Combined Lake & Stormwater Irrigation System

Group 3
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Background

Problem Statement

-The University of Regina's land is irrigated through potable water

-The highest utility cost is through irrigation

-The land is irrigated from May to September, with the demand increasing during summer months.

-Utility cost has been increasing by an average rate of 4.5% per year over the last 10 years

-Expecting 2022's price to reach $2.18/ cubic meter

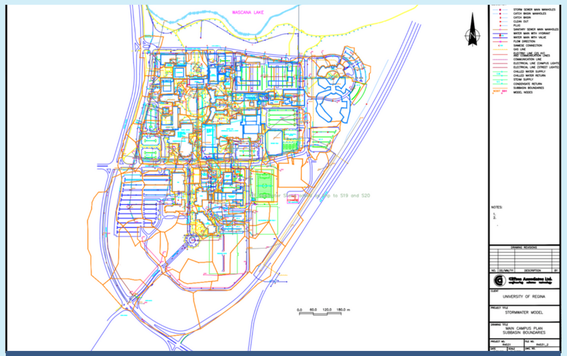

Figure 1: Utilities map (Facilities Management)

Current System

The irrigation system currently intakes water from the City of Regina, where it feeds into the west side of campus. There are two main valves located on the North and South mains, which later distributes in a loop through 6 distribution valves around campus. The campus irrigation demand is in the range of 40-60 000 m3 depending on the season.

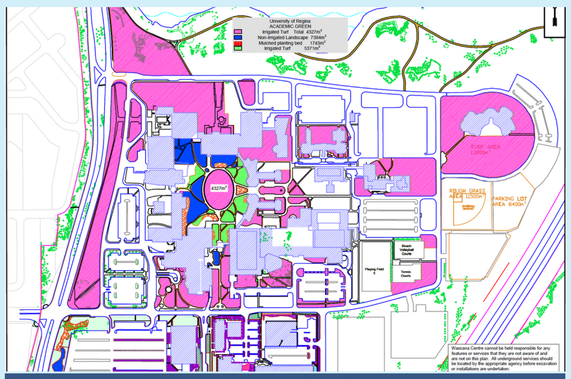

Figure 2: Campus Irrigation map (PCC)

Storm

Stormwater accumulates on campus and is captured by storm drains. An underground piping system handles minor and surface storage of stormwater. The minor system collects and drains the water from two pipes, which then exit into Wascana Lake. The major system stores peak runoff, then drains through the minor system after the peak has passed. Major events occurring in 1:25 and 1:100 events result in ponding on campus. It is important to note no stormwater flow values are collected through the minor pipes.

Lake Water

The University of Regina has a drainage system that empties into Wascana Lake on the North side of camps. The system currently is made so drainage occurs without retaining or holding the water, which means an accumulation of undissolved solids can be the cause of pollutant sources. An estimation within a given season states an approximation of 570.0m-570.6m . As allowance clears 569m of water, the system clears the feasibility to take lake water

Parameters

To comply with irrigation and water quality guidelines the following parameters were considered:

Calcium (150 mg/L)
Chloride (140 mg/L)
Conductivity (960 mg/L)
Magnesium (35 mg/L)
Nitrate (100 mg/L)
pH (8)
Sodium (70 mg/L)
Sulfate (400 mg/L)
Total Alkalinity (100 mg/L)
Sodium Adsorption Ratio (6 mg/L)

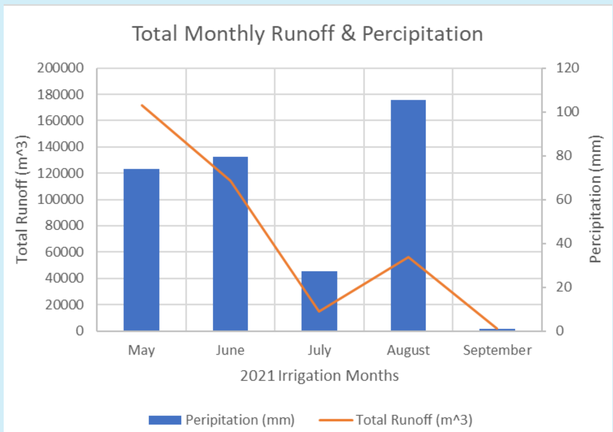

Figure 3: Total Runoff 35826m^3

Proposed System

Phase 1: Pump Station on North Side of Campus

Phase 2: Two retention ponds on the North Side of Campus

Phase 3: Pumping station connecting both systems

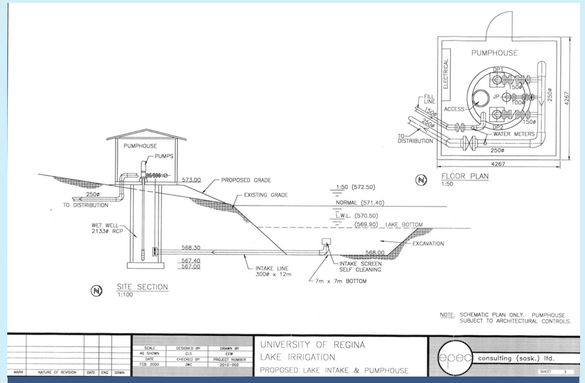

Figure 4: Proposed lake intake and pumphouse (EPEC)

Water Balance

Water Balance:

Runoff = Precipitation - Infiltration - Evapotranspiration

Infiltration Using Green & Ampt Method (Turfs Only):

- Case 1: $i < Ks$; No Runoff
- Case 2: $i > Ks$; $f = i$ untill Surface Saturation (F) Occurs. After that $f = K_S\left(1 - \frac{M_d \psi}{F}\right)$

Evapotranspiration Multipliers:

- May & September = 0.35
- June = 0.6
- July & August = 0.85

Cost Analysis - Lake Water

Pump Station

Wet well $ 60 000 - 80 000
Pumphouse and structural $ 50 000 - 75 000
Mechanical work $ 80 000 - 90 000
Electrical 50 000
Landscaping $ 7000 - 10 000
Electrical Service $ 10 000
Engineering and Contingency 30% of total cost

Distribution Mains

Supply and Install Mains $300 - 500 000 (4 inch lines- $150-200)
Construct bored and cased street crossings 60 000 - 80 000
Landscaping 40 000 - 50 000
Engineering and Contingency 30% of total cost

Cost Analysis - Storm Water

Retention ponds size : 20 000 m3
Cost: $15 / m3
Liner - 15 / m2
Mechanical - $ 80-90 000
Engineering - 30 % of total cost

Feasibility

Based on a cost analysis, the most feasible design is to implement the Lake Water system. One retention pond would approximately equate to the cost of a singular total pump station.

A conclusion was drawn to implement the Lake Water system, and further consider connecting stormwater to our existing design.

Approval Process

Proponent Development Checklist within the Provincial Capital Commission

1. Preliminary Proposal
2. Statement of Intent
3. Conceptual Design
4. Detailed Design

Future Recommendation

1. Add flowmeters in the north side of Wascana Lake
2. Conduct a comparative analysis between flow meter value and estimated data
3. Attain water level from Wascana Creek model conducted by WSA for water availability

After all considerations phase 1 can be implemented