

**SEWPCC Upgrading/Expansion  
Conceptual Design Report**

**SECTION 21 - Building Envelope and Structural Assessment**

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## 21.0 Building Envelope and Structural Assessment

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### 21.1 INTRODUCTION

This section serves as a follow-up to the SEWPCC PDR Section 6.0.

### 21.2 SCOPE OF WORK

The majority of items in the PDR and the recommended actions therein, have been completed or are in the process of being completed by the City of Winnipeg.

A number of items requiring Stantec involvement as part of the conceptual design were identified as action items in the May 20, 2008 City of Winnipeg memorandum authored by Mr. Jerry Comeau, P.Eng. These items are addressed in this section.

### 21.3 FOLLOW-UP ASSESSMENT

On August 6, 2008 the authors of PDR Section 6, Mr. Tom Lobay, MAA and Mr. Walter Schoenfeld, P.Eng., met with Mr. Ron Hahlweg, CET, Treatment Plant Supervisor at the SEWPCC to review and discuss courses of action for the items identified by the City as requiring Stantec input. The following serves as a summary of this meeting.

Reference numbers correspond to the report sections noted in Table 6.2 in the PDR. Recommended actions noted in this memorandum are included for reference:

**1. General 6.3.0 – Item – Corroded Piping, especially flushing water line. Preliminary Design recommended action- Investigate extent of corrosion and repair as required.**

**Comment:** During our preliminary assessment, concern regarding the corrosion noted on flushing lines was expressed by staff. Since our initial inspection, the City of Winnipeg has replaced a portion of these lines and has budgeted to replace the remainder as part of their on-going maintenance program.

**Action:** No action by Stantec required.

**2. General 6.3.0 – Item – Concrete and concrete coatings for clarifiers, reactors, channels, chambers, etc. unavailable for review at time of assessment. Preliminary Design recommended action-Investigate integrity of concrete and concrete coatings upon removal of contents and/or temporary suspension of operations.**

**Comment:** Concrete and concrete coatings for clarifiers, reactors, channels, chambers, etc., could not be assessed during the review due to the presence of liquid contents.

There were no obvious signs of distress at the time of our assessment. The recommendation for further review would be a review that may be performed during a time of opportunity, when maintenance programs require contents removal. The initial review would be a visual assessment, and should areas of concern be identified, further action would be recommended.

During March 2008, Primary Settling Tanks (PST) No. 1 and 2 were emptied for maintenance purposes.

At that time, Stantec reviewed the condition of the concrete components of the clarifiers and found them to be structurally sound.

**Action:** City of Winnipeg to inform Stantec when other treatment system components will be taken out of operation for maintenance. During these maintenance periods, Stantec will coordinate with the City Operations Staff to undertake visual examinations when opportunity arises. No immediate action required.

**3. Grit Building 6.3.3.2 – Item – Efflorescence through hairline cracks in concrete walkways around clarifiers at ground level. Preliminary Design recommended action- Investigate integrity of concrete and reinforcing steel.**

**Comment:** The efflorescence is a sign that moisture is migrating through the concrete slabs. In this case, it is believed that water used to wash the floors is finding its way into the cracks and then “wicking” upward via capillary action as the concrete dries. In time this will lead to deterioration of the concrete and possibly reinforcing steel corrosion. At the time of our review, significant signs of distress were not noticeable. The orientation of the hairline shrinkage cracks appear to be parallel to the slab spans which would suggest that the moisture migration affect on the primary reinforcing steel may be limited.

**Action:** Consideration should be given to sealing the cracks to retard the rate of deterioration. Action optional for added durability.

**4. Oxygen Reactors 6.3.10.2 and 6.3.11.2 – Item – Wall cracks and exposed reinforcing in concrete walls. Preliminary Design recommended action- Investigate integrity of the concrete wall and repair as required.**

**Comment:** During a walk through review, it was noted that areas of previously exposed reinforcing steel at the base of the walls had been repaired. It was also observed that recent maintenance work had painted over the horizontal and vertical hairline cracks previously noted along the walls. At the time of the initial assessment, these cracks were not considered structurally detrimental and evidence of leakage was not evident. The vertical cracks are likely due to concrete shrinkage during its initial curing period. The horizontal cracks may be due to horizontal forces attributed to the filled tanks. Should the horizontal cracks reappear, they should be monitored to determine if they are getting wider. This could

5. be accomplished by installing gauges across the horizontal cracks and recording crack width changes over a period of time.

**Action:** If horizontal cracks reappear, monitoring of these cracks is recommended.

6. **Secondary Clarifiers No. 1 and 2 6.3.14.2 – Item – Delamination of concrete at concrete apron at northeast corner of Clarifier No. 2. Preliminary Design recommended action- Investigate integrity of all concrete aprons and repair as required.**

**Comment:** Concrete has delaminated in the location noted. Delamination is likely due to insufficient concrete cover of the reinforcing steel. Moisture is allowed to reach the reinforcing steel surface causing it to rust and expand. The thin concrete cover does not have the strength to resist the expansive forces, resulting in concrete delamination. Loose and delaminated concrete in the area noted should be removed and repaired. Exposed reinforcing steel should be examined to confirm that rust is limited to the surface only. Reinforcing steel surfaces should be cleaned prior to replacing delaminated concrete. Subsequent investigation of the concrete at the other apron areas suggest that the delamination is limited to the area noted in the report. The aprons were checked for delamination by hammer “sounding”. See Figure 21.1.

**Action:** Remove loose and delaminated concrete, examine reinforcing steel, and repair concrete surfaces.

7. **Secondary Clarifiers No 1 and 2 6.3.14.2 – Item – Exposed reinforcing steel in precast concrete double tee roof sections and column. Preliminary Design recommended action – Investigate integrity of beams and column and repair as required.**

**Comment:** It is our understanding that the current condition may have existed since original construction. It appears as if the reinforcing steel had been placed too close to the formwork. Obvious structural distress was not noted at time of review. Although these conditions may have existed since original construction, and signs of structural distress are currently not evident, we recommend that closer examination of the reinforcing steel be undertaken to confirm that the corrosion noted is limited to surface rusting only. We also recommend that a protective coating be applied to the reinforcing steel to protect against on-going corrosion. This examination and repair could take place at a moment of opportunity, during future maintenance activities or during the SEWPCC Upgrading/Expansion project when the clarifiers are out of service. In the interim, occasional monitoring is recommended and any signs of structural distress should be reported immediately.

**Action:** Visually monitor on an annual basis until closer examination and repair is economically feasible.

- 8. Secondary Clarifiers No. 1 and 2 6.3.14.2 – Item – Uncoated steel ties between precast concrete roof tee sections. Preliminary Design recommended action- Apply protective coating to steel to protect against corrosion.**

**Comment:** The roof panels over Secondary Clarifiers 1 and 2 have not been galvanized, likely a choice made by the original designer. Signs of obvious structural distress to date are not evident. Protective coatings would provide added durability to the connections. In construction of Secondary Clarifier No. 3, the designer has specified galvanized ties for similar roof system.

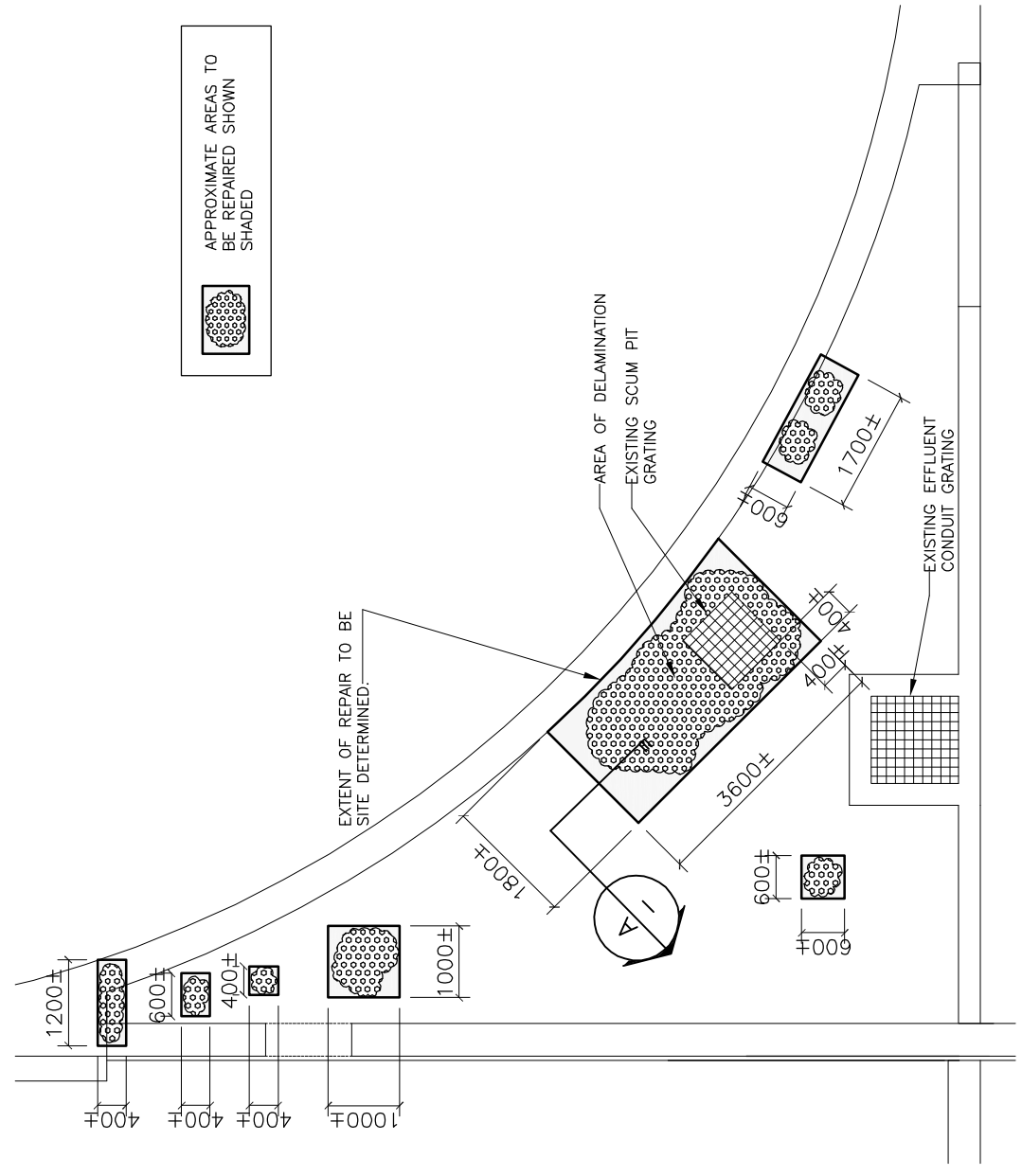
**Action:** Observation only. Optional coating of ties for added durability.

- 9. Oxygen Reactors 6.3.10.3 and 6.3.11.3 – Item – Vegetation is forming on the rooftop. Preliminary Design recommended action- An investigation should be undertaken to determine the extent of deterioration of roofing system.**

**Comment:** Vegetation growth is occurring through cracks in the concrete wearing surface atop the Oxygen Reactor roofs. The vegetation and any soil or sediment should be removed by pressure washing. This maintenance work should be done on a schedule of 24 months to prevent possible root penetration into the deck surface, which could cause deterioration of the deck surface. It is not felt that sealing of all deck cracks would have any cost benefit at this time.

**Action:** Remove soil and plant growth on a periodic basis.

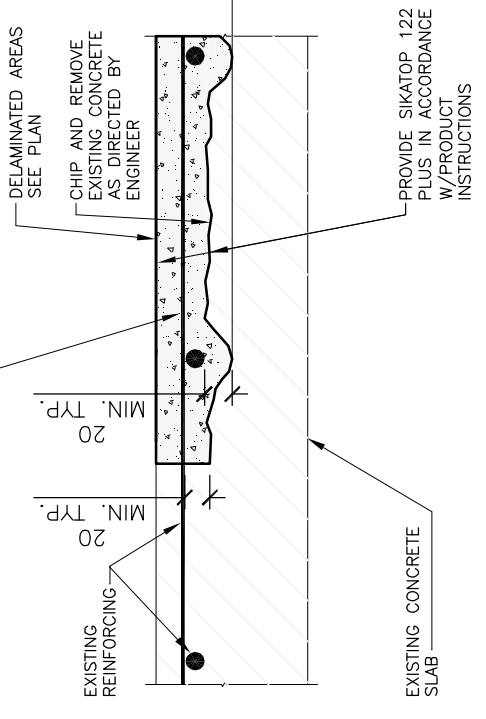
APPROXIMATE AREAS TO BE REPAIRED SHOWN SHADED



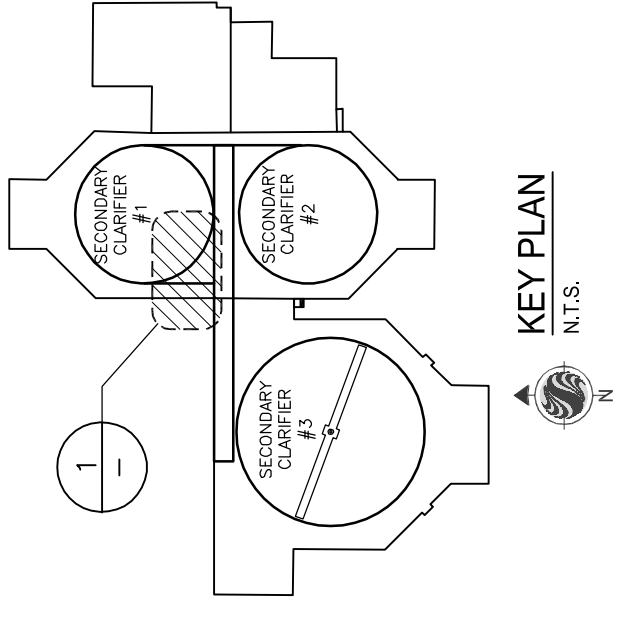
**PARTIAL PLAN**  
1 -  
1:100

NOTE:  
REINFORCING STEEL TO BE REVIEWED BY ENGINEER.

WIRE BRUSH REINFORCING PRIOR TO CONCRETE PLACEMENT



**TYP. CONCRETE REPAIR**  
A -  
1:10



**LOCATION APPROVED UNDERGROUND STRUCTURES**

COMMITTEE DATE

NOTE:  
LOCATION OF UNDERGROUND STRUCTURES AS SHOWN ARE BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF PREPARATION OF THIS DRAWING. THE LOCATION OF ALL UTILITIES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION.

B.M. ELEV.	NO.	REVISIONS	DATE	BY

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DESIGNED BY	CHECKED BY	DATE
DRAWN BY	APPROVED BY	
HOR. SCALE: VERTICAL:	RELEASED FOR CONSTRUCTION:	

ENGINEER'S SEAL