDEN FLOOD PUMPING STATION - FINAL REPORT  
DECEMBER 2006

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**KGS**  
GROUP

KONTZAMANIS ▪ GRAUMANN ▪ SMITH ▪ MACMILLAN INC.  
CONSULTING ENGINEERS & PROJECT MANAGERS

## SUMMARY

The Linden Flood Pump Station (FPS) is a **Combination Station** and is located in a residential area at the end of Linden Avenue on the east side of the Red River. The station superstructure is a medium sized 66 m<sup>2</sup> building. The building structure consists of loadbearing wood framed walls and a sloped wood framed roof supported by the exterior walls and an interior wood beam and post. The exterior wall finish is painted wood siding. The interior wall surfaces are covered with unfinished hardboard paneling. The entry door is a solid core wood unit in a wood frame. The building appears to be as originally constructed in 1951 and is generally in fair condition.

There are two separately coupled, overhung impeller axial flow centrifugal pumps installed in the FPS drywell (P46 – 24", 125HP, P47 - 30", 175HP). These pumps start and stop in sequence based on the level in the wetwell as determined by the ultrasonic level control system. This station is serviced with a drywell electric resistance unit heater and drywell pressurization fan. The main floor is provided with a 14 000 cfm cooling fan. Several mechanical upgrades are recommended for this FPS over the next 10 years. A new drywell ventilation system and a main floor cooling fan system are proposed for this FPS. Replacement of the shaft seal water line valves and some of the flanged connection hardware and victaulic couplings on the PFS piping is recommended. A new corrosion and wear – resistant coating system is proposed for the drywell's pumps, piping, and lineshafts. This station would also benefit from an ongoing Ultrasonic Test Program and a Vibration Testing / Thermal Scanning Program.

The Linden FPS is classified as having a low risk of failure. The site is located along an inside bend in the river and there is no evidence of overall bank instability. Existing riprap erosion protection is in place along the shoreline but there is evidence of ongoing erosion above the riprap. A detailed visual inspection of the riverbank stability conditions at the FPS plus internal inspection of the outfall pipes should be performed at the site every five years. In addition, upgrading of the existing riprap blanket should be undertaken sometime during the life of the station to reduce the potential for future erosion.

The station substructure appears to be as originally constructed in 1951 and is generally in a good/fair condition. The pump bases are in a good/fair condition. The discharge box walls and floor are in a good/fair condition. The flap gate & thimble were installed in 1993 and are in a fair condition. The slide gate and thimble were installed in 1951 and are in a poor condition. Almost

all the anchor bolts on the sides of the frame are sheared off. The other anchor bolts are heavily corroded with section loss. The gate chamber concrete is in a good condition. There is some debris accumulated at the bottom of the gate chamber.

The recommended upgrades and their estimated costs have been compiled by discipline; Building and Site, Mechanical, Geotechnical, Sub-Structure & Gates and Electrical. All of the costs shown are in 2005 dollars and have not been adjusted for price escalation during the upgrade program (i.e. the 11 to 50 year cost estimates are still in 2005 dollars). These estimates include engineering, administration and contingencies. The recommended upgrades have been prioritized by the following categories:

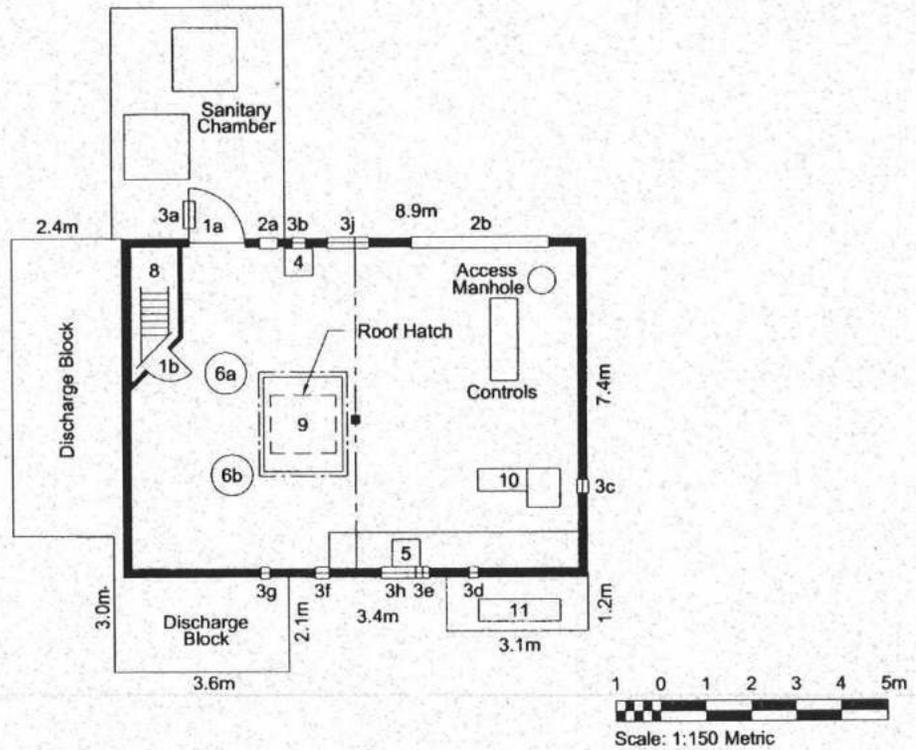
- 0 to 5 year implementation
- 6 to 10 year implementation
- Future upgrades (i.e. 11 to 50 years)

Total estimated costs for this station are as follows:

- |                 |           |
|-----------------|-----------|
| • 10 year       | \$495,950 |
| • 11 to 50 year | \$203,420 |

### KEY STATION DATA

**BUILDING PLAN**



**LINDEN FLOOD PUMP STATION SITE INSPECTION  
 KEY STATION DATA**

ITEM DESCRIPTION	ITEM NO.	WIDTH (mm)	HEIGHT (mm)	COMMENTS
<b>Station Data</b>				
Door	1a	1210	2120	
	1b	660	1900	
	1c			
Window	2a	400	2000	
	2b	3000	1000	
	2c	-		
Louver/Vent	3a	610	310	
	3b	280	280	
	3c	300	300	
	3d	200	300	
	3e	300	400	
	3f	300	400	
	3g	200	300	
	3h	900	1400	
	3j			Triangular gable
	3k	-		

ITEM DESCRIPTION	ITEM NO.	WIDTH (mm)	HEIGHT (mm)	COMMENTS
<b>Station Data</b>				
Fan (Dry Well)	4	-		Drywell ventilation rate – estimated at 700 cfm or 7 air changes per hour
Fan (Cooling)	5	-		Permanent cooling fan – estimated at 14 000 cfm
Pump	6a	-		P46 – 24", 125 HP
	6b	-		P47 – 30", 175 HP
Stair	7	-		
Ladder	8	-		
Floor Hatch	9	2100	1700	
Flap Gate	10	1524	Round	Cast Iron
Slide Gate	11	1524	1829	Cast Iron
Level Control System	12			Ultrasonic
<b>Other Relevant Data</b>				
Year Built				1951
Modifications				1993 - Oufall renewal, New Flap & Thimble (Existing Slide)
Location				End of Linden Avenue
Tributary				Red River
Building Area				73 sq. m. (789 sq. ft.)
Wall Framing				Wood Frame
Wall Finish (exterior)				Painted Wood Siding
Roof Framing				Wood Frame
Roof Slope				3/12
Roofing Type				Asphalt Shingles
Windows				Yes
Renovation Status				Original
Vandalism (type & frequency)				None
Substructure				Rectangular drywell, 1 level of concrete beams
Pipes – Outfall Pipe		1524 mm diameter		
Pipes – FPS Pipe		1675 mm diameter		
Geotechnical Assessment Rating				Low Risk
River Meander Pattern				Inside bend
Bank Slope				4.5H:1V
Surface Drainage				Positive
Existing Bank Works				Limestone and concrete rubble riprap around pipe outlet
Erosion Conditions				Minor above riprap
Bank Stability Condition				No evidence of overall instability at FPS

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  - Condition Assessment – Photos, Data Collection Sheets and Test Results

## 1.0 INTRODUCTION

The Linden Flood Pump Station (FPS) is a **Combination Station** and is located in a residential area at the end of Linden Avenue on the east side of the Red River. The Photos (as referenced throughout this report) can be found in each of the Annexes section, by department, at the end of this report. A building plan, site location plan and station isometric are provided in the summary section of this report, pages iii, v and vi respectively.

The station superstructure is a medium sized 66 m<sup>2</sup> building. The building structure consists of loadbearing wood framed walls and a sloped wood framed roof supported by the exterior walls and an interior wood beam and post (Photo A19-10). The exterior wall finish is painted wood siding. The interior wall surfaces are covered with unfinished hardboard paneling. The entry door is a solid core wood unit in a wood frame. There are two windows in the station including the door sidelight. The roofing consists of asphalt shingles with painted wood fascia boards. The station building is not insulated. Access to the sanitary sewer chamber is from inside the station drywell through a door at an intermediate steel platform.

Linden FPS is a typical Flood Pumping Station complete with two separately coupled, overhung impeller centrifugal pumps installed in its drywell (P46 – 24", 125HP, P47 – 30", 175HP). The station is serviced with a drywell electric resistance construction heater and drywell pressurization fan. This is a combination sewage / flood pumping station where both the flood pumping station and the sewage pumping station are directly accessible from the FPS interior.

The Linden FPS is located along an inside bend on the east bank of the Red River at Linden Avenue and Kildonan Drive. The overall bank slope is approximately 4.5H:1V and the building is set bank 18 m from the top of bank.

The Linden FPS substructure consists of a formed concrete wet well, dry well and discharge box. The substructure is physically linked to the adjacent sanitary station. The rectangular dry well is 6.6 m in depth and has a mid-sized footprint area of 36 m<sup>2</sup>. Immediately downstream of the station is a concrete gate chamber that houses a cast iron flap gate and slide gate. The gate chamber is linked to an outfall pipe that leads to the Red River. The chamber and gates were most recently modified in 1993. At this time a new flap gate & thimble were installed

upstream of the slide gate. The slide gate & thimble were left “as-is”. The gates installed at the Linden FPS are small relative to other typical flood pumping stations.

This report describes the results of the condition assessment and the recommended upgrades to extend the life of the project for 50 years. Implementation strategies for these upgrades are described in the main report.

## **2.0 CONDITION ASSESSMENTS**

### **2.1 BUILDING AND SITE CONDITION ASSESSMENT**

#### **2.1.1 Building Superstructure**

The building appears to be as originally constructed in 1951 and is generally in fair condition.

##### **Exterior**

With the exception of some moisture staining on the exposed roof framing and the interior wall paneling the structure appears to be sound. The exterior wood siding is in fair condition. The paint finish is rated as poor due to considerable flaking (Photos A19-1, A19-2 & A19-3). Wall areas immediately above concrete discharge blocks and gate chamber are suspect to have at least some rot in the sill plate of the wood stud wall framing (Photo A19-4 and A19-6). The interior wall above the gate chamber has considerable moisture staining (Photo A19-13).

##### **Roof**

The asphalt shingles are in poor condition. No formal roof drainage control system is provided. Uncontrolled roof drainage has caused some damage to the wood roof trim and soffits. The painted wood fascias and trim are generally in poor condition.

##### **Doors**

The wood entry door and frame are in fair condition. The face of the door is split. The paint finish on both the door and frame is poor.

##### **Windows**

The windows consist of wood frame units with glass block glazing (including a door side light). The frames and glazing units are generally in fair condition. Based on the moisture stains on the wall paneling below the window units it would appear as though the glazing units are a regular source of frost and condensation.

## **Aesthetics**

Aesthetically the station building blends in reasonably well with the surrounding community. In general the station building is structurally sound but its visual appearance is poor, due in combination to a failed paint finish and deteriorating siding, and general neglect.

### **2.1.2 Interior Features / Safety Issues**

Permanent steel guardrails are provided around the main floor equipment hatch (Photo B19-7). A galvanized steel stair, with an intermediate landing and a fixed ladder provides access to the drywell below (Photos A19-17 & A19-18). The stairs are steep but allowable by code for service areas. Due to the installation of the foamed plastic insulation around the top of the drywell there is no insufficient hand clearance along the stair handrails at these locations creating an unsafe condition when using the stair. The height of the guardrails around the intermediate landings is approximately 900 mm (less than the 1 070 mm required by the current Manitoba Building code), and only a top rail is provided (Photos A19-17 & A19-18). A galvanized ladder provides access to the drywell floor from the intermediate platform (Photo A19-18). The galvanized ladder to the drywell has a safety cage around it, but it does not conform to current safety codes due to an insufficient number of vertical restraint bars (leaving excessive openings in the cage). In addition the installation of the foamed plastic insulation has reduced the required toe clearance, making it difficult to obtain proper and safe footing on the rungs in that area.

The drywell ceiling and the upper 2 400 mm of the drywell walls are lined with 50 mm of flammable foamed plastic insulation (extruded polystyrene – STYROFOAM) which is a potential fire/safety hazard (Photo A19-18).

### **2.1.3 Building Site and Security**

#### **Driveway**

An overgrown gravel driveway leads to the building. The site has shrubs and trees nearer the river.

## **Grade**

The main floor of the building is approximately at grade. The surrounding grade is relatively flat all around the building and slopes down towards the river on the west side. There are no signs of deterioration due to the site drainage conditions. The site drainage conditions are poor and need to be addressed.

## **Security**

The site is completely open. The site is generally not illuminated at night. Graffiti is not a problem at this station. Other than normal wear and tear, there are no other signs of damage due to vandalism.

## **2.2 MECHANICAL CONDITION ASSESSMENT**

### **2.2.1 General**

There are two separately coupled, overhung impeller centrifugal pumps installed in the FPS drywell. This station is serviced with a drywell electric resistance unit heater and drywell pressurization fan. The main floor is provided with a 14 000 cfm cooling fan (Photo B19-1).

### **2.2.2 Ventilation**

#### **Drywell Ventilation**

The existing drywell ventilation fan, which also services the sanitary pump station, is intended for protection of occupants from contaminated air only and is located on the building's main floor. This single-speed 700 cfm fan is operated only when personnel are present in the drywell. An intake duct draws air from outside through a louver and transfers it via discharge ductwork to a location above the drywell floor. A branch off this ductwork also discharges air to the sanitary pump station. Since there is no direct extraction of contaminated air from the drywell floor, this arrangement is only diluting the air in the drywell, not providing direct air changes. The air change rate is therefore less than seven Air Changes per Hour (ACH). The City of Winnipeg Water and Waste Department has established the requirement to provide ventilation for

personal protection in FPS drywells at 15 ACH. A more reliable method for ensuring a consistent 15 ACH is to provide two fans for drywell ventilation. One fan and duct would supply air to the top of the drywell while the other fan and duct would exhaust air from the bottom of the drywell.

### **Main Floor Cooling Ventilation**

This FPS is equipped with a 14 000 cfm cooling fan to remove the heat generated by the FPS motors and switchgear when flood pumps are in operation. This fan is oversized and should be replaced with a smaller cooling fan. Details describing the criteria for fan selection and sizing are contained in the Summary Report.

### **2.2.3 Piping**

#### **Shaft Seal Water Piping and Valves**

The shaft seal water line provides water to the packing gland for cooling and lubrication. This station's shaft seal water line has been converted over to PVC for the most part; however, some copper piping and brass fittings are still present on portions of the main line and where the line ties-in to the pump seal water connections. The remaining copper piping and joints are badly corroded, especially on the main line. The strainer and all the valves on the main line and on the branch lines are also badly corroded (main line = Photos B19-2 and B19-3, branch to Pump 46 = Photo B19-4, branch to Pump 47 = Photo B19-5). At this station, the strainer, the check valve and the gate valves on the main line are located in the sanitary station drywell while the pressure regulating valve and the solenoid valve are in the FPS drywell. Corroded piping and valves should be considered for replacement.

#### **Flood Pump Piping**

The pump suction lines are corroding and have lost their protective paint where the pipe meets the floor (Pump 47 = Photo B19-6).

The discharge piping at this FPS runs horizontally and exits the drywell just above the floor level. Advanced surface corrosion is present on the flood pump discharge piping and large sections of paint are flaking off (Pump 46 = Photo B19-7).

The flange nuts and studs on the suction side of pump 46 and on both the suction and the discharge sides of Pump 47 are corroded (Pump 46 = Photo B19-8, Pump 47 = B19-6 and B19-9). The corrosion on these components is advanced and should be considered for replacement.

Ultrasonic testing was performed at Linden FPS in January 2005. The P46 (24" pipe) and P47 (30") suction and discharge lines were tested to determine remaining wall thickness at several points around the circumference and longitudinally on the lines. The welded carbon steel discharge lines had thicknesses ranging from 0.218" to 0.317" on P46 and from 0.182" to 0.308" on P47. The cast iron suction lines had thicknesses that are higher as would be expected for cast iron in comparison to carbon steel. The suction line thicknesses ranged from 0.922" to 1.125" on P46 and from 0.926" to 1.193" on P47.

ASME B31G-1991 "Manual for Determining the Remaining Strength of Corroded Pipelines" is a supplement to ASME B31.3 and was referred to in our assessment of the condition of the discharge piping at this station. The chief limitation of the ultrasonic testing that was performed is that all points along the entire surface area of the piping have not been tested. Since only a sampling of points has been arbitrarily selected, it is possible that areas with less wall thickness than the tested area have been overlooked. Testing at an increased number of transducer locations would have required a significantly higher expenditure for stripping of the entire surface of existing lead based paint and subsequent immediate painting of the piping once the tests were complete. Testing at an increased number of transducer locations was therefore considered impractical.

Based on our review of the data and taking into account the limitations of the test procedure and ASME B31G-1991, the piping at this FPS appears to be in satisfactory condition for normal service conditions. This piping should be considered for the ultrasonic monitoring program to allow an evaluation of consequential progression of corrosion and/or erosion of the suction and discharge piping.

## **2.2.4 Pumps**

There are two separately coupled, overhung impeller centrifugal pumps installed in the FPS drywell (P46 – 24", 125HP, P47 - 30", 175HP). These pumps start and stop in sequence based on the level in the wetwell as determined by the ultrasonic level control system.

Pumps 46 and 47 are shown in Photos B19-10 and B19-11, respectively. Areas of concern for these pumps are as follows:

1. Pump bowl paint is flaking due to corrosion on and around the bearing cover.
2. Bearing cover nuts and studs are corroding (Pump 46 = Photo B19-12, Pump 47 = Photo B19-13).
3. The nuts and studs on the base of Pump 47 are badly corroded (Photo B19-14).

The corroded hardware mentioned above should be considered for replacement. All other components not addressed above as areas of concern are considered to be in acceptable condition, this assessment should be re-evaluated in another 8 to 10 years.

## **2.2.5 Line Shaft Assemblies**

Vibration testing was performed at this FPS in April 2005. From this testing it was concluded that the line shaft assemblies are in good condition. For further details on the vibration test results please refer to "Pump Shaft Vibration Testing Report – Interim Report" in Appendix C.

## **2.3 GEOTECHNICAL CONDITION ASSESSMENT**

### **2.3.1 Existing Site Conditions**

The Linden FPS is located along an inside bend on the east bank of the Red River at Linden Avenue and Kildonan Drive. The overall bank slope is approximately 4.5H:1V and the building is set back 18 m from the top of bank. The upper bank area was covered with landscaped grass. Several mature trees were located along the shoreline. There was positive surface drainage from the station to the river.

There was no evidence of overall riverbank instability at the site. Along the shoreline there was limestone riprap mixed with occasional concrete rubble erosion protection was in place. The riprap extended approximately 10 m upstream and 15 m downstream of the outfall pipe, as shown on Photo C19-1 and C19-2. In general, the riprap appeared to be in good condition but was discontinuous in some areas resulting in some localized erosion within the limits of the blanket. Immediately up slope of the existing riprap blanket there was evidence of active ongoing shoreline erosion extending up to the top edge of bank. In this area the bank was undercut and over steepened with undermining of trees, as shown in Photo C19-3.

An internal inspection of the outfall pipe was performed in 2004 and there was no evidence of separated joints or other pipe distress which could be indicative of bank movements.

### **2.3.2 Historical Bank Performance**

#### **Aerial Photography**

**1992** - There was evidence of ongoing shoreline erosion upstream and downstream of the station with steep near vertical drops from the Ordinary High Water Mark (O.H.W.M.) down to the normal river level. Overhanging trees and deadfall typically defined the top of bank, which suggests ongoing erosion and undercutting. At the station there was some evidence of rubble erosion protection along the shoreline, but the extent of the material was largely masked the tree canopy and sediment deposition. There was no evidence of overall riverbank instability.

**1998** - Riverbank conditions between the station and the river edge where general masked by the tree canopy but there did not appear to be any overall bank instability at the FPS.

#### **Existing Records**

The Linden FPS was inspected and assessed by KGS Group geotechnical engineers in 1995 as part of the previous City of Winnipeg Flood Adequacy Review Study. The previous study concluded there was no evidence of instability at the site and that active shoreline erosion was occurring. The site was classified as low risk of failure.

In 2001 the outfall pipe was replaced along with the placement of a 8 m long x 13 m wide x 0.6 m thick riprap blanket below the outlet based on review of City of Winnipeg As-Built Drawing LD-2469.

### 2.3.3 Geotechnical Assessment Rating

The Linden Avenue FPS is classified as having a **low risk of failure**. The risk of failure criteria is described in the Summary Report. The site is located along an inside bend and there is no evidence of overall bank instability. The outfall is in good condition with no evidence of distress. Existing riprap erosion protection is in place along the shoreline but there is ongoing active erosion above the existing riprap blanket up to the top edge of bank. The bank is undercut and over steepened in this area which could cause shallow slumping along the shoreline and potential overall slope movements in the future.

## 2.4 SUBSTRUCTURES AND GATES CONDITION ASSESSMENT

### 2.4.1 Substructure

The station substructure appears to be as originally constructed in 1951 and is generally in a good/fair condition. The main floor slab is good with some minor hairline cracks. The plywood hatch covers are worn and are generally in a fair condition.

The dry well concrete beams and shaft guide mounts are in a good condition. The concrete beams have been patched at a few locations along the bottom and sides but these repairs appear to be performing well (Photo D19-2). There are horizontal and vertical cracks on all walls around the perimeter of the dry well. White residue (efflorescence) and staining is evident along the cracks indicating past seepage and corrosion of wall reinforcement. This is particularly evident at the concrete infills around the pump intake pipes where there are many hairline cracks. The main horizontal cracks were previously injected and/or patched (Photo D19-4).

The floor has minor hairline cracks and is generally good. A 2" deep by 3" wide trench has been chipped in the floor along the length of the dry well to facilitate drainage to the sump pit (Photo

D19-5). The pump bases are in a good/fair condition with only minor vertical hairline cracks evident (Photo D12-9). There is however some bases where the grout shoulders are cracked and have spalled off completely (Photo D19-7). Some base plates and anchor bolts have minor surface corrosion.

The discharge box walls and floor are in a good/fair condition. There are multiple horizontal & vertical cracks on the interior of the walls. There are spalled areas on the roof with exposed reinforcing steel (Photo D19-9). There are also moisture accumulations at the top of the exterior wall and on the roof (inside surface).

The station wetwell appears to be generally in a good to fair condition. The roof slab is in fair condition with large concrete spalls and exposed rebar around a large rectangular section that was cutout (Photo D19-20). There are a lot of areas with minor spalling but with no exposed rebar. Exposed rebar is visible at many other locations on the underside of the slab but is not causing the concrete to spall. The walls are in good to fair condition with lots of moisture. There is minor horizontal and vertical cracking as well as a large spall with exposed rebar on the north wall (Photo D19-22). There is a large spall with exposed rebar on the south wall column.

The intermediate strut beams are in good condition with no cracking and only minor concrete spalling on the edges. The ladder is in good to fair condition with no cage. The bottom rungs and verticals have heavy corrosion with significant section loss (Photo D19-25).

The trashracks for the pumps are in good condition with a lot of debris covering them but no corrosion or section loss. There is one trashrack that is not properly seated against the wall with approximately a four-inch gap (Photo D19-27). The vertical trashrack by the outlet culvert is new and in good condition. The inlet and outlet culverts are in good condition. The outlet culvert has no concrete spalling or cracking. The inlet culvert has minor cracking at the top and medium spalling at the bottom. The wetwell floor has high water and could not be visually inspected, but the sides of the floor have large spalls with a rough surface.

## **2.4.2 Gates**

### **Flap Gate**

The flap gate & thimble were installed in 1993 and are in a fair condition. The flap gate is corroded but there is no significant section loss (Photo D19-13). The thimble is heavily corroded throughout. The gate seating face was not accessible for inspection.

### **Slide Gate**

The slide gate and thimble were installed in 1951 and are in a poor condition (Photo D19-15). The slide gate & thimble are heavily corroded with major section loss. Almost all the anchor bolts on the sides of the frame are sheared off. The other anchor bolts are heavily corroded with section loss. The gate seating face is rough and corroded.

The slide gate was operated to monitor the travel during the inspection and the gate lowered slowly and poorly. The operator shaft and guide mounts are heavily corroded with some section loss. The gate chamber concrete is in a good condition. There is some debris accumulated at the bottom of the gate chamber (Photo D19-17). The exterior of the above ground portion of the gate chamber is deteriorated and in a very poor condition (Photo D19-20).

## **2.5 ELECTRICAL CONDITION ASSESSMENT**

### **2.5.1 General**

The KGS Report, "Flood Control Adequacy Review Study", looked at 14 representative stations and examined the following electrical aspects of the flood pump stations. The study determined the existing motors, motor starters, main distributors, pump controls and SCADA System equipment were in acceptable condition and do not require major upgrade.

## **Main Service**

The main service (Manitoba Hydro) was found to be of adequate capacity. The only issue was the need for refurbishment of the ITE breakers. The breakers require refurbishment based on testing results (see Appendix F, ITE Breaker Investigation).

## **Flood Pump Motor Starters**

The motor starters for the pumps were also found to be in good condition and to provide reliable service. Although they are old, they are of heavy duty construction and experienced very little hours of use due to the nature of the FPS and spare parts are still available. Accordingly no remedial action is required for the starters.

## **Flood Pump Motors**

The report determined that the flood pump motors were also judged to be in acceptable condition with no major remedial action required. WWD has an ongoing program to upgrade the motor insulation on selected stations. Where moisture is present the existing insulation absorbs the moisture and reduces the motor insulation values. This requires drying out in the spring before use. The motors are removed and refurbished with a better quality insulation system. The costs for this ongoing program are not included in these estimates.

## **Flood Pump Controls**

The report determined the existing bubbler or ultrasonic level control systems were in adequate condition and did not require any major upgrade.

The dial up SCADA system was judged to be in good condition. WWD is considering a major upgrade of its SCADA system and the costs and scope would be handled as a separate project.

### **2.5.2 Lighting**

The interior lighting consists of incandescent bulb fixtures. These fixtures are not used frequently and as such would not normally be replaced on an energy conservation basis. There is, however, generally insufficient lighting in the drywell of the station. This is normally supplemented with trouble lights for specific tasks. The fixtures throughout the interior should generally be upgraded to modern sealed fluorescent fixtures. This will provide quality light with minimal maintenance and no requirements to connect extra lighting.

There is currently no exterior lighting. An upgraded facility would typically have several High Pressure Sodium (HPS) fixtures controlled via a photocell. This allows good security lighting for the building and generally low maintenance.

### **2.5.3 Controls**

The ultrasonic level control that starts and stops the pumps performs well and no significant problems have been encountered.

An RTU Communicates over a telephone line to the WWD SCADA Center. The FPS is polled in a regular schedule (8-15 min.) and reports back on an “exception” or “change of state” basis.

### 3.0 RECOMMENDED UPGRADES AND ESTIMATED COSTS

Recommended upgrades for each of the assessment areas; building and site, mechanical, geotechnical, substructure and gates, and electrical are described in Sections 3.1, 3.2, 3.3, 3.4 and 3.5 below. Estimated costs for the recommended upgrades and the basis for the estimates are summarized in Section 3.6 and the Detailed Cost Estimates are shown on Table B19.1.

#### 3.1 BUILDING AND SITE RECOMMENDED UPGRADES

The following repairs and upgrades are recommended, to accommodate the Mechanical upgrades, ensure uninterrupted performance of the station, extend the functional life of the station, and when possible reduce the level of upkeep maintenance required. Considering its location, general appearance and condition this station is not a priority for aesthetic upgrading. Criteria for the aesthetic upgrading is described in the Summary Report.

1. **Roofing** - Replace all metal trim with new prefinished metal equivalents. Remove the existing asphalt shingles and all associated components. Patch and repair existing roof structure and substrates as required. Install new high quality (30 year rating) asphalt shingles over a 2-ply nonperforated No.15 roofing felt underlayment. Install with prefinished metal drip flashings along all edges, and ice and water shield at eaves and valleys. Any wood blocking or sheathing used in the roofing replacement or repair shall utilize pressure treated material. Also replace all roof hatch covers with new units utilizing pressure treated lumber and plywood covered with a new prefinished metal pan flashing over a roofing felt underlayment.
2. **Roof Trim Repair Upgrade** – Remove all existing wood fascias and soffits panels. Install new pressure treated fascia and trim boards and cover with prefinished metal. Install new prefinished vented metal soffits panels and prefinished metal roof drainage components and trim.
3. **Exterior Siding Replacement** – Remove existing wood siding, trim and building paper to expose existing wood sheathing. In places where wall is rotting remove sheathing to inspect structural members and replace as required. Install a new nonperforated No.15 roofing felt or Tyvek moisture barrier over existing sheathing. Strap walls with pressure

- treated vertical wood strapping and install new wood siding over strapping. Provide appropriate flashing, closures and trim to create a rainscreen cladding installation. Paint new siding with a high quality breathable exterior paint finish system.
4. ***Installation of New Door or Separate Entrance to Sanitary Sewer Area*** – An allowance has been provided to minimize or completely eliminate the negative effects related to elevated humidity and/or odour, and the result increased extent and accelerated rate of damage to station components. Option one involves installation of a well sealed corrosion proof door between the flood pump station drywell and the sanitary station. If unsuccessful, option two involves a small building addition attached to the existing station building which will enclose a new access stair and opening into the sanitary chamber below grade (door from drywell would be infilled). Common to both options, any openings or hatches in the sanitary station floor would be sealed.
  5. ***Entry Door*** - Replace the existing entrance door and frame with new steel door and frame. Hardware would also be new and would include an exit (panic) device on the primary door. Patch and paint.
  6. ***Remove and In-fill Existing Windows*** – Remove the existing windows and window frames. In-fill opening with framing to match existing wall construction taking care to blend exterior components and finishes. In this case contrasting panels to mimic the appearance of windows may be desirable.
  7. ***Wall Opening(s) for Ventilation Upgrade*** - Rework existing exterior wood framed wall and exterior finish to facilitate the installation of cooling fan(s) and ventilation louver(s) as specified by Mechanical. See Mechanical section for ventilation requirements and associated costs to do this work.
  8. ***Wall Flashing*** - Install a new hot-dipped galvanized flashing along all brick wood framed walls supported directly on the surface of the discharge block or similar concrete chamber. The flashing should extend up at least three brick courses, terminate in a mortar joint and be sealed with joint sealant. The flashing should extend up at least 12” from the top of the horizontal slab and terminate behind the exterior siding and wall

moisture barrier. The siding should be removed for about 6" above the slab. The bottom shall extend outward over the concrete surface and be sealed to the concrete.

9. **Insulation Protection** - Install an approved thermal barrier over existing foamed plastic insulation in drywell.
10. **Drywell Access Stair Safety Upgrade** - Install bolt-on intermediate rail to stair landing guardrail in drywell.
11. **Site Regrading** – An allowance for the improvement of existing site drainage conditions. This would involve the lowering of the existing grade around the station building where required and the creation of a shallow drainage swale to direct surface run-off away from the building perimeter to the river.

## 3.2 MECHANICAL RECOMMENDED UPGRADES

### 3.2.1 General

This FPS would benefit from several mechanical upgrades. The following sections provide basic descriptions of these recommended measures. Criteria and background information regarding the rationale for the proposed upgrade measures are given in the Summary Report.

### 3.2.2 Ventilation

#### Drywell Ventilation

To bring the FPS into compliance with the WWD-specified criteria of 15 Air Changes per hour drywell ventilation rate, the existing ventilation arrangement will have to be revised. An arrangement that discharges approximately 1 500 cfm at ceiling level of the drywell and extracts at 1 600 cfm near the floor of the drywell would offer the most effective air transfer. This simultaneous supply and exhaust arrangement ensures that air changes are made at a known rate. A single fan arrangement can only dilute contaminated air, rather than provide direct air changes.

Both fans would be installed near the top of the building's exterior wall on the main floor of the FPS. The supply fan would draw air in through a louver and transfer it through ductwork to discharge the air at the top of the drywell. The exhaust duct would be located with its intake end 2 ft above the drywell floor and its discharge louver on the FPS main floor wall.

The existing drywell ventilation fan services both the sanitary and flood pump station sides. If these two are separated, it should be noted that a ventilation system will also be required for the sanitary side. It is assumed that the existing drywell ventilation fan will be used for this purpose. The cost estimate in this report does not include an allowance for a new sanitary drywell ventilation system.

### **Main Floor Cooling Ventilation**

The current cooling fan installed at this station is oversized and should be moved to the Clifton FPS. To provide station cooling during 90°F outdoor air temperatures and when both pumps are running, a new smaller cooling fan sized for 6 000 cfm should be installed. A vaneaxial fan mounted on a steel frame and equipped with a silencer is appropriate for this FPS. The 3 HP fan motor will be equipped with a VFD and controlled by a temperature sensor to modulate fan speed from 40 to 100%. Details describing the criteria for fan selection and sizing are contained in the Summary Report.

### **3.2.3 Piping**

#### **Shaft Seal Water Piping and Valves**

1. **Convert Copper Piping to PVC** – Aside from the copper piping at the entry point to the drywell and where the line ties-in to the pumps, the shaft seal water line has already been converted over to PVC.
2. **Replace Existing Valves** – The main line valves (strainer, check, solenoid, PRV, and gate valves) and the valves (swing check and gate valves) on the branch lines to the pumps should be considered for replacement as per the attached cost summary table (Table B19.1).

3. **Replace Copper Pipe at Drywell Entry Point** – The copper shaft seal water piping at the entry point to the drywell should be considered for replacement to prevent it from further surface corrosion resulting in major loss of material.
4. **Replace Copper Pipe at Tie-in to Pump(s)** - The sections of the copper shaft seal water line that tie-in to the pumps should be replaced to prevent them from further surface corrosion resulting in loss of base material and structural integrity. This section of pipe cannot be converted to PVC since it threads directly into a FNPT port on the pump.

### **Flood Pump Piping**

1. **Replace Flood Pump Pipe Victaulic Couplings and/or Flange Nuts and Studs** – The suction side flange nuts and studs on Pumps 46 and 47 should be replaced as well as the discharge side flange nuts and studs on Pump 47. Although this conclusion is not anticipated to change, the condition of the remaining victaulic couplings and flange hardware and their potential need for replacement should be re-evaluated in 8 to 10 years.
2. **Discharge Pipe Replacement** – Review of the ultrasonic test data indicates that discharge pipe replacement does not appear to be necessary for any of the pumps at this FPS. This assessment should be re-evaluated in 8 to 10 years with the benefit of another round of ultrasonic test data to be acquired at that time.

#### **3.2.4 Flood Pumps**

##### **Bearing Cover Hardware Replacement**

Several of the nuts and studs securing the bearing covers have experienced significant loss of material due to corrosion. The entire ring of nuts and studs on the bearing covers of Pumps 46 and 47 should be considered for replacement.

### **Packing Gland Cover Hardware Replacement**

The nuts and studs on the packing gland covers of the pumps do not need to be replaced. Although this conclusion is not anticipated to change, the condition of this hardware and its potential need for replacement should be re-evaluated in 8 to 10 years.

### **Packing Gland Cover Replacement**

The packing gland covers on the pumps do not need to be replaced. Although this conclusion is not anticipated to change, the condition of these covers and their potential need for replacement should be re-evaluated in 8 to 10 years.

Another set of ultrasonic test data should be acquired in five years to re-evaluate the results of this assessment.

### **Pump Bushing Clearance Assessment**

Vibration testing was performed at this station in April 2005. From this testing it was concluded that this assembly is in good condition on both pumps. For further details on the vibration test results please refer to "Pump Shaft Vibration Testing Report – Interim Report" in Appendix C.

#### **3.2.5 Line Shaft Assemblies**

Vibration testing was performed at this station in April 2005. From this testing it was concluded that the line shaft assemblies are in good condition. For further details on the vibration test results please refer to "Pump Shaft Vibration Testing Report – Interim Report" in Appendix C.

#### **3.2.6 Sandblasting and Painting**

As a minimum, the remaining copper pipe should be monitored for corrosion, although surface cleaning and painting of the piping would provide better long-term protection. Sandblasting and repainting of all the flood pumps, line shafts, suction and discharge piping corroded surfaces should be performed to extend the life of these components.

PPG Phillips and Carlson Sandblasting were asked to provide information on the ideal coating system that would provide a tough, long-lasting, corrosion resistant finish for these items. They have recommended that the following process and materials be utilized:

1. Initial stripping with paint stripper to remove as much lead based paint as possible. This should reduce the lead hazard enough that sandblasting could be done without the spent blast media being considered hazardous waste.
2. Sandblast any residual material to clean surfaces to base metal.
3. Apply one coat of zinc rich primer.
4. Apply one coat of high build epoxy primer.
5. Apply top coat.

Scaffolding or other means of providing access to line shafts and piping at higher levels will have to be setup as part of this work.

### **3.2.7 Monitoring**

#### **Ultrasonic Testing**

Review of the ultrasonic test data acquired in January 2005 suggests that the suction and discharge piping at this FPS should be placed on an ultrasonic monitoring program that has the FPS tested at approximately 10 year intervals. This approach will increase the probability that piping problems are detected before they can progress to a state where they could result in a line failure.

#### **Vibration Testing and Thermal Scanning**

Vibration testing and thermal scanning was performed at this FPS in April 2005 to detect any immediate problems and establish a baseline that future monitoring can be compared against. Vibration testing tends to reveal mechanical problems such as misaligned shafts and bearing faults. Thermal scanning will expose electrical issues that result in hotspots in the electrical components' infrared signature. These two measures are ongoing as a part of the work

program by KGS Group with the assistance of Motor Check Canada. Vibration Testing and Thermal Scanning are typically conducted during the same site visit.

In addition to the initial test that has been completed, an ongoing vibration testing and thermal scanning program should be initiated that has this FPS re-tested every 8 to 10 years.

### **3.3 GEOTECHNICAL RECOMMENDED UPGRADES**

#### **3.3.1 0 To 10 Year Upgrades**

To monitor the future extent and rate of the ongoing erosion above the existing riprap a detailed visual inspection of the riverbank conditions and internal inspection of the outfall pipe should be performed every five years. The results should be documented and summarized in a database format maintained by the City. The estimated cost to perform the monitoring is outlined below.

#### **3.3.2 Future (11 To 50 Year Upgrades)**

In addition to the monitoring recommended above, additional riprap erosion occurring protection should be placed along the top edge of bank during the remaining life of the station. This will improve the overall level of erosion protection at the site and reduce the potential for future bank loss and potential instability. Based on our experience additional riprap will also have to be placed within the river channel below the winter ice to offset the weight of riprap proposed for the top edge of bank. This will reduce the potential for shoreline instability caused by overloading the crest of the slope. The thickness and extent of the recommended riprap will have to be determined by detailed slope stability analysis.

The requirement for additional riprap is dependent on the future extent and rate of erosion at the site. To determine these parameters a visual inspection of the riverbank stability conditions plus internal inspection of the outfall pipe should be performed every five years for the remaining life of the station. The recommended monitoring program will help establish these parameters and assist with future planning and construction timing. Based on review of stereo aerial photography and comparison of the existing bank conditions to our previous 1995 assessment we anticipate the recommended riprap blanket will be required at the site beyond 10 years time.

### 3.4 SUBSTRUCTURE AND GATES RECOMMENDED UPGRADES

The following repairs and upgrades are recommended within the next 10 years to extend the functional life of the station. Criteria and background information related to the various recommended upgrades are described in the summary report. The estimated cost of the upgrades and their relative priority are summarized in Table B19.1.

1. **Grade Beams** - No repairs required.
2. **Hatch Covers** - No repairs required.
3. **Dry Well Beams** - No repairs required.
4. **Dry Well Walls** - Remove loose deteriorated concrete at spalled locations and along structural cracks. Inject structural cracks with epoxy resin and patch all repair areas with grout.
5. **Dry Well Floor** - Remove loose deteriorated concrete at spalled locations and along trenches chipped in floor. Prepare concrete surface and apply epoxy bonding agent. Cast new concrete floor topping with adequate slope to existing sump pit.
6. **Pump Bases** - Remove and replace any loose or fractured base plate grout.
7. **Discharge Box** - Remove loose deteriorated concrete at spalled locations and along structural cracks. Sandblast any exposed reinforcing steel and then patch repair areas with grout. Inject structural cracks with epoxy resin and patch with grout. Install new vents or reopen existing vents at the top of the exterior concrete walls to improve air circulation and reduce condensation on the interior surface of the walls. Removable covers could be installed over the vents to control odours during summer months as required.
8. **Stoplogs & Guides** – No repairs required.
9. **Flap Gate & Thimble** – No immediate repairs required. Flap gate and thimble will likely require replacement within 20 to 30 years.
10. **Slide Gate & Thimble** - Remove existing slide gate and frame. Wire brush clean and/or sandblast existing corroded thimble and apply new protective surface coating. Replace damaged wedge blocks, wedge bolts and sealing strips as required. Install new slide gate and frame complete with new anchor bolts.
11. **Gate Chamber Concrete** - Remove any accumulated debris from the base of the chamber.
12. **Access Platforms** - Install a new structural steel platform/catwalk to access the pump shaft guide mounts for regular mechanical maintenance. The platforms will be located at

the level of the existing intermediate concrete support beams and will be accessed from the existing stairway/ladder. Platforms will have a grated surface wide enough for one maintenance worker and will be equipped with standard handrails on each side.

13. **Wetwell Roof Slab and Beams** – Remove loose deteriorated concrete at spalled locations. Patch all repair areas with grout.
14. **Wetwell Walls and Columns** – Remove loose deteriorated concrete at spalled locations. Patch all repair areas with grout.
15. **Wetwell Intermediate Slab and Beams** – No repairs required.
16. **Wetwell Floor / Inlet and Outlet Culverts** – No repairs required.
17. **Wetwell Trashracks** – Trashracks to be cleaned, inspected, and minor repairs performed as required. Trashrack not properly seated against wall to be repaired.
18. **Wetwell Slide Gate, Shafts and Guides** – No repairs required.
19. **Wetwell Ladders and Railings** – Replace existing ladder with new.
20. **Additional Unidentified Scope Items** – Provide an allowance for miscellaneous structural items that may arise during the implementation of the upgrade program.

A brief inspection of the gates should be performed annually as part of the department's regular gate maintenance program. Specifically the condition of the anchor bolts and wedge bolts should be monitored and any sheared bolts replaced. Any accumulated debris that may interfere with the operation of the gates should be removed. A detailed condition assessment of the gates and substructure should be performed every 10 years for the remaining life of the station. An allowance for future upgrade costs beyond the initial 10 year program has been included in the tables.

### 3.5 ELECTRICAL RECOMMENDED UPGRADES

The interior and exterior lighting should be replaced/upgraded with other building upgrades. An allowance has been made to replace all lighting over the 50 year span as this typically exceeds the life-span of lighting fixtures.

An allowance has been made to refurbish the ITE breakers.

An allowance has been made for minor electrical items which will arise over the years (Minor conduit replacement etc.)

Electrical Costs associated with the mechanical items such as improved ventilation are included in the mechanical cost estimates.

There is no cost considered for thermal scanning, as costs for this task have been included with mechanical estimates and when performed on a regular basis should help avoid other larger electrical costs.

### **3.6 TOTAL ESTIMATED UPGRADE COSTS AND PRIORITIES**

#### **3.6.1 Total Estimated Costs**

The recommended upgrades, as shown in Table B19.1 and their estimated costs have been compiled by discipline; Building and Site, Mechanical, Geotechnical, Sub-Structure & Gates and Electrical. All of the costs shown are in 2005 dollars and have not been escalated for future costs (i.e. the 11 to 50 year cost estimates are still in 2005 dollars). These estimates include engineering, administration and contingencies. The recommended upgrades have been prioritized by the following categories:

- 0 to 5 year implementation
- 6 to 10 year implementation
- Future upgrades (i.e. 11 to 50 years)

Table B19.1 shows the estimated costs and priorities for the next 10 years (i.e. 2006 to 2016) as well as the cost estimated for the remaining 50 year life of the stations (i.e. 11 to 50 years). Total estimated costs for this station are as follows:

- |                 |           |
|-----------------|-----------|
| • 10 year       | \$495,950 |
| • 11 to 50 year | \$203,420 |

Priorities of very high, high, medium and low have been assigned to the 10 year cost estimates. These are shown on the cost estimate sheets and reflect the relative urgency of each of the work items. Items assigned a very high priority should be completed as soon as possible, high priority items within the next 1 to 3 years and medium priority items within the next 4 to 7 years. Low priority items should be addressed within the next 10 years.

In some cases, the future upgrades have been assigned a probability to reflect the uncertainty associated with the future need to undertake the work scope. The rationale for assigning probabilities to the future upgrades is described above and in the Flood Pumping Station Summary Report.

The future costs and their associated probabilities (where applicable) are shown in Table B19.1 for each of the individual station cost estimates.

### **3.6.2 Basis of Cost Estimate**

Building/superstructure costs are based on a combination of contractor estimate, past experience and recent tendered prices for similar work by the Water and Waste Department at the Flood Pump Stations.

Estimated mechanical costs include all labour and materials necessary to complete the work described for each item. Construction labour rates of \$50/hour have been applied in most cases with the exception of items such as Ultrasonic Testing and Sandblasting/Painting where labour has been rolled into a lump sum cost estimate provided by a contractor.

Geotechnical costs are based on recent construction tenders received for similar work and KGS Group experience in completing numerous riverbank monitoring and stabilization projects in Winnipeg. Similarly, substructure and gate cost estimates are based on contractor input, recent similar WWD project tender pricing, supplier quotations and KGS experience.

Cost associated with the substructure and gate upgrades are based on recent similar work by WWD, discussion with contractors familiar with work of this nature, supplier quotations and KGS Group experience.

Electrical cost estimates are based on engineering experience and costs provided by ABB.

An allowance of 20% of the total estimated construction costs for Engineering and Administration have been included. This estimate allows for final design work such as drawing production (where necessary) as well as materials or equipment selection and specification.

Contract Administration and technical assistance during the initial implementation phase are also included in this engineering allowance.

A 20% contingency has been considered in the estimate since the details of each implementation item are preliminary and could be affected by complications in the field and/or cost fluctuations of materials, equipment and labour. As well the contingency reflects the preliminary nature of the estimate at this stage and the fact that additional, minor, scope items will likely be added at the final design stage.

## 4.0 REFERENCES

### 4.1 REFERENCE REPORTS

1. 56th Canadian Geotechnical Conference 2003, Darren Yarechewski, UMA Engineering and Jeff Tallin, UMA Engineering, Riverbank Stabilization Performance with Rock-Filled Ribs/Shear Key and Columns.
2. A. Dean Gould ITL, 1980, Appendix 3 Report on Riverbank Stability at the Proposed Outfall in St. John's Park for the St. John's/Polson Sewer Relief Project Phase 1.
3. A. Dean Gould, P.Eng., January 1988, Report on Riverbank Stability Analysis Newton Avenue Outfall.
4. Baracos and Marantz, December 1956, Soil Mechanics Investigation Proposed Ash Street Pumping Station.
5. City of Winnipeg – Works & Operations Division, 1986, Basement Flooding Relief Program Review.
6. City of Winnipeg, 1989, City of Winnipeg Instruction Manual of Operations for Flood pumping Station (Orange Book).
7. Dillon Consulting Limited, 1983, Winnipeg Flood Protection – Volume 1 (High River Levels – Engineering Review).
8. Dyregrov & Burgess, August 1986, Geotechnical Report Cockburn Flood & Wastewater Power Station.
9. Geotewan Engineer, July 28, 1989, Geotechnical Investigation Hart Wastewater Pumping Station Upgrading.
10. Hardy BBT Limited, October 1991, Riverbank Pathway Between Mostyn Park & Cornish Avenue Geotechnical Feasibility Study.
11. KGS Group Letter/Report, June 29, 1989, Assiniboine River Walkway Geotechnical/Hydraulic Feasibility Study.
12. KGS Group Letter/Report, September 16, 2004, Proposed Transformer Installation Aubrey Street FPS Geotechnical Investigation and Riverbank Stability Assessment.
13. KGS Group Report, December 2003, 2003 Outfall Maintenance Program Dumoulin Outfall RR-58 Geotechnical Evaluation.
14. KGS Group, 2002, City of Winnipeg Flood Manual "Flood Pump Station Overview Report" (Appendix E) and data Sheets included in Appendix F.
  - Flood Pump Stations – Metric Geodetic – Baseline Data – Control Elevations
  - Flood Pump Stations – Metric Geodetic – Baseline Data – Station Elevations

- Flood Pump Stations – Metric Geodetic – Baseline Data – Pumps
  - Flood Pump Stations – Metric Geodetic – Baseline Data – Outfall & Miscellaneous
15. KGS Group, Report, December 2004, Granite Curling Club Riverbank Stability Evaluation.
  16. KGS Group, Report, June 29, 1990, Jessie FPS Riverbank Stability Study and KGS Group, Report, October 1991, Functional Design Report.
  17. Templeton Engineering Company, March 1975, Riverbank Stability Study at the Proposed Hawthorne Outfall Replacement
  18. UMA Engineering, December 1980, Geotechnical Evaluation for Slope Stabilization at Mager Drive.
  19. UMA Engineering, December 1995, Geotechnical Investigation for North West District Outfall Restriction St. John's Avenue Outfall.
  20. UMA Engineering, February 1986, Report on Proposed Outfall Repairs at Cornish Avenue & Clifton Avenue Sites.
  21. UMA Engineering, January 1989, Report on Geotechnical Investigations for the Polson Avenue and Armstrong Avenue Outfalls.
  22. UMA Engineering, March 1991, Geotechnical Investigation for the Syndicate Street Outfall.
  23. UMA Engineering, March 1991, Geotechnical Investigations for Selkirk Avenue Outfall.
  24. UMA Engineering, May 1990, City of Winnipeg Waterworks, Waste and Disposal Department Lyndale Drive Slope Stability Study.
  25. UMA Engineering, September 1990, Mager Drive Pumping Station Preliminary Slope Stability Investigation.
  26. UMA Letter Report, January 30, 1992, Selkirk FPS
  27. UMA Letter Report, July 25, 1991, Selkirk FPS
  28. UMA, January 1993, Jefferson Avenue Outfall

## 4.2 REFERENCE DRAWINGS

Author	Title	Year	Drawing
Greater Winnipeg Dyking Board	Linden & Dumoulin Pumping Stations	1951	2.00E+03
Greater Winnipeg Dyking Board	Linden Avenue Pumping Station	1951	3-SD-2-1, SD-2-2 & 2-SD-2-1
Greater Winnipeg Sanitary District	Linden Flood Pumping Station (East Kildonan) - Temporary Sewage Screen for 24" Pump	1952	M-174
Greater Winnipeg Sanitary District	Linden Flood Pumping Station (East Kildonan) - Temporary Sewage Screen for 30" Pump	1952	M-175
The Metropolitan Corporation of Greater Winnipeg Waterworks & Waste Disposal Division	Linden Outfall - Weir & Flap Gate	1965	S - 314
The City of Winnipeg, Works and Operations Division, North East District	Linden Avenue Outfall Concrete Removal and Rip-Rap	1993	NE - 1294
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Linden, Newton, Mission and Armstrong Flood Control Upgrading Project - Armstrong Gate Chamber Slide Gate & Flap Gate Installation, Arrangement & Concrete Outlines	1993	LD -1300, File #FP10409
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Linden, Newton, Mission and Armstrong Flood Control Upgrading Project - Miscellaneous Metal Details	1993	LD - 1302, File #FP10411
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Linden Flood Station Automatic Level Control and Alarm System - Wiring Diagram and Panel Layout	1994	49-FS-Q-1
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Linden Flood Station Automatic Level Control and Alarm System - Wiring Diagram and Panel Layout		45-FS-Q-1

## ANNEXES

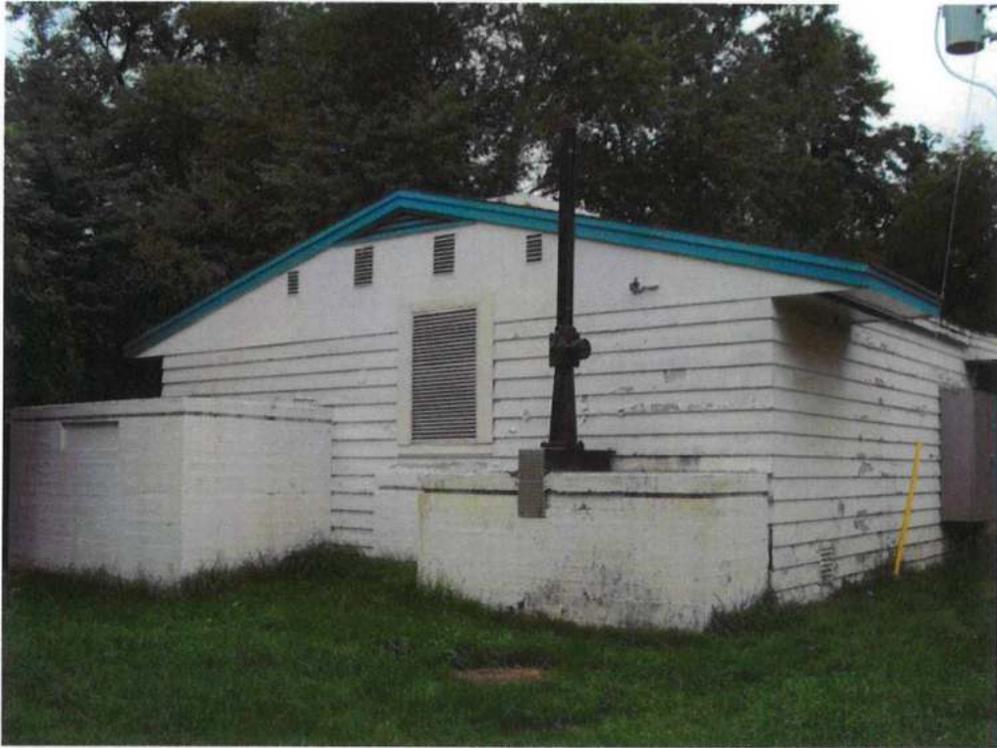
**ANNEX A19  
BUILDING AND SITE  
PHOTOS**



**PHOTO A19-1**  
**EAST SIDE**



**PHOTO A19-2**  
**SOUTH EAST CORNER - FLAKING PAINT**



**PHOTO A19-3**

**SOUTHWEST CORNER - FLAKING PAINT**



**PHOTO A19-4**

**WEST WALL TO GATE CHAMBER WATER DAMAGE**



**PHOTO A19-5**

**GATE CHAMBER ALONG WEST WALL CONCRETE CRUMBLING**



**PHOTO A19-6**

**ROOF - NORTH SIDE DISCHARGE BLOCK - DEADFALL AND VEGETATION**



**PHOTO A19-7**

**NORTH SIDE - LOOKING EAST - FLAKING PAINT**



**PHOTO A19-8**

**ROOF - SOUTHWEST CORNER - DETERIORATED SHINGLES**



**PHOTO A19-9**

**BUILDING INTERIOR - MOISTURE STAINING**



**PHOTO A19-10**

**WOOD FRAMED ROOF CONSTRUCTION**



**PHOTO A19-11**

**WOOD FRAMED ROOF CONSTRUCTION - GABLE VENTS**



PHOTO A19-12

MOISTURE STAINING/LEAKAGE ABOVE GATE CHAMBER

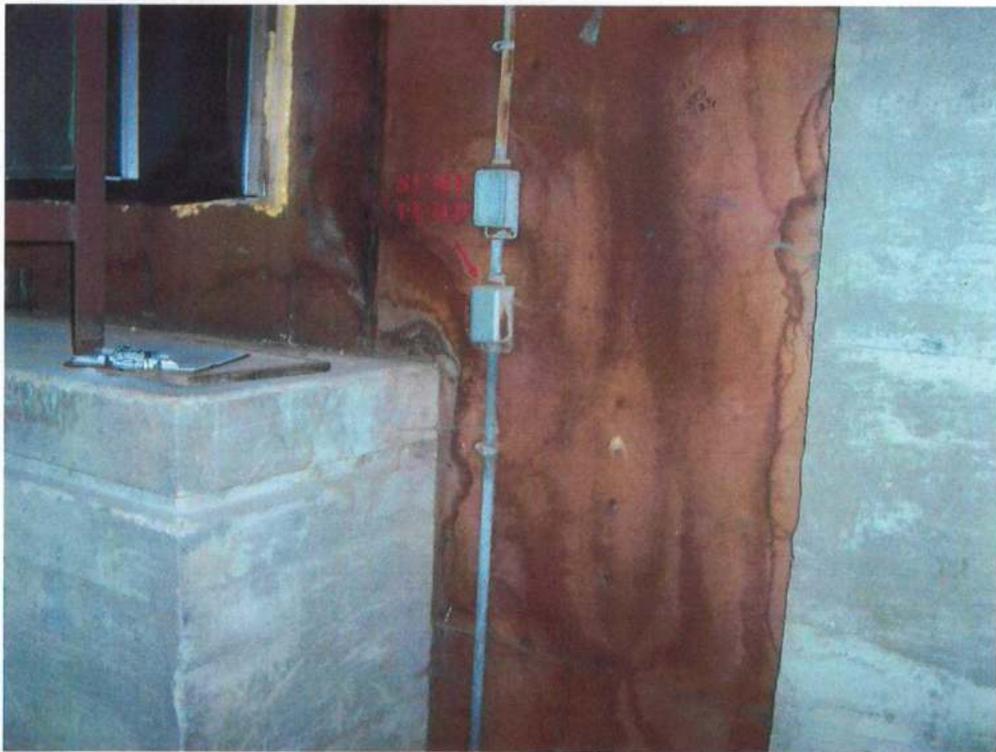


PHOTO A19-13

MOISTURE STAINING/LEAKAGE ABOVE AND BESIDE GATE CHAMBER

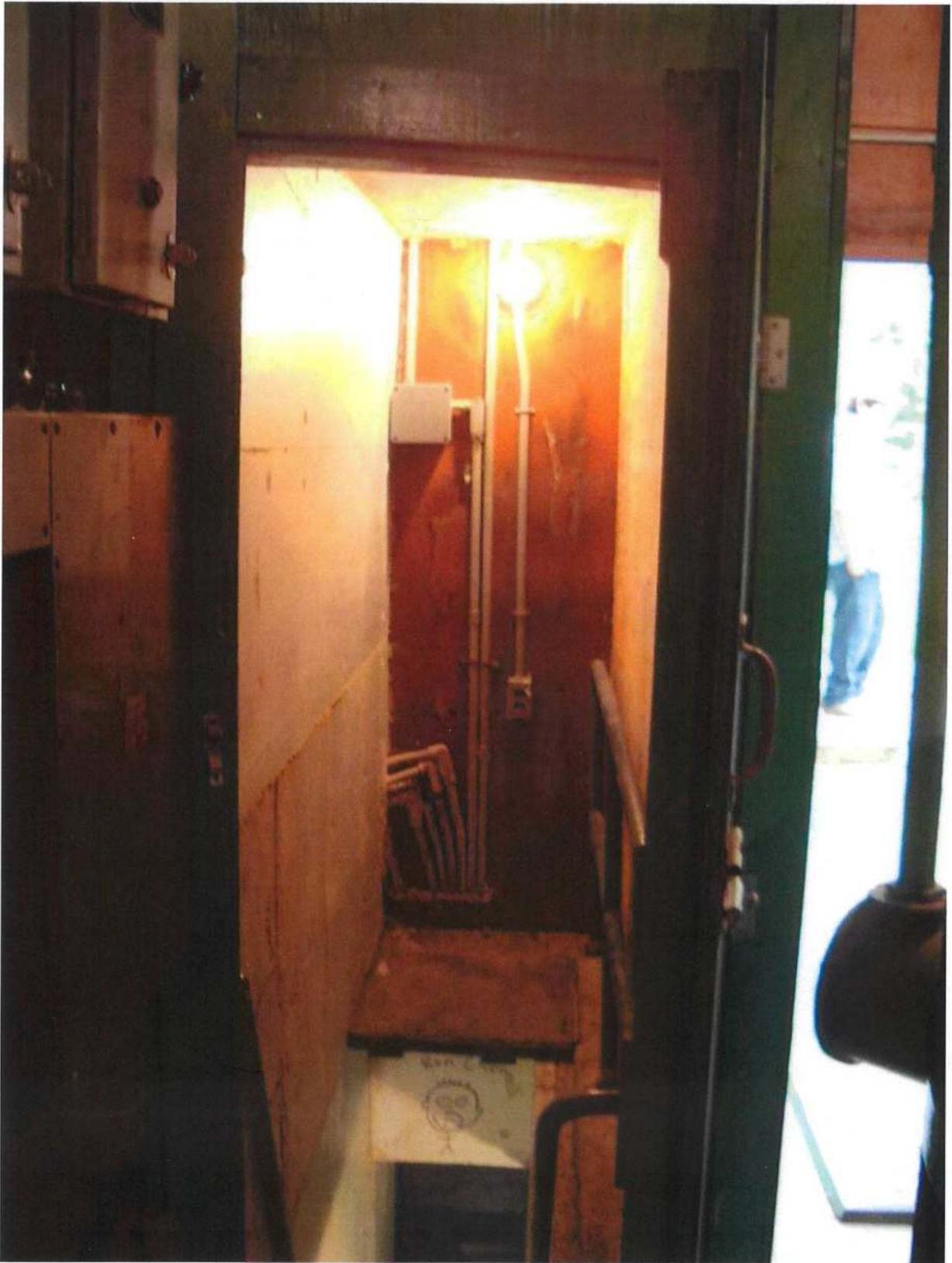


PHOTO A19-14

ACCESS TO DRYWELL



**PHOTO A19-15**

**DOORWAY FROM DRYWELL PLATFORM TO SANITARY SEWER AREA**

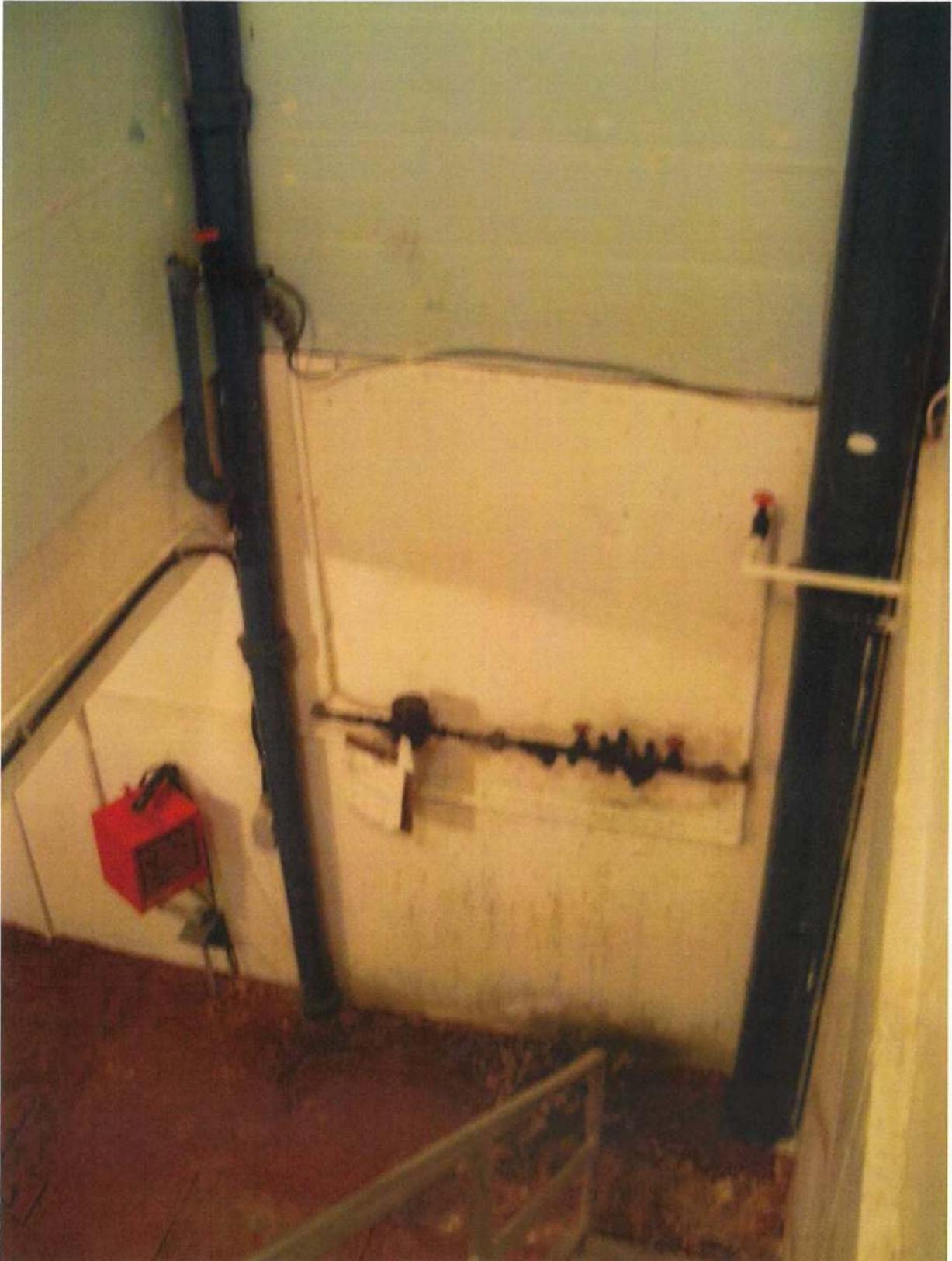


PHOTO A19-16

SANITARY SEWER AREA CHAMBER - FOAMED PLASTIC INSULATION



PHOTO A19-17

DRYWELL ACCESS STAIR AND PLATFORM



PHOTO A19-18

DRYWELL ACCESS LADDER FROM PLATFORM LEVEL - FOAMED PLASTIC INSULATION

**ANNEX A19  
BUILDING AND SITE  
DATA COLLECTION SHEETS  
AND TEST RESULTS**

**FLOOD PUMP STATION SITE INSPECTION  
BUILDING SUPERSTRUCTURE & BUILDING SITE  
DATA COLLECTION SHEET**

FPS NAME: Linden  
INSPECTION DATE: 15-Sep-04  
INSPECTOR: R. Nickel, KGS Group  
INSPECTION DATE: 26-Sep-06  
INSPECTOR: T. Froehlich (Re-inspection)

**BUILDING SUPERSTRUCTURE**

**EXTERIOR WALLS**

General Description	Wood Frame
Insulation	Not Insulated
Wall Thickness	150mm
Wall Height (Interior)	3100mm to u/s wood joists
Construction (Exterior to Interior)	Wood siding (painted) Building paper 20mm wood sheathing 38x89 wood studs @ 400 o/c 20mm wood sheathing Waxed paper vapour barrier 3mm hardboard
Condition (General)	Fair
Condition (Ext. Finish)	Poor
Condition (Int. Finish)	Poor / Unfinished / Moisture Stained
Comments	1. Average moisture stains on walls 2. Exterior siding in fair to poor condition - finish is poor - considerable flaking paint 3. West wall above gate chamber has moss growing at concrete to wall location. Gate chamber concrete is crumbling and in very poor condition

**ROOF**

General Description	Wood Framed
Roof Slope	3/12
Insulation	Not Insulated
Construction (Exterior to Interior)	Asphalt shingles 20mm wood sheathing 38x184 wood rafters @ 400 o/c (max.) 38x235 wood ceiling joists @ 400 o/c (max.) 200x250 timber beam 200x200 timber post
Condition (General)	Good
Condition (Int. Finish)	Good / Unfinished / Open
Comments	1. Minimal moisture staining 2. Triangular gable vent on east side 3. 4 rectangular gable vents on west side

**FLOOD PUMP STATION SITE INSPECTION  
BUILDING SUPERSTRUCTURE & BUILDING SITE  
DATA COLLECTION SHEET**

FPS NAME: Linden  
INSPECTION DATE: 15-Sep-04  
INSPECTOR: R. Nickel, KGS Group

Roof Weather Barrier Asphalt Shingles  
Last Replacement Unknown  
Condition (General) Poor / Replace

Comments

1. Well worn 3 tab shingles
2. Large areas without granules at eaves
3. Moss

Overhang (Width) <300mm / 900mm  
Soffits Vented / Unvented / Wood  
Soffit Finish Paint  
Condition (General) Poor  
Condition (Finish) Poor

Comments

1. Short sections of 900mm wide at corners - vented
2. 150mm wide at south and north - unvented
3. Flush on east and west sides

Fascia & Trim Wood  
Finish Paint  
Condition (General) Poor  
Condition (Finish) Poor

Comments

Roof Drainage Control None  
Material n/a  
Finish n/a  
Condition (General) n/a  
Condition (Finish) n/a

Comments

**EXTERIOR DOORS**

Door Construction Wood (solid core)  
Door Finish Paint  
Frame Construction Wood  
Framing Finish Paint  
Condition (General) Fair  
Condition (Finish) Poor

Comments

1. Exterior surface split
2. Finish is poor - Stripping and repainting required
3. Basic hardware - bolt and padlock

**FLOOD PUMP STATION SITE INSPECTION  
 BUILDING SUPERSTRUCTURE & BUILDING SITE  
 DATA COLLECTION SHEET**

FPS NAME: Linden  
 INSPECTION DATE: 15-Sep-04  
 INSPECTOR: R. Nickel, KGS Group

**WINDOWS**

General Description	Glass Block
Window Glazing	n/a
Framing Construction	Wood
Framing Finish	Paint
Condition (Glazing)	Fair
Condition (Framing)	Fair
Condition (Framing Finish)	Poor

Comments	<ol style="list-style-type: none"> <li>1. Grout joints between glass block cracking</li> <li>2. Repointing required</li> </ol>
----------	--

**INTERIOR WALLS**

General Description	Wood Frame
Construction (Exterior to Interior)	12mm plywood (painted) 38x89 wood studs @ 400 o/c 6mm plywood (painted)
Condition (General)	Fair
Condition (Finish)	Fair

Comments	<ol style="list-style-type: none"> <li>1. West wall above gate chamber has evident dark and white stains from water damage. Wall was not wet.</li> </ol>
----------	--

**INTERIOR DOORS**

Door Construction	Wood Frame and Plywood
Door Finish	Paint
Frame Construction	Wood
Framing Finish	Paint
Condition (General)	Good
Condition (Finish)	Fair

Comments	
----------	--

**FLOOD PUMP STATION SITE INSPECTION  
 BUILDING SUPERSTRUCTURE & BUILDING SITE  
 DATA COLLECTION SHEET**

FPS NAME: Linden  
 INSPECTION DATE: 15-Sep-04  
 INSPECTOR: R. Nickel, KGS Group

**INTERIOR FEATURES / SAFETY ISSUES**

Stairs	
Handrails	<ol style="list-style-type: none"> <li>Galvanized top rail only</li> <li>No hand clearance at foamed plastic insulation (both sides)</li> </ol>
Ladders	<ol style="list-style-type: none"> <li>Galvanized ships ladder to platform (grating) with caged ladder to drywell floor.</li> <li>Safety cage does not conform to current code</li> </ol>
Guardrails	<ol style="list-style-type: none"> <li>Painted steel guardrail around floor equipment hatch</li> </ol>
Floor Hatches	<ol style="list-style-type: none"> <li>Wood frame and plywood</li> </ol>
Foamed Plastic Insulation	<ol style="list-style-type: none"> <li>50mm extruded polystyrene insulation at drywell ceiling and upper 2.4m of upper walls. Fire hazard - high flame spread rating.</li> </ol>
Other	<ol style="list-style-type: none"> <li>Additional 100 square meters of foamed plastic insulation in sanitary sewer area</li> </ol>

**BUILDING SITE AND SECURITY**

**SITE PAVING**

Driveway Construction Condition	None n/a
Sidewalk Construction Condition	None n/a
Width x Length	n/a
Comments	

**FLOOD PUMP STATION SITE INSPECTION  
BUILDING SUPERSTRUCTURE & BUILDING SITE  
DATA COLLECTION SHEET**

FPS NAME: Linden  
INSPECTION DATE: 15-Sep-04  
INSPECTOR: R. Nickel, KGS Group

**SITE DRAINAGE** Poor

Comments

1. Site built up over years - approximately same level as main floor  
2. No evidence of rot along bottom of walls

**FENCING**

Fencing Function(s) n/a  
Fencing Construction None  
Fencing Finish n/a  
Condition (General) n/a  
Condition (Finish) n/a  
  
Height x Length n/a

Comments

**GENERAL SECURITY & VANDALISM**

General Site Security Open site  
  
Exterior Lighting  
Fixture Locations None  
Site Lighting Levels Poor  
Control n/a

Comments

Evidence of Graffiti

1. No

Evidence of Damage

1. No

Comments

1. Quiet neighbourhood

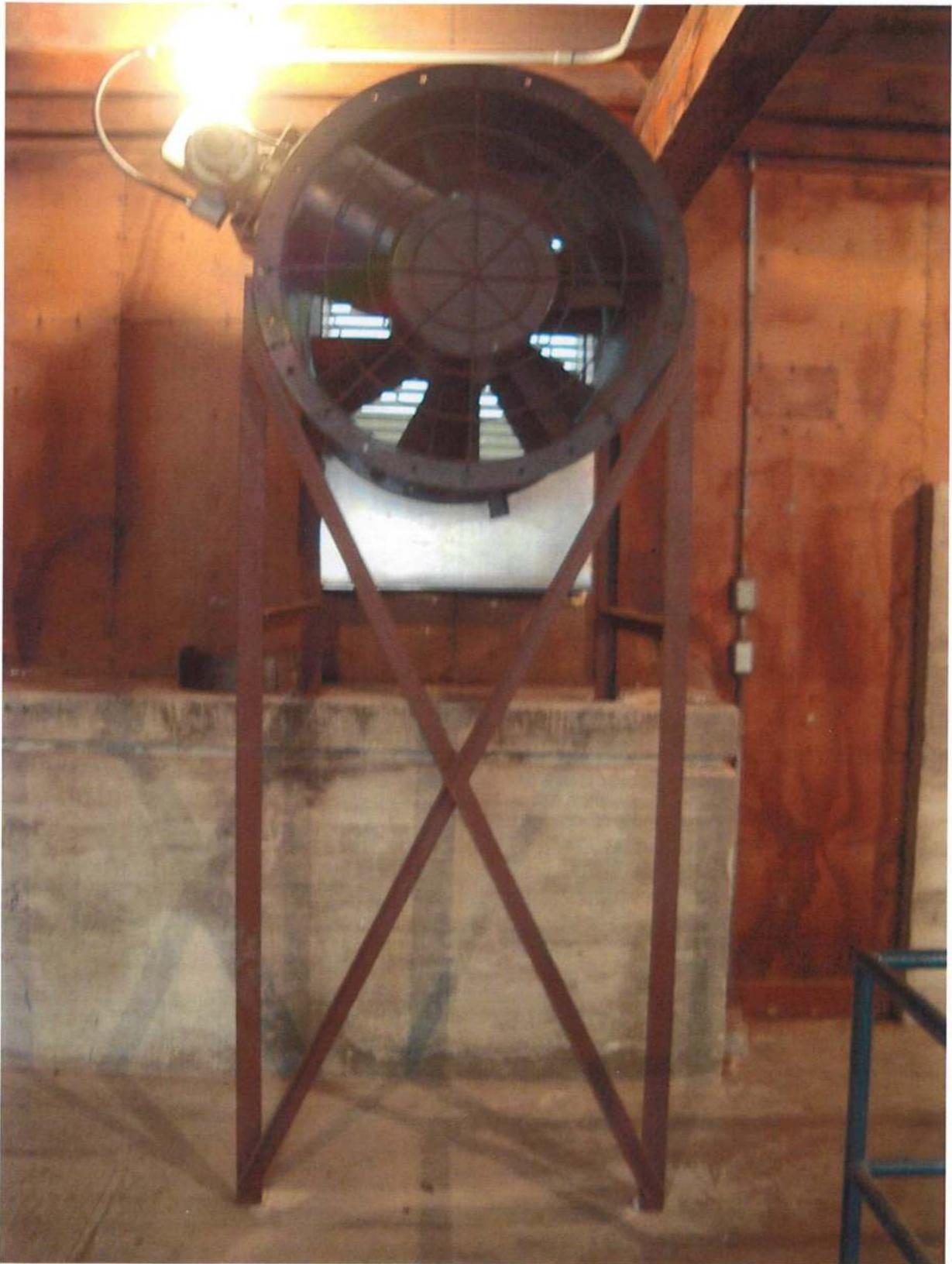
**FLOOD PUMP STATION SITE INSPECTION  
BUILDING SUPERSTRUCTURE & BUILDING SITE  
DATA COLLECTION SHEET**

FPS NAME: Linden  
INSPECTION DATE: 15-Sep-04  
INSPECTOR: R. Nickel, KGS Group

**GENERAL COMMENTS**

1. Station combined with sanitary sewer area - Minimal odour at time of site visit
2. More corrosion in drywell but not noticable in station building
3. Well painted solid wood door and frame separating sanitary area from drywell. Sanitary area accessible from upper level platform in drywell.
4. No weatherstripping around door to sanitary area
5. Station was reportedly painted approximately 5 years earlier at which time some rotten boards were replaced.
6. Siding in poor condition - large sections of multi-layer paint flaking

**ANNEX B19  
MECHANICAL  
PHOTOS**



**PHOTO B19-1**

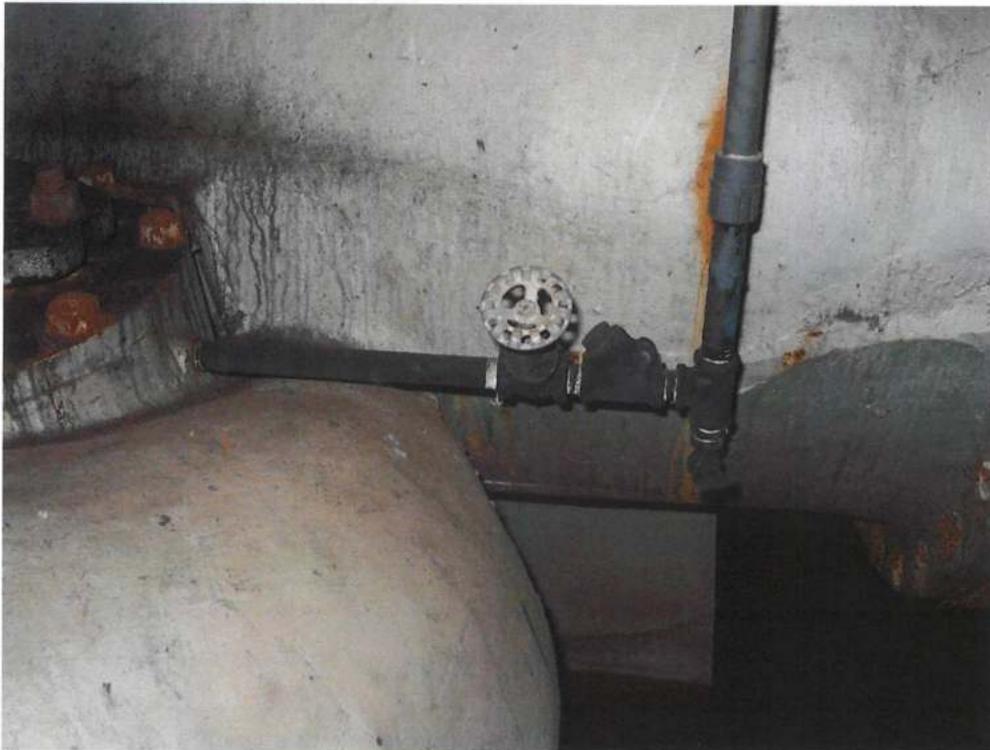
**COOLING FAN**





**PHOTO B19-4**

**PUMP 46 - CORROSION ON COPPER SHAFT SEAL WATER LINE**



**PHOTO B19-5**

**PUMP 47 - CORROSION ON COPPER SHAFT SEAL WATER LINE**



PHOTO B19-6

CORROSION ON PUMP 47 SUCTION LINE



PHOTO B19-7

CORROSION ON PUMP 46 DISCHARGE LINE



PHOTO B19-8

CORROSION ON PUMP 46 SUCTION LINE



PHOTO B19-9

CORROSION ON PUMP 47 DISCHARGE LINE



PHOTO B19-10

PUMP 46



PHOTO B19-11

PUMP 47



**PHOTO B19-12**

**PUMP 46 - CORROSION ON PACKING GLAND AND BEARING COVER'S NUTS AND STUDS**



**PHOTO B19-13**

**PUMP 47 - CORROSION ON PACKING GLAND AND BEARING COVER'S NUTS AND STUDS, COPPER SHAFT SEAL  
WATER LINE CORROSION**



**PHOTO B19-14**

**BASE OF PUMP 47 - CORROSION ON ANCHORING NUTS AND STUDS**



**PHOTO B19-15**

**CORROSION ON PUMP 47 DISCHARGE LINE**

**ANNEX B19  
MECHANICAL  
DATA COLLECTION SHEETS  
AND TEST RESULTS**

FLOOD PUMP STATION SITE INSPECTION  
 MECHANICAL EQUIPMENT AND SYSTEMS  
 DATA COLLECTION SHEET

FPS NAME: Linden  
 INSPECTION DATE: 15-Sept-2004  
 INSPECTOR: H. Williams, KGS Group

HVAC EQUIPMENT  
 Main Floor Cooling Fan

FAN DATA

Tag	
Make	Chicago Blower
Model No.	
Size	36-1/219 CI.1
Arrangement	9
Airflow	CFM
Pressure	in. w.g.
RPM	701
Serial No.	A14131-10
Date of Manufacture	
Type	Vaneaxial
Drive	Belt
Acoustic Lining	
Exhaust Orientation	
Installation Type	Permanent
Comments / Condition Assessment	
<ul style="list-style-type: none"> <li>• Vibration isolator at wall.</li> <li>• Fan noise is fairly loud behind the front (east side) of the station.</li> <li>• Fan is set up to draw air out of FPS.</li> <li>• This fan was previously configured to discharge on the east side of the FPS, this was later revised to the current (west side discharge) configuration to deal with noise concerns.</li> </ul>	

FAN MOTOR DATA

Tag		
Make	Baldor	
Model No.	L1410T	
Serial No.	F294	
HP	5	HP
RPM	1725	rpm
Volt	208	V
Phase	1	Ph.
Current Draw	25	amp
Freq.	60	Hz
Frame	184T	
Comments / Condition Assessment		
<ul style="list-style-type: none"> <li>• Service factor = 1.15</li> <li>• NEMA Nom. Eff. 82.5%</li> <li>• P.F. 87%</li> </ul>		

FLOOD PUMP STATION SITE INSPECTION  
 MECHANICAL EQUIPMENT AND SYSTEMS  
 DATA COLLECTION SHEET

FPS NAME: Linden  
 INSPECTION DATE: 15-Sept-2004  
 INSPECTOR: H. Williams, KGS Group

HVAC EQUIPMENT  
 Drywell Ventilation / Pressurization Fan

FAN DATA

Tag	
Make	Alpha Manufacturing Co.
Model No.	BF 1050
Size	
Arrangement	
Airflow	CFM
Airflow	Air Changes per Hour
Pressure	in. w.g.
RPM	
Serial No.	C 7618
Date of Manufacture	
Type	
Drive	Belt
Discharge Duct Dimensions	8 " diam.
Suction Duct Dimensions	10 " diam.
Comments / Condition Assessment	
<ul style="list-style-type: none"> <li>• Style HC GP.</li> <li>• Note that this fan has an 8" discharge duct that splits into two 8" ducts, one going to the FPS drywell and one to the sanitary drywell.</li> </ul>	

FAN MOTOR DATA

Tag		
Make	Emerson	
Type		
Model No.	SA SSNXTE-4494	
Serial No.		
Catalog No.		
HP	1/3	HP
RPM	1725	rpm
Volt	115	V
Phase	1	Ph.
Freq.	60	Hz
Current Draw	5.3	amps
Frame		
Max. Amb.	40	deg. C
Comments / Condition Assessment		
<ul style="list-style-type: none"> <li>• Service Factor = 1.35</li> </ul>		

DRYWELL SIZE

Height	21.25	ft.
Length	21.7	ft.
Width	13	ft.
Diameter		ft.
Volume	5985	ft <sup>3</sup>

FLOOD PUMP STATION SITE INSPECTION  
 MECHANICAL EQUIPMENT AND SYSTEMS  
 DATA COLLECTION SHEET

FPS NAME: Linden  
 INSPECTION DATE: 15-Sept-2004  
 INSPECTOR: H. Williams, KGS Group

HVAC EQUIPMENT  
 Heating

DRYWELL HEATER

Tag		
Make	Stelpro	
Model No.	PCH4800T	
Serial No.		
Input	4.8	kW
Output		kW
Volt	240	V
Phase	1	Ph.
Freq.	60	Hz
Current Draw	20	amps
Date	January 26, 2000	
Comments / Condition Assessment		
<ul style="list-style-type: none"> <li>• Coil is corroding.</li> <li>• Aluminum fan blades are not corroding but are dirty.</li> </ul>		

MAIN FLOOR HEATER

Tag		
Make		
Model No.		
Serial No.		
Input		kW
Output		kW
Volt		V
Phase		Ph.
Freq.		Hz
Current Draw		amps
Date		
Comments / Condition Assessment		
<ul style="list-style-type: none"> <li>• No main floor heater installed at this station.</li> </ul>		

PIPING

Shaft Seal Piping

(see data summary for condition ratings)

Main or Pump Branch Service	Pipe Size [inch]	Pipe Condition	Valve Condition	Paint Condition	Joint Condition
Main (see comment 1)	3/4	Good	Surface corrosion on solenoid and pressure reducing valves. Gate valve body and stem are corroded.	PVC (unpainted)	Threaded teflon in good condition.
Main	3/4	Heavy surface corrosion.	Heavy surface corrosion on gate and check valves and strainer.	Copper (unpainted)	Threaded teflon corroded (is located in sanitary drywell).
Main	3/4	Good	N/A	PVC (unpainted)	Cement in good condition.
Branch to Pumps 46 and 47	1/2	Good	N/A	PVC (unpainted)	Cement in good condition.
Branch to Pumps 46 and 47	1/2	Surface corrosion has turned pipe black.	Gate and check valves have turned black due to surface corrosion.	Copper (unpainted)	Threaded teflon OK. Joint to packing gland in good condition.

Comments

1. Strainer, check, and gate valve assembly are not located in FPS drywell, they are in the sanitary station drywell (just solenoid valve and pressure reducing valve are in FPS drywell).
2. Surface cleaning required for all copper pipes and brass valves – also monitor progression of corrosion.
3. Copper tube for pressure switch is badly corroded and cover for pressure switch has been left off.
4. Note that there is a gate valve installed in the drywell wall to the right of pump P46 that is used to drain groundwater from in between the drywell and wetwell interstitial space. This valve is opened periodically by maintenance crews. This interstitial water is likely the source of seepage at the base of the drywell.

FLOOD PUMP STATION SITE INSPECTION  
 MECHANICAL EQUIPMENT AND SYSTEMS  
 DATA COLLECTION SHEET

FPS NAME: Linden  
 INSPECTION DATE: 15-Sept-2004  
 INSPECTOR: H. Williams, KGS Group

Flood Pump Piping  
 (see data summary for condition ratings)

Pump Tag	Pipe Size [inch]	Pipe Condition	Valve Condition	Paint Condition	Joint Condition
46 Suction	24	Surface corrosion at base.	N/A	Poor at rust but otherwise fair.	Nuts and bolts are rusting at flange. Surface corrosion on victaulic coupling and at flange.
46 Discharge	24	Heavy surface corrosion (especially at underside of pipe).	N/A	Poor – was painted over rust with no surface prep.	Flange in good condition. Victaulic coupling and flange nuts and bolts have surface corrosion
47 Suction	30	Heavy surface corrosion at the base.	N/A	Poor at rust but otherwise in good condition.	Surface corrosion at victaulic coupling and flange nuts and bolts.
47 Discharge	30	Heavy surface corrosion (especially at underside of pipe).	N/A	Poor – was painted over rust with no surface prep.	Flange in good condition. Victaulic coupling and flange nuts and bolts have surface corrosion.

Comments

- 47 suction has very bad surface corrosion and a lot of material loss at the base. The nuts and bolts at the base flange are very corroded. Corrosion is also bad where packing gland drips over the side of bowl and down suction pipe.
- Suctions, pumps and discharges need cleaning and paint, special attention to discharges and especially #47 suction (ultrasonic test) since these have such heavy corrosion damage.
- Blind flanged "spare" suction is corroding and should be cleaned and painted.

FLOOD PUMP STATION SITE INSPECTION  
 MECHANICAL EQUIPMENT AND SYSTEMS  
 DATA COLLECTION SHEET

FPS NAME: Linden  
 INSPECTION DATE: 15-Sept-2004  
 INSPECTOR: H. Williams, KGS Group

FLOOD PUMP SYSTEMS

PUMP DATA

Tag	46
Make	Manitoba Bridge and Engineering Works
Model No.	
Order No.	
Size	24
Arrangement	
Flow	gpm
TDH	ft
RPM	
Serial No.	
Date of Manufacture	
Type	
Shaft Seal Packing Material	
Comments / Condition Assessment	
<ul style="list-style-type: none"> <li>Nameplate is too corroded to read.</li> <li>Packing gland and stuffing box cover have minor surface corrosion and nuts and bolts are also corroding.</li> <li>Packing gland black rope has discolored surface and bowl.</li> <li>Surface cleaning and paint is necessary on packing gland cover, stuffing box cover and bowl.</li> <li>Packing gland is not leaking.</li> </ul>	

PUMP MOTOR DATA

Tag	46	
Make	English Electric Co. of Canada Ltd.	
Model No.		
Type		
Serial No.	183028	
HP	125	HP
RPM	695	rpm
Volt	550	V
Phase	3	Ph.
Freq.	60	Hz
Current Draw	126	amp
Amps per Terminal		amp
Frame	V-125.5-A	
Temp. Rise	40	deg. C
Brg PE/Drive end Grease	6320	every 12 months
Brg OE/Opposite end Grease	926710/40	every 12 months
Duty	Cont.	
Duty	% load every	hours
Comments / Condition Assessment		

FLOOD PUMP STATION SITE INSPECTION  
 MECHANICAL EQUIPMENT AND SYSTEMS  
 DATA COLLECTION SHEET

FPS NAME: Linden  
 INSPECTION DATE: 15-Sept-2004  
 INSPECTOR: H. Williams, KGS Group

FLOOD PUMP SYSTEMS

PUMP DATA

Tag	47
Make	Manitoba Bridge and Engineering Works
Model No.	
Order No.	
Size	30"
Arrangement	
Flow	gpm
TDH	ft
RPM	
Serial No.	
Date of Manufacture	
Type	
Shaft Seal Packing	
Material	
Comments / Condition Assessment	
<ul style="list-style-type: none"> <li>Nameplate is too corroded to read.</li> <li>Packing gland and stuffing box cover have minor surface corrosion and nuts and bolts are also corroding.</li> <li>Packing gland black rope has discolored surface and bowl.</li> <li>Surface cleaning and paint is necessary on packing gland cover, stuffing box cover and bowl.</li> <li>Packing gland is not leaking.</li> </ul>	

PUMP MOTOR DATA

Tag	47	
Make	English Electric Co. of Canada Ltd.	
Model No.		
Type		
Serial No.	183048	
HP	175	HP
RPM	580	rpm
Volt	550	V
Phase	3	Ph.
Freq.	60	Hz
Current Draw	175	amp
Amps per Terminal		amp
Frame	V-125.5-C	
Temp. Rise	40	deg. C
Brg PE/Drive end Grease	6320	every 6 months
Brg OE/Opposite end Grease	926710/40	every 6 months
Duty	Cont.	
Duty	% load every	hours
Comments / Condition Assessment		

FLOOD PUMP STATION SITE INSPECTION  
 MECHANICAL EQUIPMENT AND SYSTEMS  
 DATA COLLECTION SHEET

FPS NAME: Linden  
 INSPECTION DATE: 15-Sept-2004  
 INSPECTOR: H. Williams, KGS Group

FLOOD PUMP SYSTEMS  
 Wetwell Level Control System

Type	Ultrasonic	
Compressor Make		
Model No.		
Serial No.		
Motor HP		
Motor RPM		
Date of Manufacture		
Airflow	scfm @	psi
Max. Pressure	Psi	
Ultrasonic Controller Make Milltronics Multiranger Plus		
Tag	CF-149-LIT	
Model No.		
Serial No.		
Date of Manufacture		
Level Transmitter Make		
Tag		
Model No.		
Serial No.		
Calibration	inches H <sub>2</sub> O	
Output		
Supply	VDC max.	
Max. W.P.	Psi	
Pressure Switch Make		
Tag		
Model No.		
Type		
Serial No.		
Range	Psi	
Differential	Psi	
Supply	Amps	VDC
Enclosure Type		
Constant Differential Relay Make		
Tag		
Model No.		
Pressure Reg. Valve Make		
Tag		
Model No.		
Serial No.		
Range	Psi	recommended
Range	Psi	actual
Comments / Condition Assessment		

FLOOD PUMP STATION SITE INSPECTION  
 MECHANICAL EQUIPMENT AND SYSTEMS  
 DATA COLLECTION SHEET

FPS NAME: Linden  
 INSPECTION DATE: 15-Sept-2004  
 INSPECTOR: H. Williams, KGS Group

PHOTOS

	Acquired
<b>DRYWELL PHOTOS</b>	
Drywell Heater & Elec. Connection	✓
Sump Pump Connection in Drywell	✓
Drywell Ventilation Fan Discharge Duct	✓
Drywell Overall Shot from Bottom of Well	✓
Drywell Overall Shot from Top of Well	✓
Drywell Insulation	✓
Drywell Lighting	✓
Pump(s)	✓
Pump Suction(s)	✓
Pump Discharge(s)	✓
Shaft Seal Main Piping	✓
Shaft Seal Branch Piping to Pump(s)	✓
Shaft Seal Branch Piping at Packing Gland(s)	✓
Electrical Conduit Condition	✓
Wall Condition	✓
Floor Condition	✓
Bearings	✓
Guardrail / Ladder	✓
<b>MAIN FLOOR INDOOR PHOTOS</b>	
Cooling Fan & Motor	✓
Cooling Fan Ductwork	✓
Drywell Ventilation Fan & Motor	✓
Drywell Ventilation Ductwork	✓
Main Floor Heater	—
Motor(s)	✓
Motor Shaft Connection(s) to Pump	✓
Distribution Panel Schedule	✓
Interior Lighting	✓
Bubbler or Ultrasonic Control	✓
General Telephone Entrance	✓
Interior Shots Summarizing All Walls	✓
Interior Shot of Ceiling / Roof Structure	✓
<b>OUTDOOR PHOTOS</b>	
Overall "Title Page Shot" of Exterior	✓
Exterior Shots Summarizing All Walls	✓
Exterior Shots Summarizing Station Surroundings	✓
Exterior Shots (from ladder) of Flat Rooftop	—
Typical Exterior Light	—
Air Intakes	✓
Padmount / Poletop Transformer	✓

FLOOD PUMP STATION SITE INSPECTION  
MECHANICAL EQUIPMENT AND SYSTEMS  
DATA COLLECTION SHEET

FPS NAME: Linden  
INSPECTION DATE: 15-Sept-2004  
INSPECTOR: H. Williams, KGS Group

FPS NAME: LINDEN	MAIN PUMP	46	47	#	#	#	#	TOTAL / SUMMARY (NOT INCL. D/W)	COMMENTS
MOTOR HP		125	175					300	HP
PACKING GLAND COVER		C2	C2					C2	
PACKING GLAND COVER NUTS & BOLTS CORROSION		C3	C3					C3	
BEARING NUTS & BOLTS COVER		C4	C4					C4	
SHROUD NUTS & BOLTS CORROSION		NA	NA					NA	
PUMP BOWL PAINT		P2	P2					P2	
FLOOD PUMP PIPING									
SUCTION									
MATERIAL		D.I.	D.I.					D.I.	
CORROSION		C3	C4					C3-C4	
PAINT		P3	P5					P3-P5	
DISCHARGE									
MATERIAL		C.S.	C.S.					C.S.	
CORROSION		C4	C4					C4	
PAINT		P5	P4					P4-P5	
JOINT CORROSION									
SUCTION PIPE FLANGED		C4	C4					C4	
SUCTION PIPE VICTAULIC		C3	C3					C3	
DISCHARGE PIPE FLANGED		C1	C4					C1-C4	
DISCHARGE PIPE VICTAULIC		C1	C2					C1-C2	
SHAFT SEAL WATER PIPING									
PIPING									
MATERIAL	PVC/CU	PVC/CU	PVC/CU					PVC/CU	Valve cluster piping, is mostly located in sanitary drywell.
CORROSION	C5	C4	C4					C4-C5	Pipe is mostly PVC except minor portions of main line
PAINT	PVC/CU	PVC/CU	PVC/CU					PVC/CU	valve cluster and at final tie-in to pumps.
JOINTS									
TYPE	CEM/THRTEF	CEM/THRTEF	CEM/THRTEF					CEM/THRTEF	
CORROSION	C5	C3	C3					C3-C5	
CONDITION	J3	J3	J3					J3	
VALVES									
CONDITION	C5	C4	C4					C4-C5	Note strainer/check valve/assembly is located in sanitary drywell and is corroding.

FLOCCO PUMP STATION SITE INSPECTION  
MECHANICAL EQUIPMENT AND SYSTEMS  
DATA COLLECTION SHEET

FPS NAME: Linden  
INSPECTION DATE: 15-Sept-2004  
INSPECTOR: H. Williams, KGS Group

JOINT CONDITION DEFINITIONS	JOINT TYPES	MATERIALS	CORROSION DEFINITIONS	PAINT CONDITION DEFINITIONS
J0 - Joint is like new, excellent seal	VIC - Victaulic Coupling	D.I. - Ductile Iron	C0 - No Corrosion - Surface is in like new condition	J0 - Joint is like new, excellent seal
J1 - Joint is good but not optimal	FLG - Flanged Connection	C.S. - Carbon Steel	C1 - Very minor surface corrosion - Cross section is barely affected but minor corrosion is visible	J1 - Joint is good but not optimal
J2 - Joint seal (solder/cement/teflon/threads) is slightly worn, corroded or damaged	THR - Threaded	Cu - Copper Pipe / Tubing	C2 - Minor Surface Corrosion - Cross section is slightly affected, corrosion is visible.	J2 - Joint seal (solder/cement/teflon/threads) is slightly worn, corroded or damaged
J3 - Joint seal (solder/cement/teflon/threads) is visibly worn, corroded or damaged, but not leaking	THR/TEF - Threaded w/ Teflon Tape	PVC - PVC Pipe	C3 - Surface Corrosion - Cross section is affected, corrosion is clearly visible.	J3 - Joint seal (solder/cement/teflon/threads) is visibly worn, corroded or damaged, but not leaking
J4 - Joint condition may be the cause of periodic leakage	SOL - Soldered	RR - Red Rubber Hose	C4 - Advanced Surface Corrosion - Cross section is decreasing, structural integrity is still acceptable.	J4 - Joint condition may be the cause of periodic leakage
J5 - Joint has a definite small leak	CEM - PVC Cement		C5 - Heavy Surface Corrosion - Due to loss of base material, structural integrity is questionable.	J5 - Joint has a definite small leak
J6 - Joint has a definite large leak	CLMP - Double Hose Clamp		C6 - Extreme Surface Corrosion - Major corrosive loss with rust-through at a minimum of one location.	J6 - Joint has a definite large leak

**ANNEX D19  
SUBSTRUCTURES AND GATES  
PHOTOS**



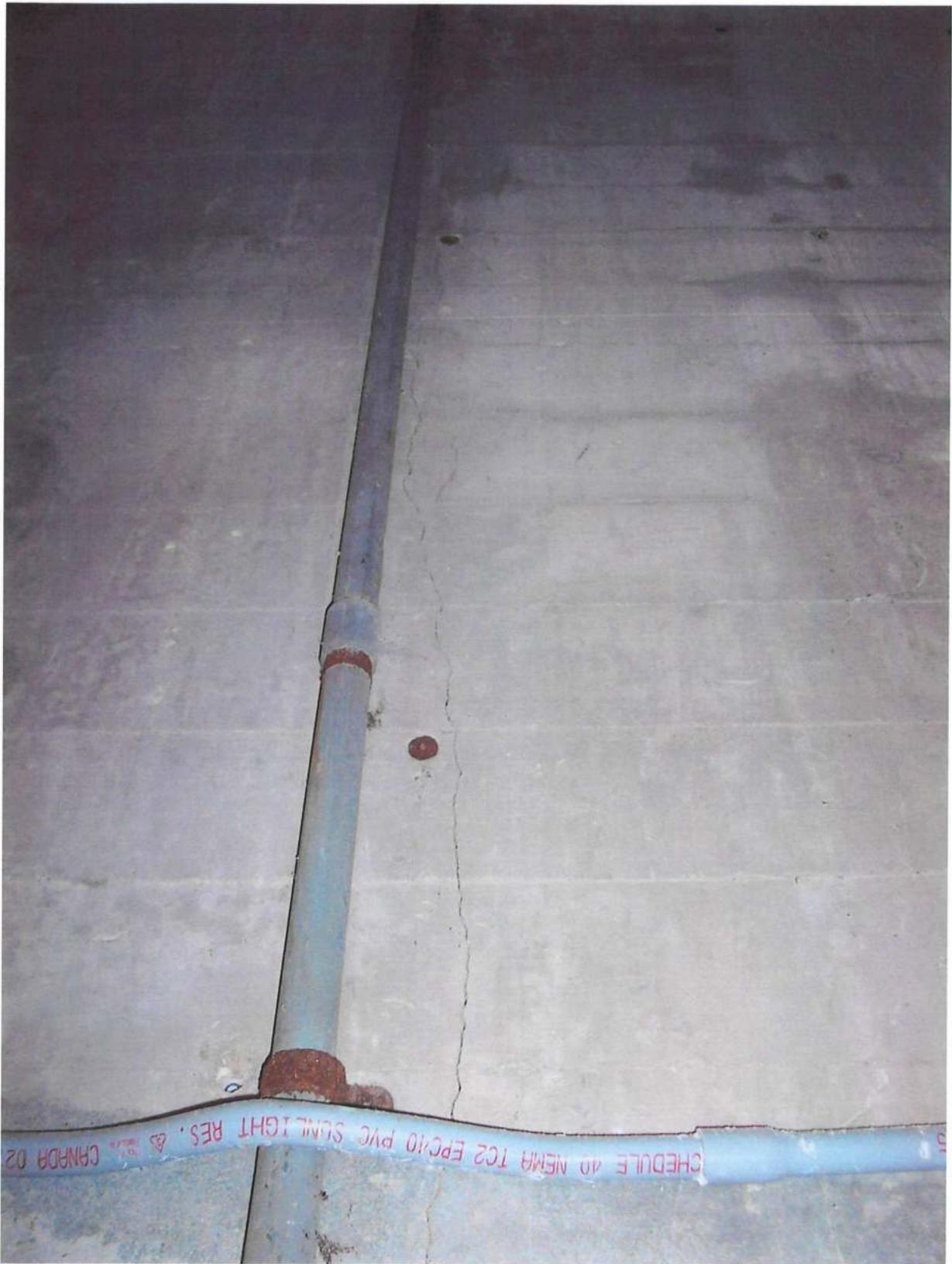
**PHOTO D19-1**

**SHAFT MOUNTS - BASE-PLATE AND ANCHOR BOLTS CORRODED (GROUT PAD GOOD CONDITION)**



**PHOTO D19-2**

**INTERMEDIATE CONCRETE BEAM (DRY WELL) - EXPOSED REINFORCING STEEL (CORRODED)**



**PHOTO D19-3**

**DRY WELL WALLS - VERTICAL CRACKS**



**PHOTO D19-4**

**DRY WELL WALLS - SNAP TIES CORRODED, MULTIPLE PATCHED AREAS AND MULTIPLE STAINS**



**PHOTO D19-5**

**DRY WELL FLOOR SLAB - JACKHAMMERED TRENCH**



**PHOTO D19-6**

**PUMP BASE - BASE PLATE AND ANCHOR BOLTS SURFACE CORROSION (PITTING)**



**PHOTO D19-7**

**PUMP BASE - GROUT PAD SHOULDERS CRACKING AND SPALLING**



PHOTO D19-8

PUMP FLANGE BOLTS - SECTION LOSS



PHOTO D19-9

DISCHARGE BOX ROOF (SLAB) - EXPOSED REINFORCING STEEL (CORRODED)



**PHOTO D19-10**

**DISCHARGE BOX WALLS - SNAP TIES CORRODED AND CRACKS**



**PHOTO D19-11**

**DISCHARGE BOX - WOODEN TRIANGULAR INSERT AND GUIDES CORRODED**



PHOTO D19-12

DISCHARGE BOX - TOP OF WINDOW FRAME OPENING EXPOSED REINFORCING STEEL (CORRODED)

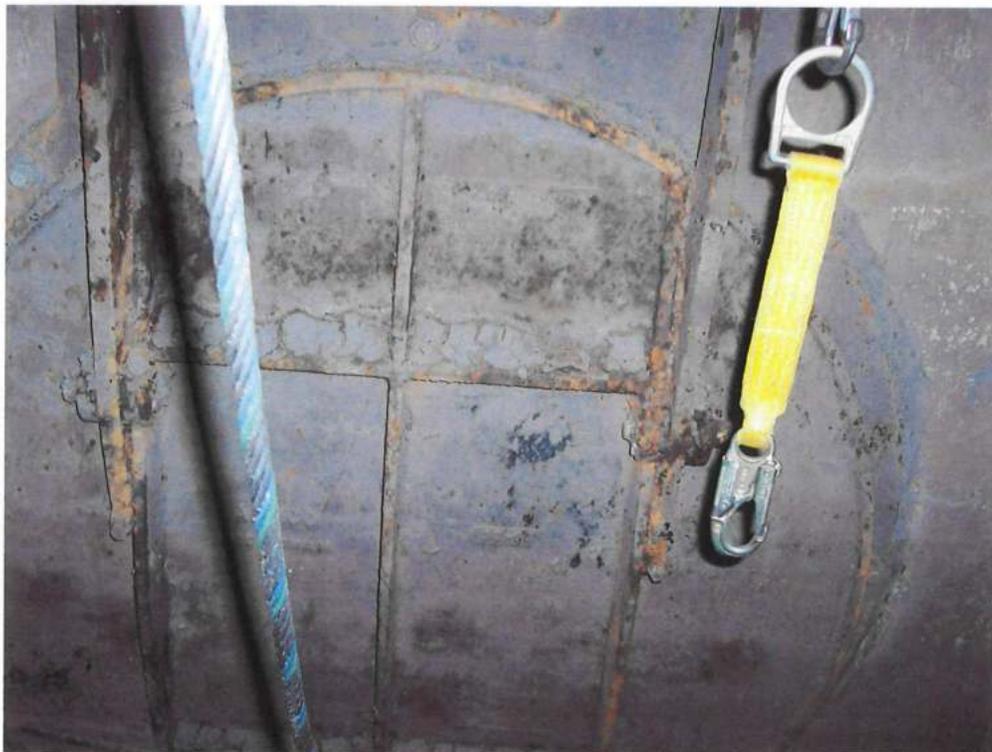


PHOTO D19-13

FLAP GATE - SURFACE CORROSION ON EDGES



PHOTO D19-14

FLAP GATE - PIVOT LUG AND LINK SURFACE CORROSION/ ANCHOR BOLTS MINOR CORROSION



PHOTO D19-15

SLIDE GATE - HEAVY SECTION LOSS



PHOTO D19-16

SLIDE GATE - HEAVY SECTION LOSS



PHOTO D19-17

CONCRETE GATE CHAMBER - DEBRIS



**PHOTO D19-18**

**SLIDE GATE SHAFT - HEAVY SECTION LOSS**



**PHOTO D19-19**

**SLIDE GATE FRAME - HEAVY SECTION LOSS AND ANCHOR BOLTS SHEARED OFF**



PHOTO D19-20

WET WELL ROOF - SPALLING WITH EXPOSED REBAR



PHOTO D19-21

WET WELL WALLS - EXPOSED REBAR



PHOTO D19-22

WET WELL WALLS - SPALLING WITH EXPOSED REBAR



PHOTO D19-23

WET WELL WALLS - VERTICAL CRACK



PHOTO D19-24

WET WELL LADDER - CORRODED



PHOTO D19-25

WET WELL LADDER - CORROSION WITH SECTION LOSS



**PHOTO D19-26**

**WET WELL TRASHRACKS - GOOD CONDITION**



**PHOTO D19-27**

**WET WELL TRASHRACKS - NOT SEATED AGAINST WALL**



**PHOTO D19-28**

**WET WELL FLOOR AND INLET - SPALLING**

**ANNEX D19  
SUBSTRUCTURES AND GATES  
DATA COLLECTION SHEETS  
AND TEST RESULTS**

**FLOOD PUMP STATION SITE INSPECTION  
SUBSTRUCTURE & GATES  
DATA COLLECTION SHEET**

FPS NAME: Linden  
 INSPECTION DATE: 01-Dec-04  
 INSPECTOR: Andi Bogdanovic  
 Jarod Bosco  
 KGS Group

**SUBSTRUCTURE**

**MAIN FLOOR SLAB**

General Description Concrete  
 Condition (General) Good  
 Cracking Minor cracks  
 Spalling No  
 Moisture No  
 Motor grout Good

**Comments**

Minor cracking on 1st motor grout in several locations  
 All bolts in good condition

**FLOOR HATCH COVER**

General Description Floor hatch opening shed enclosure above  
 Condition (General) Good  
 Handles Good  
 Accessibility & Safety

**Comments**

Pump hatch - three plywood panel covers in fair condition- edges rough /plywood peeling

**STAIRS/LADDERS**

Stairs/Ladder

Condition (General) Good  
 Corrosion No  
 Damage No  
 Accessibility & Safety Steep stairs, low handrail  
 Treads (width x depth) 20"x5"  
 Handrail Height 20"  
 Slope (rise/run) (12.5"/6") (64 degrees from horizontal)

**Comments**

Handrail 36" high on platform  
 Stairs from main floor to platform then ladder to drywell floor

**FLOOD PUMP STATION SITE INSPECTION  
SUBSTRUCTURE & GATES  
DATA COLLECTION SHEET**

FPS NAME: Linden  
INSPECTION DATE: 01-Dec-04  
INSPECTOR: Andi Bogdanovic

**DRY WELL CONC. BEAMS**

Condition (General)	Good
Cracking	None visible
Spalling	No
Shaft guide bolts	Small surface corrosion
Staining	Minor

Comments

1 level of beams, one in each direction  
Underside of beams - reinforced steel exposed and corroded at some locations  
Underside of beams(near wall) - grout - previous repair  
Grout pad - good condition  
Corrosion of shaft mounts & plates - no section loss

**DRY WELL WALLS**

Condition (General)	Good/Fair
Cracking	Vertical & Horizontal cracks (1/32" gap)
Spalling	Yes, location near ladder
Moisture	Past
Staining	Yes, multiple
Previous repairs	Yes

Comments

Several horizontal cracks grouted on wall - patched previous repairs  
Underside of beam along column wall - fair size structural crack (.25" width)  
Hairline cracks at concrete infills where pipe penetrate wall  
Sign of seepage in the past - a lot of patching and stains  
Snap ties still present from original wall construction are corroding  
Along entire wall stained (yellowish/orange/black)

**DRY WELL FLOOR**

Condition (General)	Good
Cracking	Minor cracks
Spalling	No
Moisture	No
Staining	Yes
Previous repairs	No
Sump pit	Yes

Comments

Swale created by City workers running along the backside wall near sump pit ( Jackhammered trench approx. 2" deep and 3" wide) for drainage purposes

**FLOOD PUMP STATION SITE INSPECTION  
SUBSTRUCTURE & GATES  
DATA COLLECTION SHEET**

FPS NAME: Linden  
INSPECTION DATE: 01-Dec-04  
INSPECTOR: Andi Bogdanovic

**PUMP BASES**

Condition (General) Good/Fair  
Cracking None visible  
Spalling No  
Anchor bolts Surface corrosion  
Staining  
Previous repairs No comment  
Steel baseplate Surface corrosion - pitting - no section loss

Comments Pump #1 & #2 deteriorated pump flange bolts - section loss  
Grout spalled off (top of pump base) and also cracks on grout

Other comments

**DISCHARGE BOX WALLS**

Condition (General) Good/Fair  
Cracking Yes  
Spalling No  
Moisture  
Previous repairs No comment

Comments Exterior wall vertical and horizontal cracks (1/32" gap) - top lip  
of wall vertical cracks - midheight horizontal crack along entire  
perimeter  
Minor cracks interior walls  
West wall - minor reinforced steel exposed/corroded (snap ties)

**DISCHARGE BOX FLOOR**

Condition (General) Good  
Cracking None visible  
Spalling No  
Moisture No  
Previous repairs No comment

Comments

**FLOOD PUMP STATION SITE INSPECTION  
SUBSTRUCTURE & GATES  
DATA COLLECTION SHEET**

FPS NAME: Linden  
INSPECTION DATE: 01-Dec-04  
INSPECTOR: Andi Bogdanovic

**DISCHARGE BOX ROOF**

Condition (General) Fair/Poor  
Cracking None visible  
Spalling Appears to have past spalling  
Moisture Yes, damp in some areas  
Previous repairs No

Comments

Underside of roof (slab) on both sides of metal hatch opening exposed reinforced steel (corroded) - concrete spalling off at these locations  
Condensation and frost present  
Top of window opening - exposed reinforcing steel (corroded)

**DISCHARGE STOPLOGS**

Condition (General) Good  
Timber/Concrete const. Timber  
Present/Removed Present

Comments

Two concrete cast-in-place weirs 36 " high from discharge box floor  
1 timber stoplogs (2 ply -2x12 back to back) 1 ft high per weir  
All stoplogs at top - wooden triangular wedges b/t guides and stoplogs to hold stoplogs in place  
Guides are corroded - no section loss

Other comments

**CONTROL GATES**

**GENERAL DATA**

Gate Chamber Height: ft.  
Gate Chamber Length: ft.  
Gate Chamber Width: ft.

Flap Gate Type: (cast iron / fabricated) Cast iron  
Flap Gate Model (nameplate):  
Flap Gate Opening Diameter: 5 ft.  
Flap Gate Sill Elevation (above floor): approx. 10 inches

Slide Gate Type: (cast iron / fabricated) Cast iron  
Slide Gate Model (nameplate):  
Slide Gate Opening Height: 6 ft.  
Slide Gate Opening Width: 6 ft.  
Slide Gate Sill Elevation (above floor): 1 ft

Debris Accumulations:

A lot of debris- large rocks, branches and styrofoam  
Very difficult to walk (unsafe)  
Water approx 1 ft high

**GATE CHAMBER CONC.**

**FLOOD PUMP STATION SITE INSPECTION  
SUBSTRUCTURE & GATES  
DATA COLLECTION SHEET**

FPS NAME: Linden  
INSPECTION DATE: 01-Dec-04  
INSPECTOR: Andi Bogdanovic

Condition (General) Good

**FLAP GATE**

Condition (General) Good/Fair  
Hinges Minor corrosion  
Lifting cable Yes  
Seating face (No access permitted - 1-2ft water)-Bronze

Comments Gate good/fair condition -surface corrosion on the edge of the gate and edges of stiffeners - no visible section loss

**FLAP GATE FRAME**

Condition (General) Fair/Poor  
Seat Heavy surface corrosion  
Thread Studs/bolts Minor corrosion  
Link (pivot arm) Heavy surface corrosion - no section loss  
Pivot Lugs Heavy surface corrosion  
Seating face (No access permitted)

Comments Anchor bolts around entire frame - good condition  
Interface b/t concrete and frame medium corrosion  
  
Sill not visible

**FLAP GATE THIMBLE**

Condition (General) Good

Comments Minor surface corrosion with no section loss.

**FLOOD PUMP STATION SITE INSPECTION  
SUBSTRUCTURE & GATES  
DATA COLLECTION SHEET**

FPS NAME: Linden  
INSPECTION DATE: 01-Dec-04  
INSPECTOR: Andi Bogdanovic

**SLIDE GATE**

Condition (General)	Poor
Stem block pocket	Heavy surface corrosion
Wedge	Heavy surface corrosion - section loss
Seating face	Cast iron - rough/corroded

Comments: Stiffeners on gate section loss 20%  
Gate heavy corrosion - section loss 15%

**SLIDE GATE FRAME**

Condition (General)	Poor
Wedge block	Heavy corrosion - section loss 5%
Frame flange	Heavy corrosion - section loss 5-10%
Anchor bolts	Surface corrosion
Seating face	

Comments: Bolts and washers on wedge block good condition  
Frame(South side) - 5 out of 6 anchor bolts sheared off - 1 intact first from bottom heavy corrosion (section loss 20%)  
Frame (North side) - 5 out of 6 sheared off - last bolt couldn't inspect. first from bottom

**SLIDE GATE THIMBLE**

Condition (General)	Poor
---------------------	------

Comments: Thimble heavy corrosion - 10 % section loss along entire opening

**SLIDE OPERATOR**

Condition (General)	Poor
Shaft	Heavy corrosion - 10-15% section loss
Stem guide	Appears to be corroded (visual inspection)

Comments: Gate lowered slow and poorly

**FLOOD PUMP STATION SITE INSPECTION  
WETWELL  
DATA COLLECTION SHEET  
SUBSTRUCTURE**

FPS NAME: LINDEN  
INSPECTION DATE: 22-Nov-05  
INSPECTOR: A. Bogdanovic  
T. Froehlich  
KGS Group

**WETWELL ROOF CONCRETE BEAM**

Condition (General)  
Cracking  
Spalling  
Moisture  
Staining  
Previous Repairs

Comments

N/A

**WETWELL INTERMEDIATE CONCRETE BEAM**

Condition (General) Good  
Cracking None Visible  
Spalling Yes  
Moisture None Visible  
Staining Yes  
Previous Repairs None Visible

Comments

Some white staining  
Slight spalling around edges

**WETWELL WALLS**

Condition (General) Good to Fair  
Cracking Yes  
Spalling Yes  
Moisture Yes  
Staining Yes  
Previous Repairs Yes

Comments

North wall above intermediate beam has 2' of exposed rebar and spalling  
Rebar ends exposed appears to be tierods left in wall  
Patching on west wall  
Large spall on south wall and column near bottom  
Horizontal and vertical cracks on north wall  
West wall is very wet  
White staining on walls

**FLOOD PUMP STATION SITE INSPECTION**  
**WETWELL**  
**DATA COLLECTION SHEET**  
**SUBSTRUCTURE**

FPS NAME: LINDEN  
INSPECTION DATE: 22-Nov-05  
INSPECTOR: A. Bogdanovic  
T. Froehlich  
KGS Group

**WETWELL FLOOR**

Condition (General) Fair  
Cracking None Visible  
Spalling Yes  
Moisture Yes  
Staining None Visible  
Previous repairs None Visible

Comments

Channel sides at water line appear very rough and badly spalled

**WETWELL ROOF**

Condition (General) Fair  
Cracking Yes  
Spalling Yes  
Moisture Yes  
Staining Yes  
Previous repairs None Visible

Comments

A lot of exposed rebar in many places with large spalls  
There is a large rectangular section cut out with rebar extensively exposed and lots of spalling  
Lots of areas where spalling is in its early stages

**WETWELL INTERMEDIATE SLAB**

Condition (General)  
Cracking  
Spalling  
Moisture  
Staining  
Previous repairs

Comments

N/A

**FLOOD PUMP STATION SITE INSPECTION**  
**WETWELL**  
**DATA COLLECTION SHEET**  
**SUBSTRUCTURE**

**FPS NAME:** LINDEN  
**INSPECTION DATE:** 22-Nov-05  
**INSPECTOR:** A. Bogdanovic  
 T.Froehlich  
 KGS Group

**INLET CULVERT**

Condition (General) Good  
 Cracking Yes  
 Spalling Yes  
 Moisture None Visible  
 Previous repairs Yes  
 Staining None Visible

Comments

Hairline cracks on top  
 Spalling at top right corner and gets worse towards bottom  
 Patching done at top

**OUTLET CULVERT**

Condition (General) Good  
 Cracking None Visible  
 Spalling None Visible  
 Moisture Yes  
 Previous repairs None Visible  
 Staining None Visible

Comments

Wet all around

**FLAP GATE THIMBLE (SEWER)**

Condition (General) Good  
 Seat Good  
 Embedment in concrete Good

Comments

Surface rust but no section loss  
 Rusting where concrete and steel meet

**FLOOD PUMP STATION SITE INSPECTION  
WETWELL  
DATA COLLECTION SHEET  
SUBSTRUCTURE**

FPS NAME: LINDEN  
INSPECTION DATE: 22-Nov-05  
INSPECTOR: A. Bogdanovic  
T. Froehlich  
KGS Group

**FLAP GATE (SEWER)**

Condition (General) Good  
Seating face Good

Comments: Wet with slight staining and surface rust but no section loss

**FLAP GATE FRAME (SEWER)**

Condition (General) Good

Comments: Surface rust but no section loss

**STAIRS/LADDERS**

Condition (General) Good to Fair  
Corrosion Yes  
Damage None Visible  
Accessibility & Safety No cage  
Debris Yes

Comments: Last 4 sets of rungs embedded into concrete are very rusty with section loss and covered in debris

**FLOOD PUMP STATION SITE INSPECTION**  
**WETWELL**  
**DATA COLLECTION SHEET**  
**SUBSTRUCTURE**

**FPS NAME:** LINDEN  
**INSPECTION DATE:** 22-Nov-05  
**INSPECTOR:** A. Bogdanovic  
T.Froehlich  
KGS Group

**INTERMEDIATE RAILINGS**

Condition (General)  
Corrosion  
Damage  
Accessibility & Safety  
Debris

Comments

N/A

**PIPES**

Condition (General) Good  
Corrosion Yes  
Damage None Visible  
Hangars & Bolts Corroded

Comments

Pipe on south wall for float has a lot of corrosion with section loss  
Hangars and bolts for pipe have a lot of corrosion with section loss

**WETWELL SLIDE GATE OPERATOR SHAFTS**

Condition (General)  
Corrosion  
Damage  
Hangars & Bolts

Comments

N/A

**FLOOD PUMP STATION SITE INSPECTION  
WETWELL  
DATA COLLECTION SHEET  
SUBSTRUCTURE**

FPS NAME: LINDEN  
 INSPECTION DATE: 22-Nov-05  
 INSPECTOR: A. Bogdanovic  
 T. Froehlich  
 KGS Group

**TRASHRACKS**

Condition (General)	Good
Corrosion	None Visible
Damage	Yes
Bolts	Good
Hinges	Good
Round Bars	Good
Flat Bars	Good
Exterior Frame	Good
Exterior Angle Seats	N/A
Intermediate Sept'n Wall	Good
Debris	Yes

**Comments**

Far west trashrack not properly seated against wall at top  
 Guides holding trashrack are very rusty with section loss  
 Lots of debris at the bottom with large sticks and large chunks of concrete