

City of McMinnville

Hydraulic Analysis for the Baker/Evans Property

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Background

The City of McMinnville is evaluating the impact of a new 133 unit apartment development to assess the capacity of the in the downstream portions of the existing sanitary sewer system. The proposed development (Baker/Evans Property) is shown in Attachment 1.

The Baker/Evans Property was previously classified as an R-2 development, which is a low density residential parcel (4.3 dwellings per acre). In the 2008 Conveyance System Master Plan¹ flows from this area was not directly modeled, but were included in the flows that contribute to manhole I-5-14. Converting the property to an apartment development will increase density therefore increase the flows to the sanitary sewer system.

CH2M has been hired to perform the analysis of the new development on the sanitary sewer pipeline collection system, with the additional flow from the proposed development.

Analysis Summary

Based on the analysis, computer modeling and assumptions described below, the system has capacity to handle the additional flow from the 133 unit apartment development. The additional flow from the apartment development would increase the peak flows at I-5-14 by about 8 gpm during a 5-year, 24-hour storm event. The increase in water levels in the manholes along Evans Street south of the Baker/Evans Property is incremental (about 0.01 feet).

Simulation Model

CH2M HILL modeled the McMinnville sanitary sewer conveyance system, using EPA SWMM, in 2008 as part of the master plan, but this model generally included larger pipe diameters in the system and did not extend to the pipes, manholes or pump stations that connect to I-5-14. The connection manhole from the proposed development was assumed to be I-5-40, approximately 975 feet upstream of I-5-14. The flows at I-5-14 were assumed to include the contribution from the proposed development. Therefore, the model needed to be expanded to evaluate the increased flows from the Baker/Evans Property. Figure 1 shows the modeled network; the new components are shown in blue. The model that was used for this analysis builds off of the model that was modified in July 2016 to include the Autumn

¹ CH2M Hill. 2008. *Sanitary Sewer Master Plan Updates Conveyance System Master Plan*. Prepared for City of McMinnville.

Ridge and Westside Pump Stations and the flows from a new development east of the Autumn Ridge Pump Station².

Because the Baker/Evans Property hydraulic analysis is focused primarily on the capacity of the pipes and water levels in the manholes, the evaluation included adding the following to the model:

- Manhole I-5-40 – This manhole is located at the north end of the Baker/Evans Property on Evans Street.
- Manhole I-5-41 – This manhole is located at the south end of the Baker/Evans Property on Evans Street. This manhole also receives flow from some homes east of Evans Street.
- Manhole I-5-42 – This manhole is between the Baker/Evans Property and the connection point to the larger system at I-5-14. This manhole receives flow from some homes east of Evans Street.
- Pipes that connect these manholes from I-4-9 at the north and I-5-14 at the south.

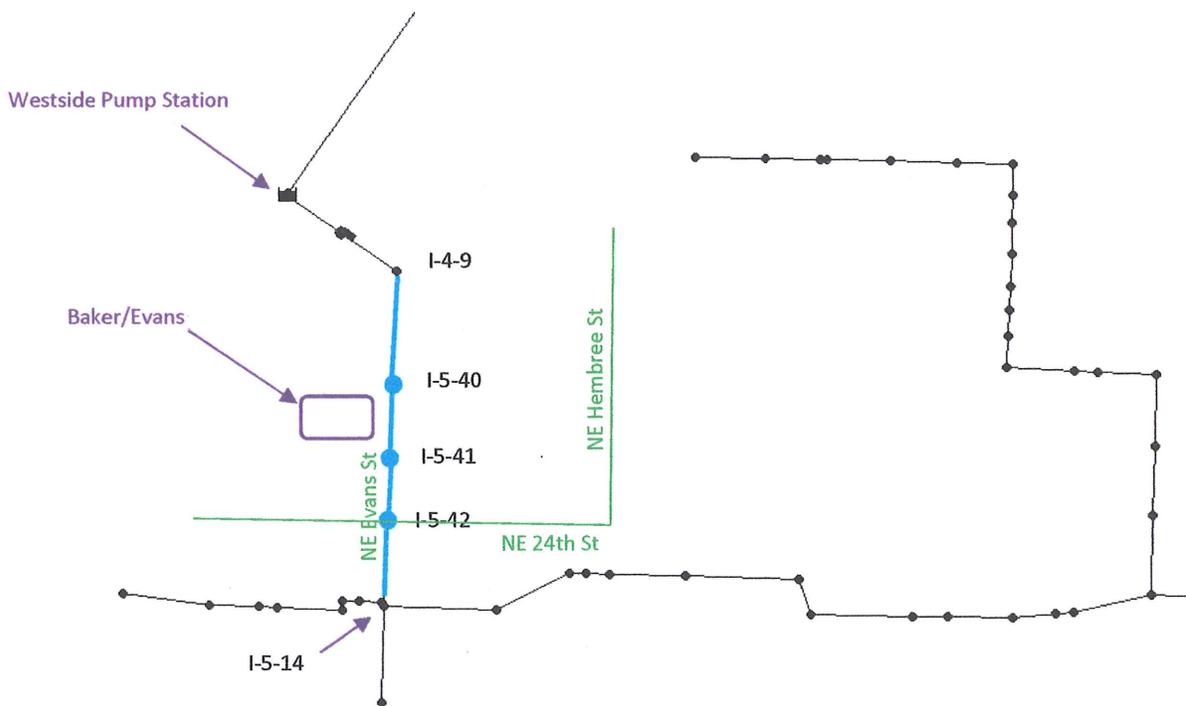


Figure 1 – Project Extents
Baker/Evans Property Hydraulic Analysis

Model Inputs

The flows in the 2008 SWMM model include the wet season average base flow for the 2008 system build out, future use wet season base flow, peak infiltration and inflow (I&I), and the total peak wet weather flow for the 5-year, 24-hour storm event. In both the 2008 model and the updated 2016 model, the flows at I-5-14 included the flows from the eastern parcel of the Baker/Evans Property. Flow from the western portion were assumed to be included with flows at I-5-8. Because the flows from the Baker/Evans Property are expected to increase from the estimates used in the 2008 Master Plan due to

² CH2M. 2016. *Autumn Ridge and Westside Pump Station Hydraulic Analysis for the Bungalows Phase III Development*. Prepared for City of McMinnville. July 20.

the higher density when converted to an apartment development, the increase in flows must be accounted for when evaluating the capacity of the system.

Current Configuration

In the 2008 Master Plan, the contributions to the sanitary sewer system from the Baker/Evans Property was assumed to flow in two different directions. The eastern portion of the property (1.9 acre parcel) was assumed to flow to the east and was a part of the inflows to I-5-14. The western portion of the property (2.5 acre parcel) was assumed to flow to the west and was a part of the inflows to I-5-8. In order to expand the model to understand the impacts of the proposed development, the flows at I-5-14 must be adjusted and manholes I-5-40, I-5-41, and I-5-42 must be added. Figure 2 shows the current routing of peak flows through the system.

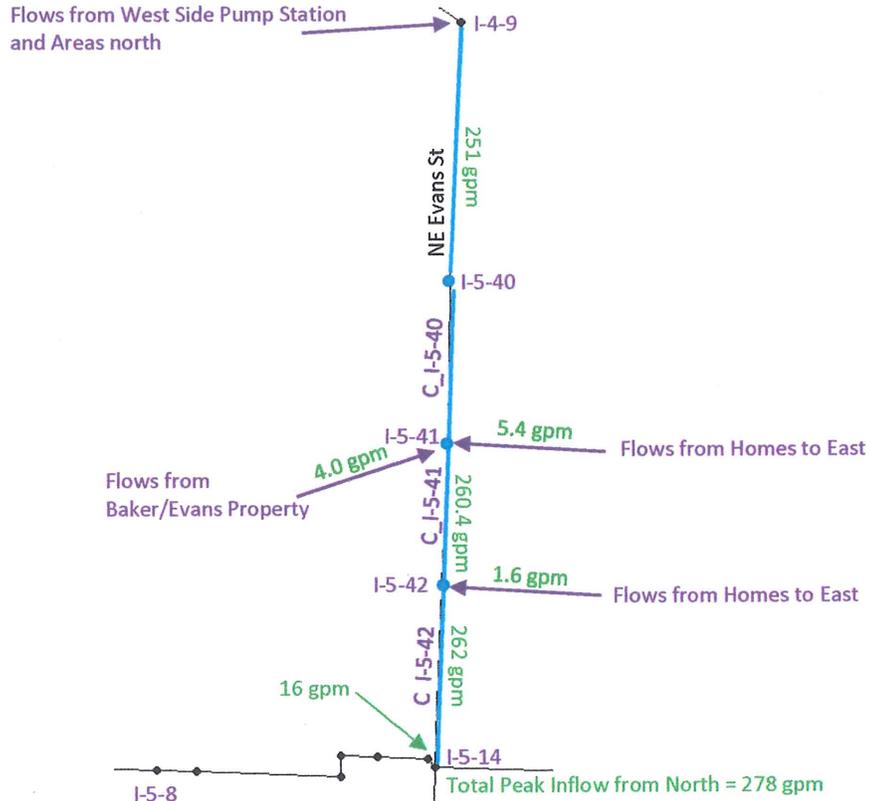


Figure 2 – Peak Flow through System
Baker/Evans Property Hydraulic Analysis

The peak inflow to I-5-14 under future development conditions, as defined in the 2008 Master Plan, and during a 5-year, 24-hour event is 278 gpm, but 251 gpm of that comes from the Westside Pump Station. Therefore, the peak flow at I-5-14, when the contributions from Autumn Ridge and West Side Pump Stations are removed, is about 27 gpm.

The peak inflow to I-5-14 is the sum of the inflows from the Baker/Evans Property, the other flows to I-5-41, flows to I-5-42, and other inflows from the north to I-5-14. The peak flows for I-5-41, I-5-42 and the Baker/Evans property are based on the ratio of the area contributing to the manholes and the area between the I-4-9 and I-5-14 (30.2 ac). These areas and peak flows are summarized in Table 1.

Table 1. Inflows to I-5-14, Current Configuration

Location	Area (acres)	Percentage	Peak Flow (gpm)
Baker/Evans Property	4.5	15%	4.0
I-5-41	6.0	20%	5.4
I-5-42	1.8	5.8%	1.6
Remaining Area	17.9	59%	16
I-5-14	30.2	100%	27

Note: The Peak Flow for I-5-14 is only for inflows between the Westside Pump Station and I-5-14

Future Configuration with Baker/Evans Apartment Development

To model the future condition, the sanitary flows needed to be modified to reflect the change in density, household size, and acreage associated with the apartment development. The Infiltration and Inflow (I&I) is assumed to be unchanged.

Table 2 shows the calculated additional sanitary flows that must be accounted for at I-5-41 from the Baker/Evans Property. Currently, there is no sanitary sewer connection on the western parcel of the property, but the 2008 Master Plan assumed for the future condition, this property would be developed. Therefore the flows at I-5-41 will need to be increased by 4.3gpm, as shown in Figure 3. Overall, the peak inflows at I-5-41 increased from 9.4 gpm to 13.7 gpm.

Table 2. Additional Sanitary Flows

	Current - 4.5 Acres of Baker/Evans Property	Future - 4.5 acres of Baker/Evans Property with Apartments	Difference (Future – Current)
Density	4.3 dwellings/acre	133 Units/4.6 acres	
Household Size	2.6 people/dwelling	1.2 people/dwelling	
Daily Water Use	57 gallons/person	57 gallons/person	
Parcel Area	4.5 acres	4.5 acres	
Total Daily Flow	2 gpm	6.3 gpm	5.4 gpm

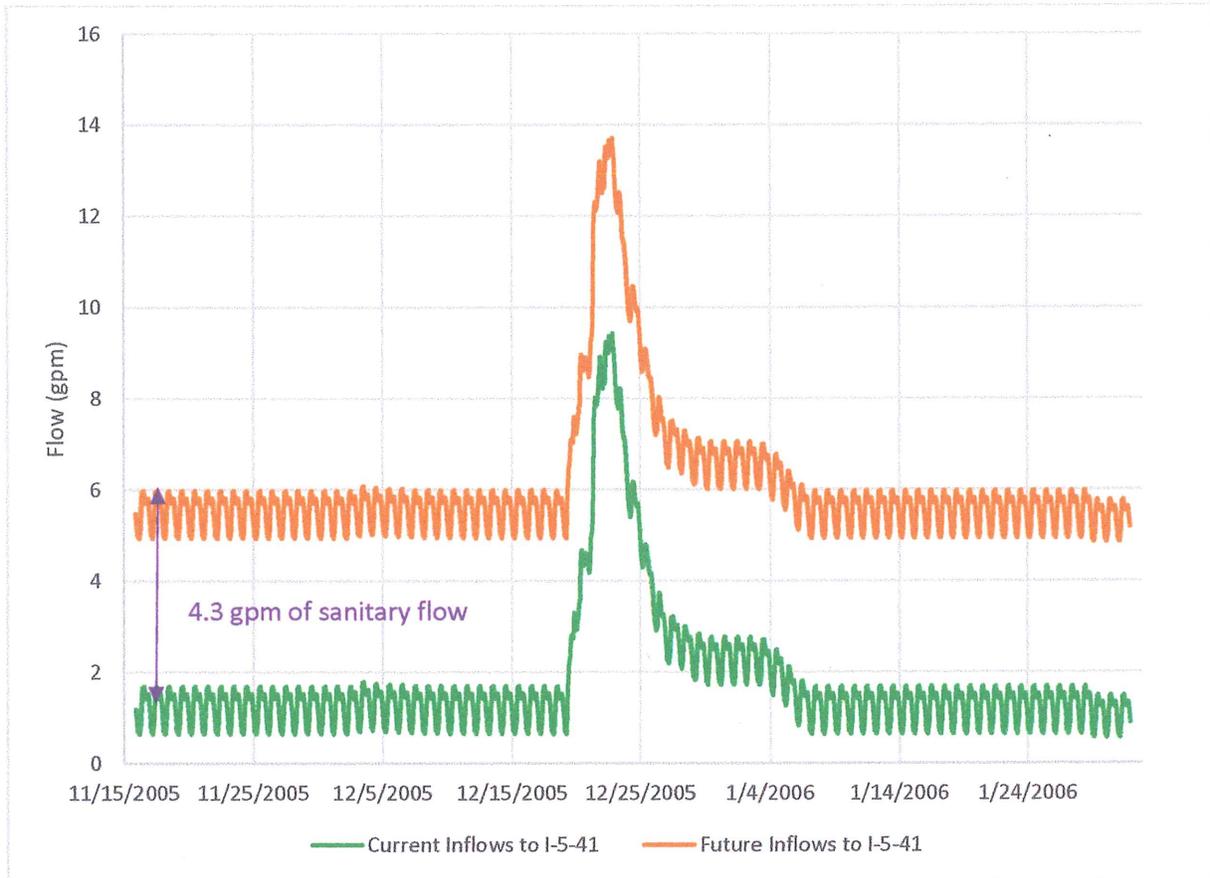


Figure 5 - Inflows to I-5-41 under Current and Future Configurations
Baker/Evans Property Hydraulic Analysis

Model Assumptions and Limitations

- No measured flows were used to develop the estimates included in this model. The flows that enter manholes I-5-41 and I-5-42 are estimated based on the sum of the area of the parcels that contribute to each of the manholes.
- Because elevation data was not available for all points between the I-4-9 and I-5-41, the system was modeled with a single pipe and did not include manhole I-5-38. The pipe has a length equivalent to the total pipe length and a slope equivalent to the average slope of the intermediate pipes.
- The assumed I&I for the apartment development is unchanged from the assumptions in the 2008 Master Plan. An increased impervious area and fewer laterals (a common RDII source) associated with the apartment development could reduce the actual I&I.

Model Results

The model was run to determine the performance of the collection system and resulting water levels in the manholes relative to the ground surface. A collection system deficiency is defined as any location with less than 2 feet of freeboard (distance between the water surface and the ground surface as specified in the 2008 Master Plan), potentially causing flooding. Even with the addition of flows from the proposed development, available freeboard is greater than 2 feet.

Table 3 summarizes the available freeboard in the manholes during each of the model runs. Water level profiles are provided in Attachment 2.

Table 3. Model Results – Freeboard (ground elevation – water elevation)

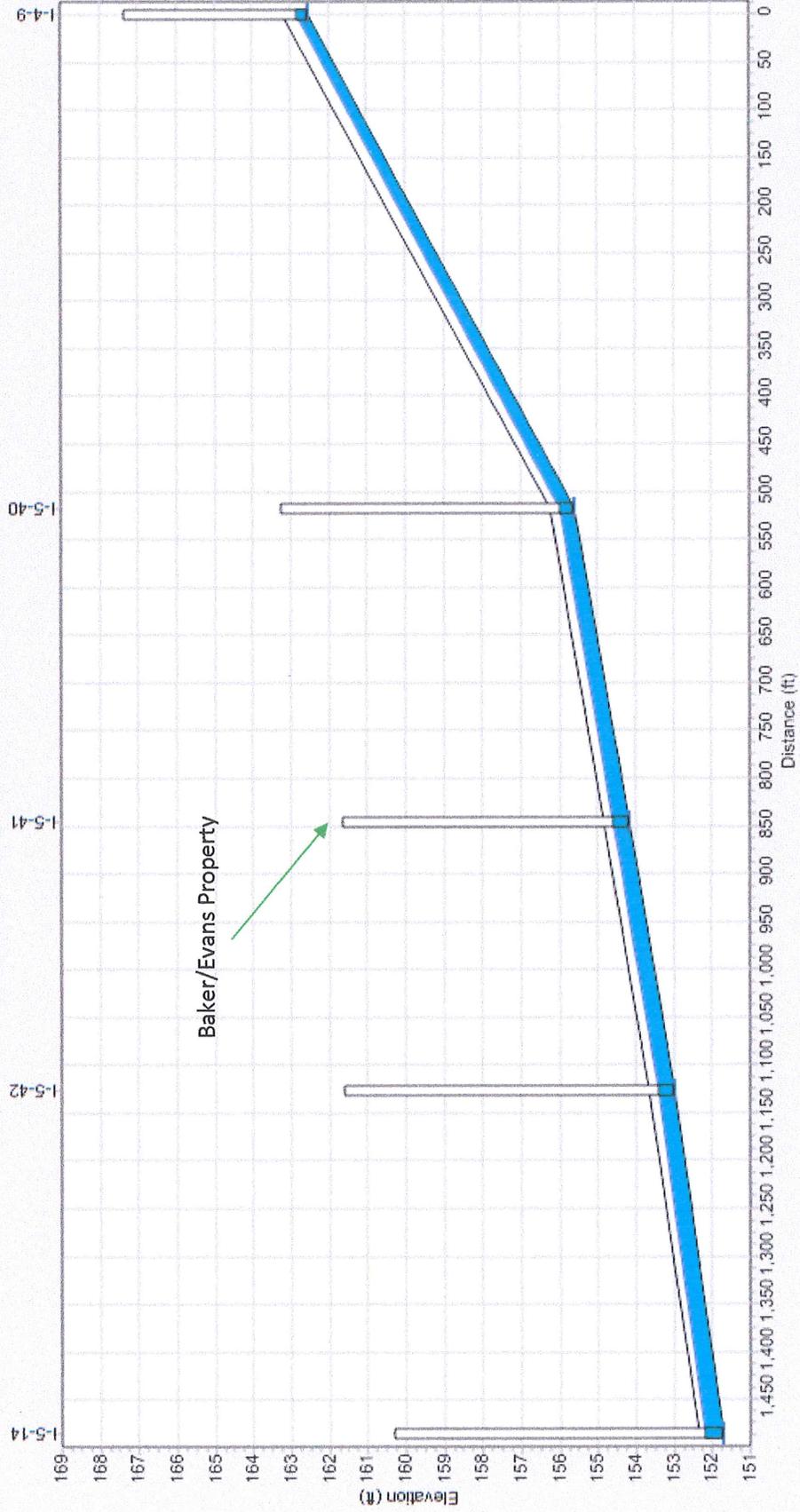
Node	Modeled Freeboard – Current	Modeled Freeboard – Future
I-4-9	4.51	4.51
I-5-40	7.24	7.24
I-5-41	7.02	7.01
I-5-42	8.19	8.18
I-5-14	8.10	8.09

Based on the analysis of available freeboard in the manholes, the flows from the proposed development can be conveyed without causing a deficiency by the current collection system configuration.

Attachment 1 – Proposed Development

Attachment 2 – Water Depth Profiles

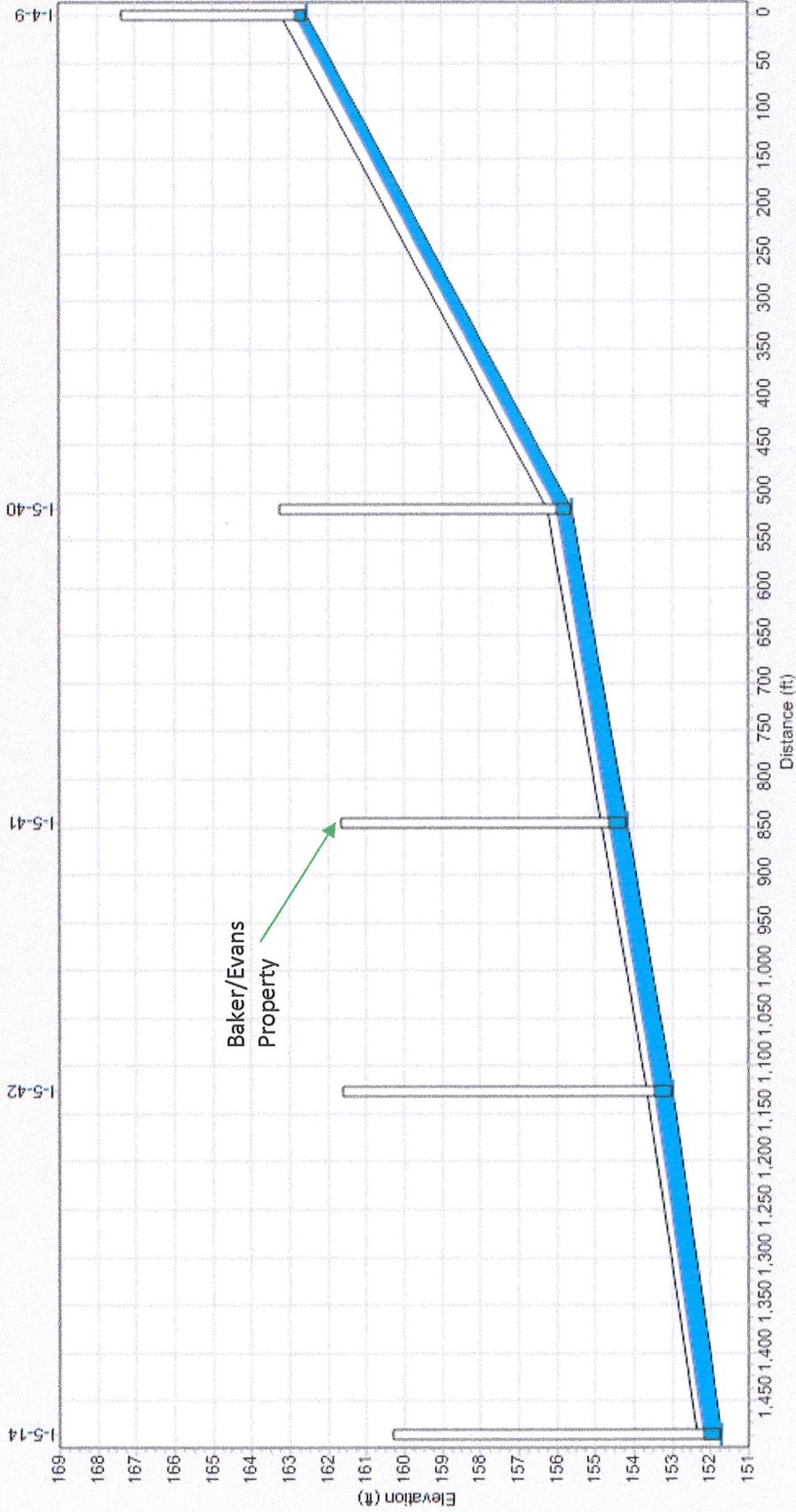
Water Elevation Profile: Node I-4-9 - I-5-14



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Water Level Profile, Current Configuration

Water Elevation Profile: Node I-4-9 - I-5-14



Water Level Profile, Future Configuration