4.10.2Priority Site #8 – Evaluation of Restoration Alternatives

Restoration Alternatives for Priority Site #8 were evaluated using the methodology outlined in **Section 4.2.** Based on this evaluation process, Alternative 3 - Sub-Reach-Based Works was selected as the preferred alternative.

4.10.3Priority Site #8 – Selection of the Preferred Alternative

As per the evaluation table, the Sub-Reach-Based Works option was selected as the preferred alternative for Priority Site #8 with a total score of 81.47/100. The local works solution was the second preferred alternative with a total score of 59.07/100 while the Do Nothing alternative was the least preferred alternative with a total score of 36.93/100.

Key elements of the Sub-Reach-Based Works alternative include:

- Removal of channel debris and failed erosion control structures (i.e., armourstone grade control structures, armourstone retaining walls, and gabion baskets).
- Apply approximately 650 metres of channel restoration work using natural channel design principles to establish riffle-pool morphology.
- Where feasible, lower and regrade channel banks to restore floodplain connectivity.
- Mitigate the major lateral erosion risk to the exposed sanitary sewer maintenance hole through a combination of minor channel realignment and construction of an armourstone retaining wall.
- Increase the depth of cover overtop of four exposed sanitary sewer crossings (Priority Site #5 - SL4031857, Priority Site #6 - SL4031887, Priority Site #7 - SL4031887 and Priority Site #9 - SL4033483) to a minimum of 1.0 m.
- Mitigate secondary lateral risk sites (Priority Site #19 - SL4032401, Priority Site #20 - SL4031887, Priority Site #22 - SL4033483, MH4918613545, SL4031888 and Priority Site #26 - SL4031857) through a combination of channel realignment and the construction of vegetated buttress bank protection works.
- Address potential future erosion related risks to the pedestrian trail system and private properties through the construction of toe erosion protection works at select locations.
- Rehabilitation of two storm sewer outfalls and their associated outfall channels (Priority Site #53 - OF4902413782 and Priority Site #65 - OF4907413839).
- Establish a geomorphically stable transition into existing channel conditions at the upstream and downstream tie-in points.
- Coordinate permission to enter agreements and/or land/easement acquisitions as required to facilitate construction. Private property impacts to be confirmed at detailed design.
- Apply restoration plantings to compensate for construction-related vegetation removals and to help stabilize regraded slopes.

4.11 Priority Site #9: Exposed Sanitary Sewer Crossing at Finch Avenue and Bayview Avenue

Priority Site #9, is located at the upstream extents of Reach N2, immediately downstream of the arched culvert crossing that conveys flows under the intersection of Bayview Avenue and Finch Avenue (**Figure 4-49**). Air photo analysis, indicates the channel has been straightened downstream of the culvert opening, through the construction of an engineered channel segment with armourstone bed and bank treatments. The armourstone bed is constructed as a series of cascades designed to dissipate energy (**Figure 4-50**). The bed and bank treatments are in poor condition, as a number of armourstone blocks have started to slump and become dislodged (**Figure 4-51**) as the finer materials between the larger blocks erode forming void spaces.

A 675 mm sanitary sewer crosses the creek at a diagonal, and has become effectively exposed within the armourstone bed (minimal cover overtop of failing bed treatments). At the downstream extents of the engineered channel works the armourstone wall has become outflanked and has started to fail as a number of blocks have become dislodged and fallen into the creek. This is contributing to the outflanking and exposure of a sanitary sewer maintenance hole that is no longer effectively protected from lateral erosion forces by the failed retaining wall and washed-out rip-rap (**Figure 4-52**). It should also be noted that near the downstream end of the armourstone bed, the bed works are in especially poor condition, with a deep scour pool having formed.

Figure 4-49: Arched Culvert conveying Flows under the Intersection of Bayview Avenue and Finch Avenue

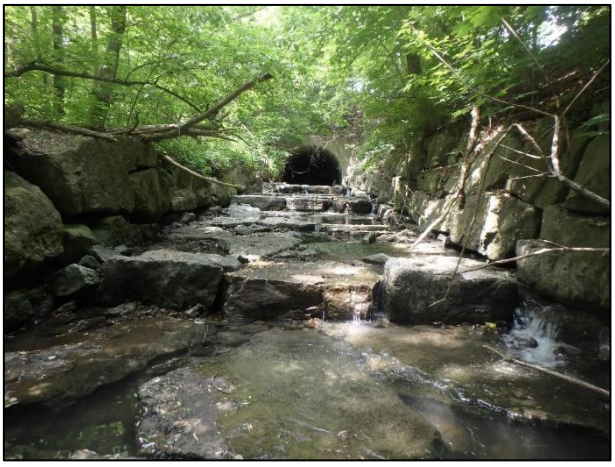

Figure 4-50: Armourstone Bed works over the 675 mm Sanitary Sewer Crossing, Constructed as a Series of Cascades

Figure 4-51: Degraded Armourstone Bed and Bank Treatments

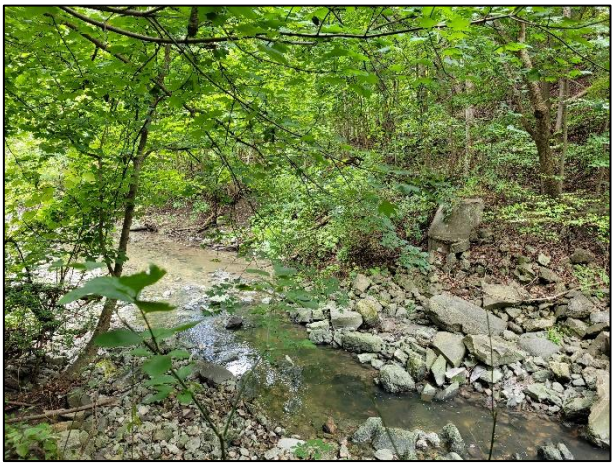

Figure 4-52: Exposed Sanitary Sewer Maintenance Hole Downstream of the Engineered Channel Works

Sanitary Sewer parameters relevant to this priority site are summarized in **Table 4-12** with a drawing illustrating the existing conditions of the project site presented in **Figure 4-53**.

Table 4-12: Summary of Priority Site #9 Sanitary Sewer Parameters

Parameter	Sanitary Trunk Sewer
Toronto Water Asset ID	SL4033483
Year of Construction	1960
Diameter	675
Depth of Cover	0 m
Estimated Time to Contact	0 years
Erodibility of Adjacent Substrate	Low

4.11.1Priority Site #9 – Description of Restoration Alternatives

Alternative 1: Do Nothing – The armourstone bed and bank treatments will continue to fail overtime leading to full exposure of the sanitary sewer crossing across the width of the channel. Failure of the bed works and bank works could lead to rapid widening and downcutting of the channel (in part because of how steeply graded this section of the creek is) resulting in increased erosion related risks to sanitary sewer infrastructure (both lateral and vertical) as well as the upstream culvert crossing and road embankment. Emergency works may need to be undertaken in the future if any infrastructure is severely damaged or fails.

Alternative 2: Local Works – Remove the failing armourstone bed and bank treatments and apply channel engineering works for about 70 metres of channel length within reach N2. The works will start at the culvert crossing and extend downstream, establishing a cascade-pool morphology constructed of grouted armourstone ribs and engineered substrate. Both banks will be lined with a new set of armourstone retaining walls, extended beyond the length of the original structures to mitigate lateral erosion related risks to sanitary sewer infrastructure. An engineered scour pool will be constructed immediately downstream of the culvert to provide energy dissipation and erosion control, as well as at the downstream extents of the proposed local works solution to facilitate a smooth transition into existing channel conditions.

Alternative 3: Sub-Reach-Based Works – Apply the local works solution described above as part of a proposed 650 metres of channel restoration work intended to increase the depth of cover over three (3) additional sanitary sewer crossings (priority sites #5, #6, and #7), mitigate lateral erosion risks to sanitary sewer infrastructure at five (5) locations (priority sites #8, #19, #20, #22 & #26), and allow for the rehabilitation of two (2) storm sewer outfalls (priority sites #53 & #65). Targeted realignment of the channel coupled with the implementation of engineered bank treatments will also help to alleviate potential erosion related risks to the pedestrian trail system. The proposed channel restoration works will include a combination of cascade-pool and riffle-pool morphology, coupled with engineered bank treatments (vegetated buttresses, and armourstone retaining walls), designed with the intent of building the creek up to establish a minimum of 1.0 metres of additional cover overtop of all applicable sanitary sewer crossings, and limit the protection of the sewer crossing's dependence on the long-term stability of any downstream grade control structures.

Preliminary concept drawings illustrating Alternative 2 and Alternative 3 are provided in **Figure 4-54**.

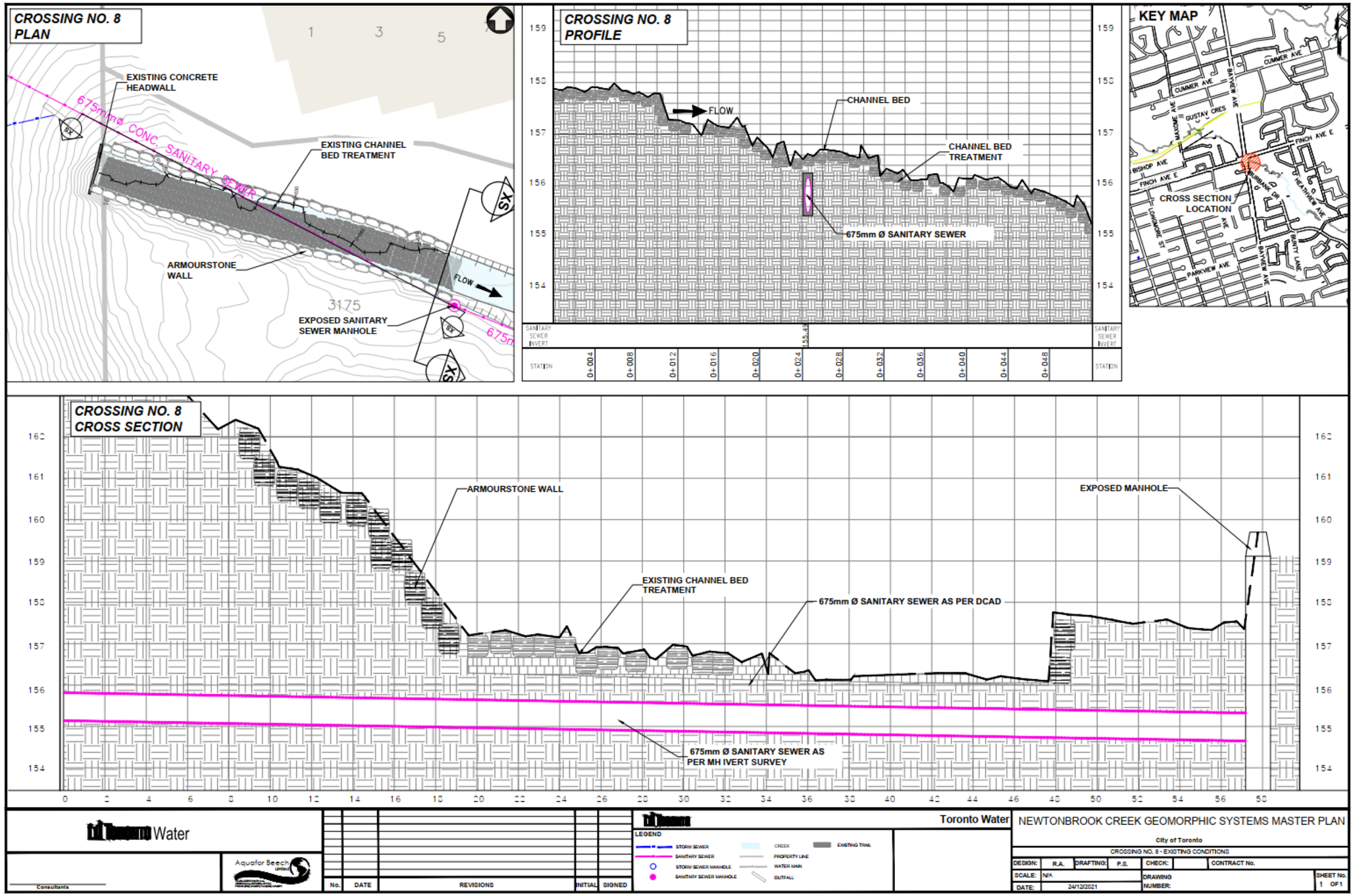

Figure 4-53: Existing Conditions - Priority Site #9

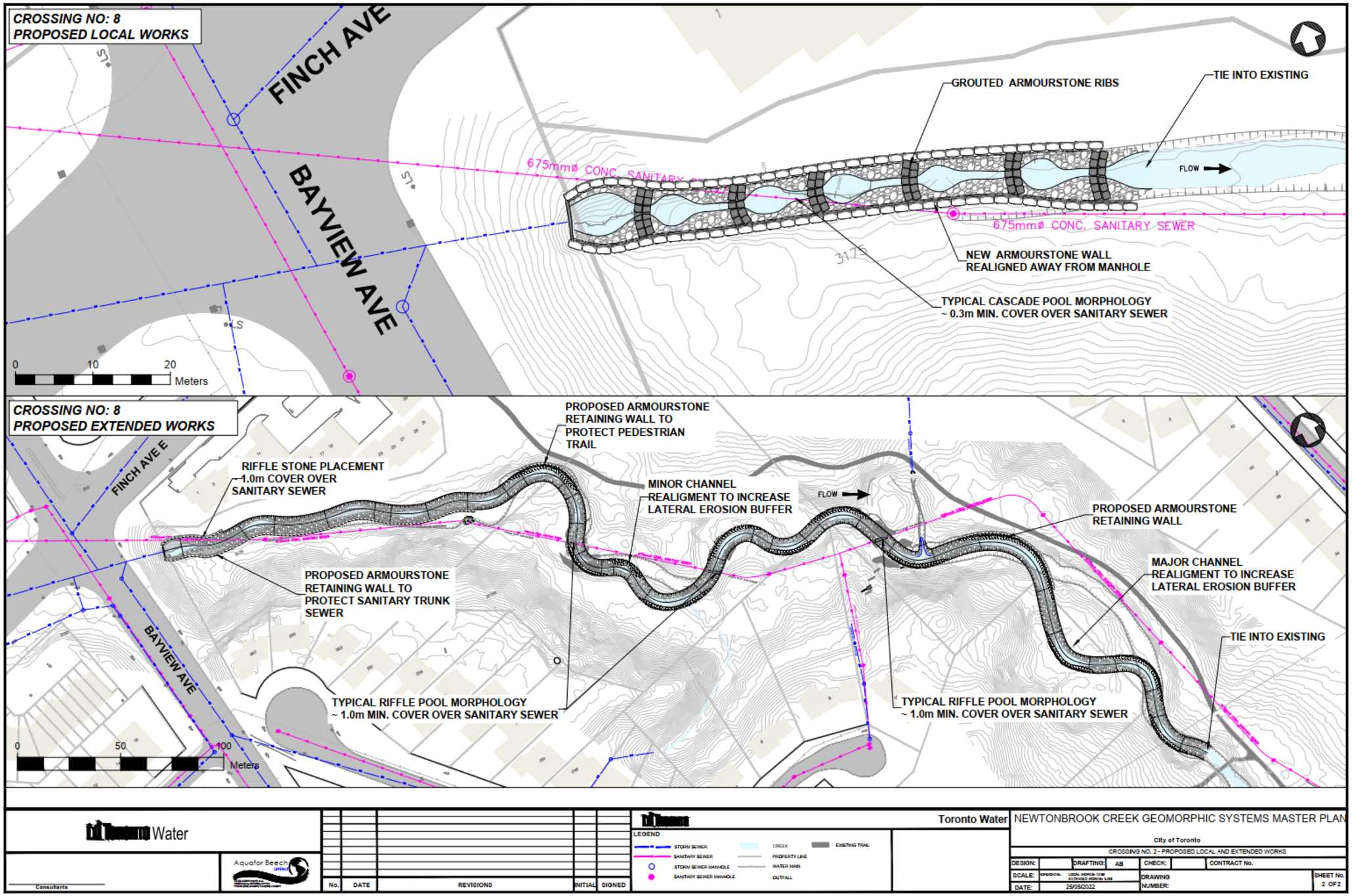

Figure 4-54: Preliminary Design Concepts Alternative 2 & 3 – Priority Site #9

4.11.2Priority Site #9 – Evaluation of Restoration Alternatives

Restoration Alternatives for Priority Site #9 were evaluated using the methodology outlined in **Section 4.2.** Based on this evaluation process, Alternative 3 - Sub-Reach-Based Works was selected as the preferred alternative.

4.11.3Priority Site #9 – Selection of the Preferred Alternative

As per the evaluation table, the Sub-Reach-Based Works option was selected as the preferred alternative for Priority Site #9 with a total score of 81.47/100. The local works solution was the second preferred alternative with a total score of 59.73/100 while the Do Nothing alternative was the least preferred alternative with a total score of 36.93/100.

Key elements of the Sub-Reach-Based Works alternative include:

- Removal of channel debris and failed erosion control structures (i.e., armourstone grade control structures, armourstone retaining walls, and gabion baskets).
- Apply approximately 650 metres of channel restoration work using natural channel design principles to establish riffle-pool morphology.
- Where feasible, lower and regrade channel banks to restore floodplain connectivity.
- Provide a minimum of 1.0 metres of cover overtop of the exposed 675 mm diameter sanitary sewer crossing.
- Increase the depth of cover overtop of an additional three exposed sanitary sewer crossings (Priority Site #53 - OF4902413782 and Priority Site #65 - OF4907413839) to a minimum of 1.0 m.
- Mitigate a major lateral erosion risk to an exposed sanitary sewer maintenance hole (Priority Site #8 - SL4033483through a combination of minor channel realignment and construction of an armourstone retaining wall.
- Mitigate secondary lateral risk sites (Priority Site #19 - SL4032401, Priority Site #20 - SL4031887, Priority Site #22 - SL4033483, MH4918613545, SL4031888 and Priority Site #26 - SL4031857) through a combination of channel realignment and the construction of vegetated buttress bank protection works.
- Address potential future erosion related risks to the pedestrian trail system and private properties through the construction of toe erosion protection works at select locations.
- Rehabilitation of two storm sewer outfalls and their associated outfall channels (Priority Site #53 - OF4902413782 and Priority Site #65 - OF4907413839).
- Establish a geomorphically stable transition into existing channel conditions at the upstream and downstream tie-in points.
- Coordinate permission to enter agreements and/or land/easement acquisitions as required to facilitate construction. Private property impacts to be confirmed at detailed design.
- Apply restoration plantings to compensate for construction-related vegetation removals and to help stabilize regraded slopes.

4.12 Priority Site #10: Exposed Watermain Chamber at Manorcrest Drive

Priority Site #10 is located in Reach N3 of Newtonbrook Creek, approximately 285 metres upstream of Bayview Avenue, where a 1,350 mm diameter watermain crosses the watercourse. As-Built Drawing records (drawing 157-M2) indicate the watermain was constructed beneath a gabion basket lined segment of channel in the early 1970's. Over the last fifty (50) years, channel erosion processes have completely removed the gabion basket bed and bank protection works overtop of the watermain crossing (**Figure 4-55**). This has resulted in the exposure of a watermain chamber setback from the main channel in the bank of the creek (**Figure 4-56**).

The depth of cover overtop of the watermain crossing has also decreased overtime to approximately 0.42 m. There is an existing gabion basket retaining wall that is still intact downstream of the watermain crossing. The retaining wall ranges in condition from poor to very poor (**Figure 4-57**), with some baskets partially buried into the slope, while others have slumped into the bed and in some cases emptied where the wire mesh has broken or corroded away (**Figure 4-58**).

Figure 4-55: Failed Gabion Basket Bank Protection

Figure 4-56: Exposed Watermain Chamber

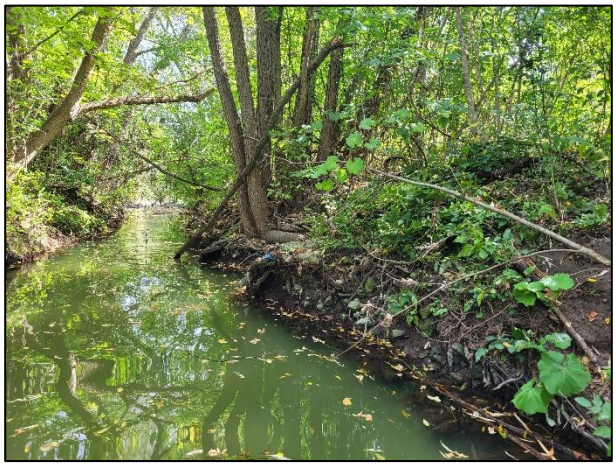

Figure 4-57: Channel Conditions Upstream of Watermain Crossing

Figure 4-58: Undermined and Emptied Gabion Baskets Upstream of Watermain Crossing

Watermain parameters relevant to this priority site are summarized in **Table 4-13** with a drawing illustrating the existing conditions of the project site presented in **Figure 4-59**.

Table 4-13: Summary of Priority Site #10 Watermain Parameters

Parameter	Watermain	Watermain Chamber
Toronto Water Asset ID	LN24062	CH4006045
Year of Construction	1971	1972
Diameter	1,350	N/A
Depth of Cover	0.42 m	Exposed
Estimated Time to Contact	19 Years	0 Years
Erodibility of Adjacent Substrate	Moderate	Moderate

4.12.1Priority Site #10 – Description of Restoration Alternatives

Alternative 1: Do Nothing – The watermain crossing will eventually become exposed and vulnerable to damage as the creek continues to scour and down-cut. Continued widening of the channel and failure of the degraded gabion basket retaining wall will lead to further exposure of the watermain chamber. Emergency works may need to be undertaken if any infrastructure is severely damaged or fails.

Alternative 2: Local Works – Apply natural channel design works for approximately 175 metres of channel length. The proposed works will tie-into existing conditions just upstream of the private property parcel owned by Blessed Trinity Parish (3220 Bayview Avenue). Adjustments to the longitudinal profile, planimetric alignment and typical channel dimensions will look to stabilize the creek from a geomorphic perspective. The proposed solution will increase the depth of cover over the watermain crossing by a minimum of 1.0 metres to at least 1.42 m, and will have the added benefit of also increasing the depth of the cover over sanitary sewer crossing #11 (Priority Site #43), located upstream of this priority site, from an estimated 1.88 metres to a minimum of 2.0 m.

Failed engineered bed and bank treatments, and accumulated debris, will be removed with riffle-pool morphology established through the placement of engineered substrate. Vegetated buttresses will be placed along the outside of each meander bend for erosion protection, with any erosion scars filled in using approved materials. The slopes behind the channel works will be regraded to tie-into existing conditions and stabilized through the application of coir matting and restoration plantings. The proposed works will also allow for the restoration of a storm outfall channel (Priority Site #69) that drains into Newtonbrook Creek downstream of the watermain crossing. The outfall channel conveys flows from a 900 mm diameter storm sewer outfall. While the outfall structure itself is in moderate to good condition, the outfall channel is heavily incised and would benefit from some proactive restoration work to prevent future undermining of the outfall structure.

Alternative 3: Sub-Reach-Based Works – Apply natural channel design works for approximately 435 metres of channel length. Accumulated debris, including failed erosion control works, will be removed with riffle-pool morphology established through the placement of engineered substrate. Adjustments to the longitudinal profile, planimetric alignment and typical channel dimensions will look to stabilize the creek from a geomorphic perspective. The slopes behind the channel works will be regraded to tie-into existing conditions and stabilized.

The proposed solution will increase the depth of cover over the watermain crossing by 1-1.5 m, and will also increase the depth of cover overtop of an exposed sanitary sewer crossing upstream (Priority Site #11) to a minimum of 1.0 m. As an added benefit the depth of cover overtop of two buried sanitary sewer crossings (Priority Sites #39 and #43) will be increased to a minimum of 1.50 m. The proposed channel restoration works will also help to establish an additional meter of cover overtop of four (4) oil and gas pipelines owned by Sun-Canadian, Imperial Oil, Trans-Northern and Enbridge Gas. Two (2) storm sewer outfalls (Priority Sites #64 and #69) will also be rehabilitated as part of the proposed sub-reach-based works solution.

Preliminary concept drawings illustrating Alternative 2 and Alternative 3 are provided in **Figure 4-60**.

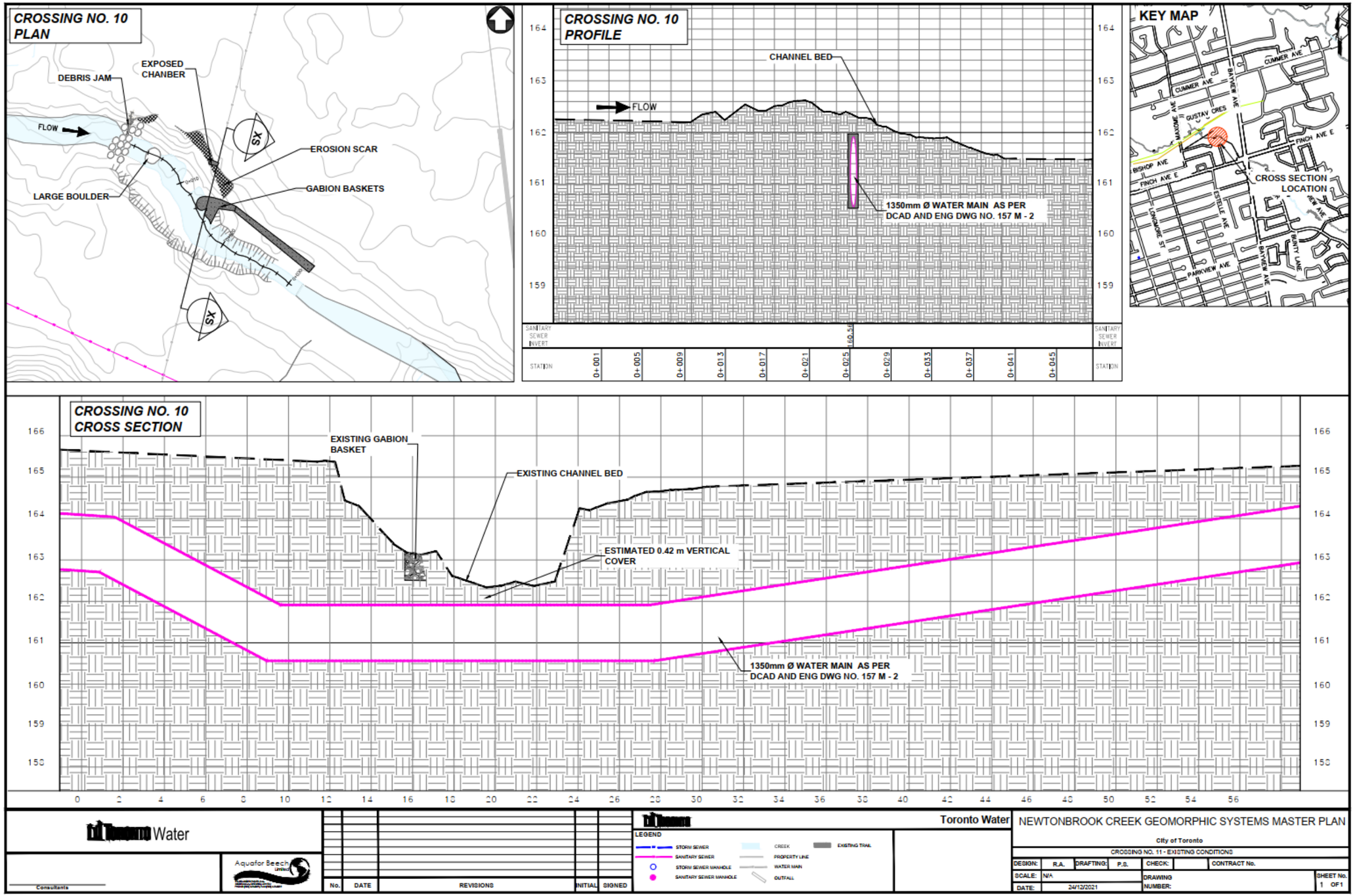

Figure 4-59: Existing Conditions - Priority Site #10

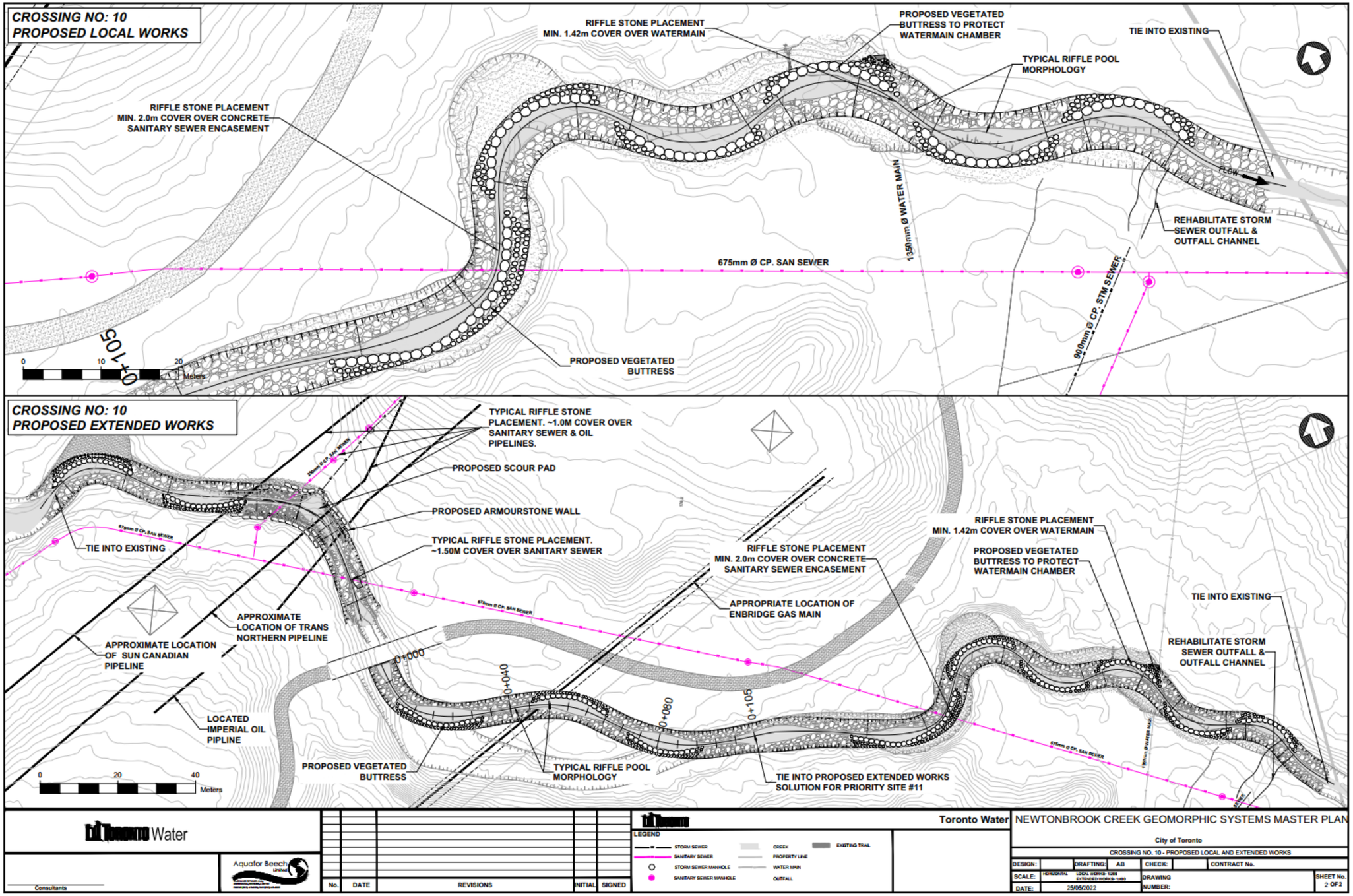

Figure 4-60: Preliminary Design Concepts Alternative 2 & 3 – Priority Site #10

4.12.2Priority Site #10 – Evaluation of Restoration Alternatives

Restoration Alternatives for Priority Site #10 were evaluated using the methodology outlined in **Section 4.2.** Based on this evaluation process, Alternative 2 - Local Works was selected as the preferred alternative.

4.12.3Priority Site #10 – Selection of the Preferred Alternative

As per the evaluation table, the Local Works option was selected as the preferred alternative for Priority Site #10 with a total score of 80.00/100. The Sub-Reach-Based Works solution was the second preferred alternative with a total score of 74.73/100 while the Do Nothing alternative was the least preferred alternative with a total score of 38.33/100.

Key elements of the Local Works alternative include:

- Removal of channel debris and failed erosion control structures (i.e., gabion baskets).
- Apply approximately 175 metres of channel restoration work using natural channel design principles to establish riffle-pool morphology.
- Where feasible, lower and regrade channel banks to restore floodplain connectivity.
- Provide a minimum of 1.42 metres of cover overtop of the 1,350 mm diameter watermain crossing.
- Mitigate the lateral erosion risk to the exposed watermain chamber through the construction of vegetated buttress bank protection works.
- Increase the depth of cover overtop of the upstream sanitary trunk sewer crossing (Priority Site #43 - SL4031891) from 1.88 metres to a minimum of 2.0 m.
- Rehabilitate an eroded 900 mm storm sewer outfall channel (Priority Site #69 - OF4940713236).
- Establish a geomorphically stable transition into existing channel conditions at the upstream and downstream tie-in points.
- Apply restoration plantings to compensate for construction-related vegetation removals and to help stabilize regraded slopes.
- Coordination with Enbridge to establish a smooth transition between the proposed channel restoration works and Enbridge’s planned future channel works project to protect their gas main crossing located upstream.