year existing conditions.

It should be noted that this represents an estimate of the number of structures impacted by overland flow. If this analysis were to be completed based on a comparison between the flood elevation and the lowest property elevation, the number of properties impacted would be significantly higher compared to the number of structures impacted.

Return Interval Storm	Number of Structures
10-year	120
25-year	280
50-year	480
100-year	700

Table 4. Estimated Number of Structures Impacted by Flooding (Existing Conditions)

5.2.3 Identification of System Bottlenecks

Using the XP-SWMM model, CBBEL completed a comprehensive analysis of the existing drainage system. This included a simulation of the Pump Station in detail under a number of different tailwater conditions or downstream receiving water surface elevations in the River.

As a conservative assumption, the existing conditions XP-SWMM model was executed assuming a 100-year tailwater condition from the River. The approximate existing condition flowrates in the inflow and outflow storm sewers at the Pump Station from this analysis are as follows:

Inflow Storm Sewer – 102-inch diameter storm sewer

- Full flow capacity = 300 cfs
- XP-SWMM Model Results:
  - Flowrate during 2-year event (surcharged conditions upstream) = 274 cfs
    - This is due to lateral sewer network restricting flow draining into the trunk line.
- Flowrate during 10-year event (significant street flooding) = 290 cfs
- Flowrate during 100-year event (severe street flooding) = 295 cfs

Outflow Storm Sewer – 84-inch diameter storm sewer and 6-foot x 10-foot box culvert

- Combined full flow capacity under maximum River tailwater conditions = 980 cfs
- XP-SWMM Model Results
  - Combined flowrate during 10-year event = 290 cfs
  - Combined flowrate during 100-year storm event = 295 cfs

Pump Station Flow

- Pump Station rated capacity = 585 cfs
  - Maximum Pump Station capacity has been evaluated under a wide range of TDH conditions. For the purpose of this analysis, the maximum capacity was limited to 585 cfs, which is a conservative assumption.

- XP-SWMM Model Results
  - Pump rate during 10-year event = 290 cfs (3 pumps running)
  - Pump rate during 100-year event = 295 cfs (3 pumps running)
    - The 10-year and 100-year flowrates are nearly identical as the Pump Station will only pump what is conveyed to it via the inflow pipes.

Based on the information above, the inflow storm sewer to the Pump Station is the limiting element in the trunk storm sewer system. The maximum rated capacity of the existing Pump Station is not utilized before capacity in the inflow storm sewer system is reached and upstream flooding begins. This is due to the limiting capacity of the 102-inch trunk sewer along Lake Avenue and the undersized lateral storm sewers draining to the trunk throughout the Village. According to the CBBEL calibrated XP-SWMM analysis, the maximum flowrate at the pump station under existing conditions is approximately 290 cfs (50% of existing rated capacity) for the 10-year storm event. The results of the XP-SWMM model show that three pumps are utilized during the 10-year storm event. An additional analysis was completed to simulate the effect of utilizing the maximum rated capacity (all five pumps) of the Pump Station during the 10-year storm event. Under this scenario, the upstream water surface elevations did not show a reduction. This confirms that the inflow storm sewer capacity is the limiting element in the system.

Village staff has indicated that all five pumps have been running simultaneously during large storms in the past; however, the fifth pump does not stay on for extended periods of time. The short operation of the fifth pump is due to the limited inflow storm sewer capacity and lack of wet well storage at the Pump Station. The inflow storm sewer performs as both conveyance to the station and an in-line wet well and is a restriction within the system. The inflow storm sewer can be pumped down quickly given the capacity of the pumps in relation to the capacity and storage of the inflow storm sewer. This is verified by the limited operation time of the fifth pump as recorded during the April 2013 storm event, when the pump was quickly cycled off and on twice during the storm event. Village staff has indicated that during storms such as the April 2013 storm event, pump operations are monitored to prevent damage to the pumps. The following conclusions were drawn from the existing condition analysis:

- The separate storm sewer system capacity is the limiting factor. The lateral sewer network restricts flow draining into the trunk storm sewer throughout the Village and the trunk sewer restricts the flow draining to the pump station.
- The existing storm sewer system was designed and constructed prior to modern stormwater management practices and current design standards.
- The Pump Station can only pump the water that is delivered to it by the storm sewer network.
- The Pump Station does not have a typical wet well. The inflow storm sewer system serves the dual purpose of a wet well and conveyance system into the Pump Station.
- The rated capacity of the pump station is 585 cfs, which is based on the midpoint of the operating range on the pump performance curves provided by the Village. The pump flowrate is a function of the water level in the pump station wet well versus the tailwater elevation in the discharge chambers that drain to the River. The hydrologic and hydraulic modeling was completed assuming a 100-year tailwater condition in the River.
- The Village operates the Pump Station manually during large storm events such as the April 2013 storm event. Given the limited capacity of the existing inflow storm sewer system, the manual