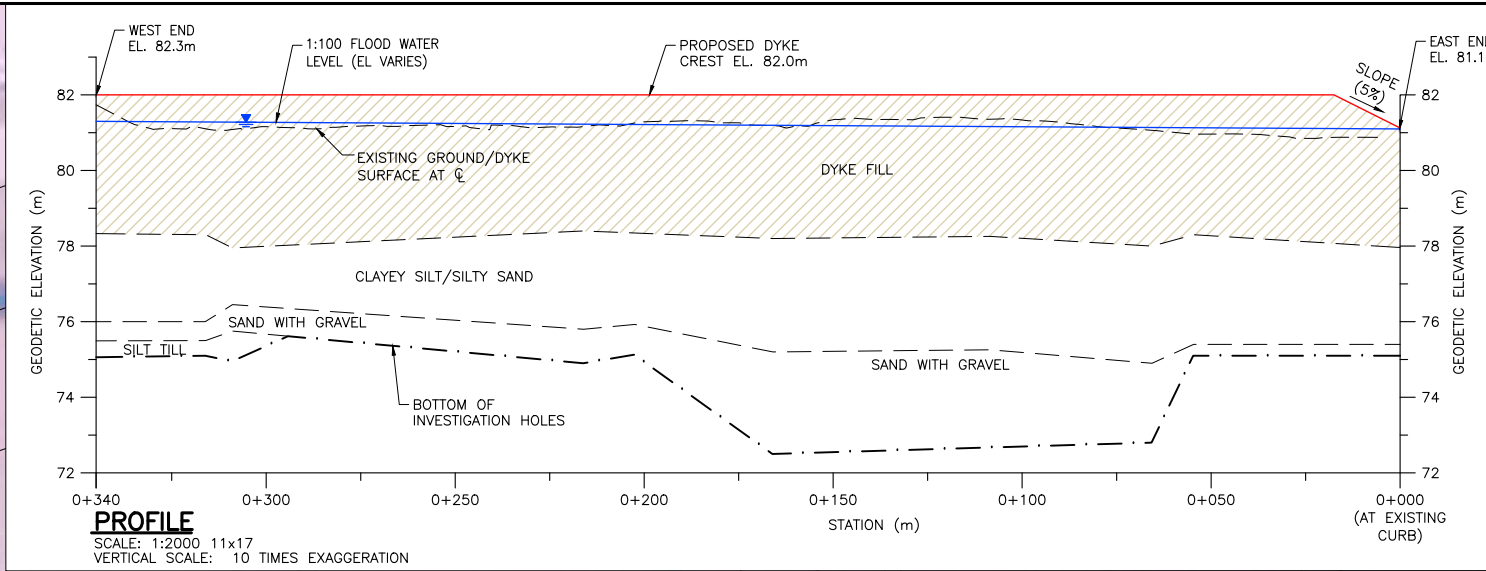
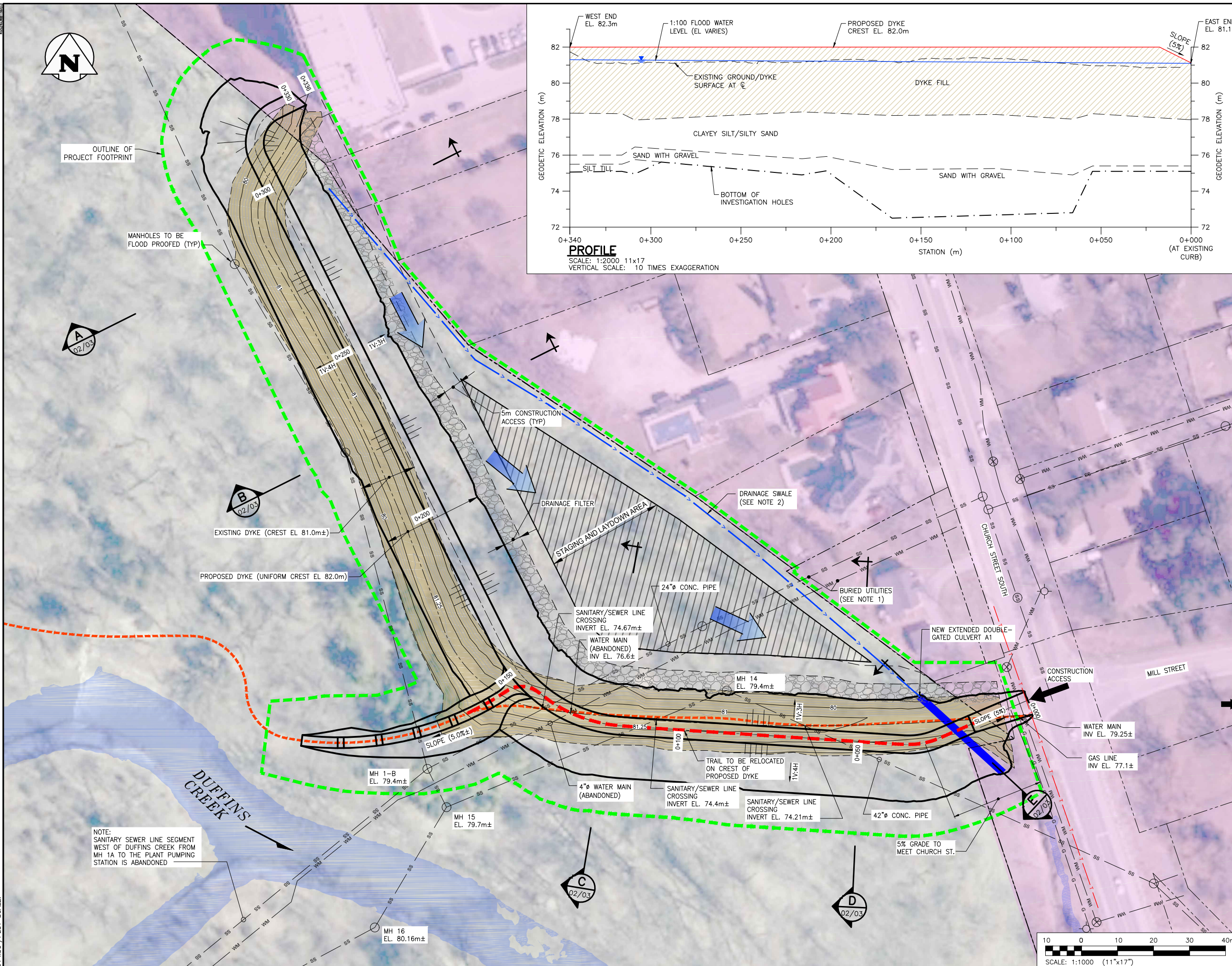


APPENDIX I

Drawings of Design Concept for the Pickering and
Ajax Dykes Rehabilitation

File: \\192.168.0.226\1-Data\Projects\2019\19-2939-003\DWG\Geo\Preliminary Design (30% Complete)\19-2939-003_G-01 - Tab:Rev0 Plotted By: Tvanment 20/05/13 [Wed 11:08am] 24 x36 PLOT SCALE:



- LEGEND:**
- ⊗ EXISTING CONTROL VALVE
 - EXISTING SANITARY/STORM MANHOLE
 - ◇ EXISTING HYDRANT
 - EXISTING CATCH BASIN
 - SS — EXISTING SANITARY/SEWER SERVICE
 - WM — EXISTING WATERMAIN/WATER SERVICE
 - G — EXISTING GAS SERVICE
 - — — — — PROPERTY LINE
 - T — EXISTING TELEPHONE CABLE SERVICE
 - > — DRAINAGE SWALE
 - - - - - EXISTING TRAIL
 - - - - - NEW TRAIL
 - — — — — CULVERT/DRAINAGE FEATURE
 - - - - - PROJECT FOOTPRINT (SEE NOTE 4)
 - — — — — DYKE CENTRE LINE STATIONING
 - — — — — PROPERTY NOT OWNED BY TRCA
 - — — — — EXISTING DYKE FOOTPRINT
 - — — — — PROPOSED DYKE FOOTPRINT
 - — — — — EXISTING OVERLAND FLOW PATTERN

- NOTES:**
1. LOCATION AND DEPTH OF UTILITIES TO BE CONFIRMED AND PROTECTED DURING CONSTRUCTION.
 2. ALL INTERNAL DRAINAGE TO BE DIRECTED TO DOUBLE GATED CULVERT A1.
 3. DRAWINGS BASED ON LIDAR DATA AND SUPPLEMENTED WITH TOPOGRAPHIC GROUND SURVEY OF THE EXISTING DYKES AS PROVIDED BY TRCA.
 4. PROJECT FOOTPRINT CORRESPONDS TO POTENTIAL DISTURBANCE FOOTPRINT.

0	20/05/15	ISSUED WITH ESR	CMR	BPA
NO.	YY/MM/DD	DESCRIPTION	DESIGN BY	DESIGN CHECK
REVISIONS / ISSUE				

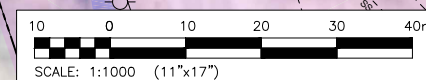


PROJECT: REMEDIAL FLOOD AND EROSION CONTROL CLASS EA FOR THE REHABILITATION OF THE PICKERING AND AJAX FLOOD CONTROL DYKES, ONTARIO

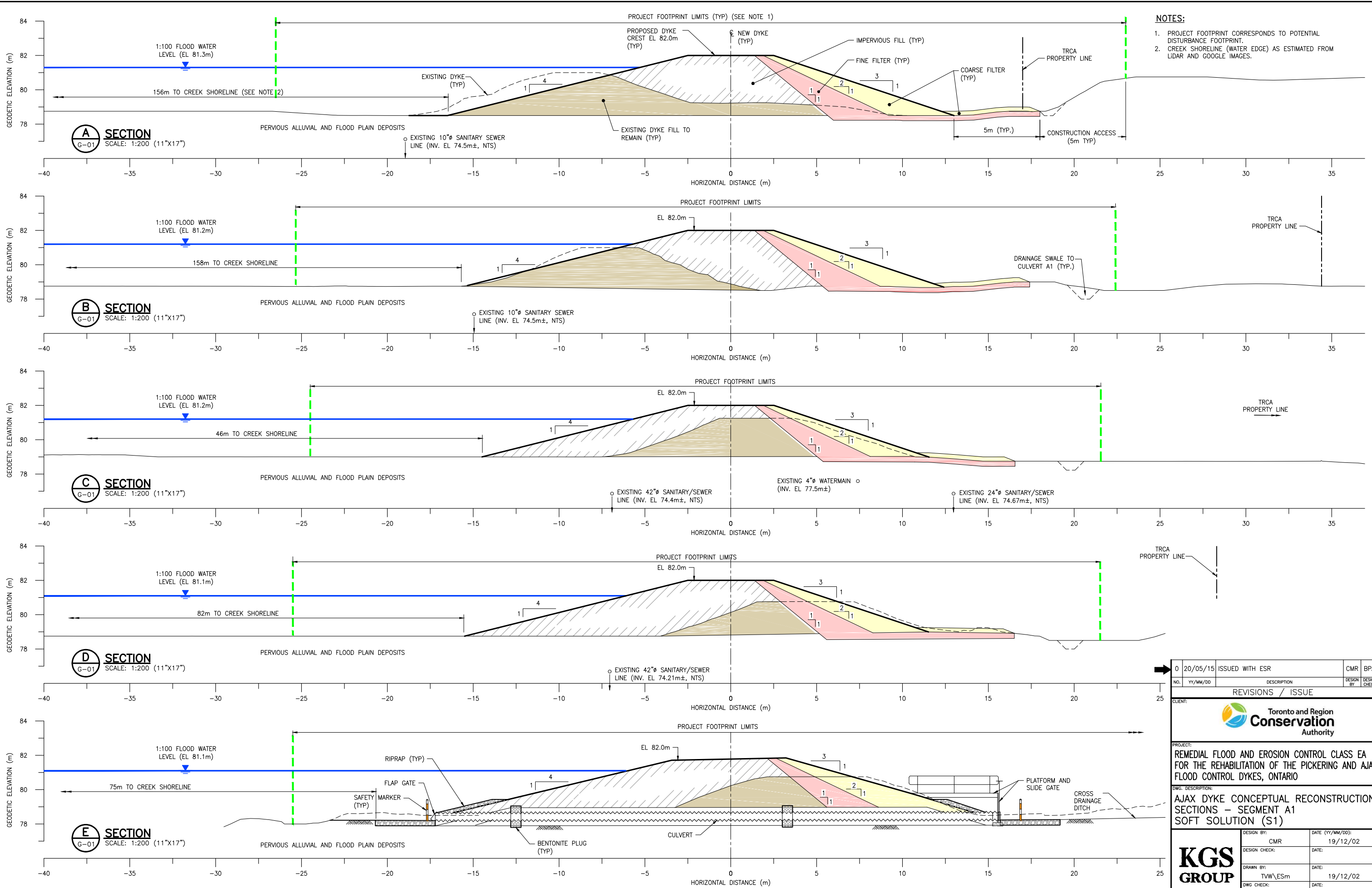
DWG. DESCRIPTION: AJAX DYKE CONCEPTUAL RECONSTRUCTION PLAN AND PROFILE – SEGMENT A1 SOFT SOLUTION (S1) AND (S2)

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	DESIGN CHECK:	DATE:
	DRAWN BY: TVW/ESm	DATE: 19/12/02
	DWG CHECK:	DATE:

DWG. NO. 19-2939-003 G-01 REV: 0



File name: \\192.168.0.226\1-data\Projects\2019\19-2939-003\DWG\Geo\Preliminary Design (30% Complete)\19-2939-003_G-02 - TabRev0 Plotted By: T\ranment 20/05/13 [Wed 11:09am] 24 X36 /PLOT SCALE:



- NOTES:**
1. PROJECT FOOTPRINT CORRESPONDS TO POTENTIAL DISTURBANCE FOOTPRINT.
 2. CREEK SHORELINE (WATER EDGE) AS ESTIMATED FROM LIDAR AND GOOGLE IMAGES.

0	20/05/15	ISSUED WITH ESR	CMR	BPA
NO.	YY/MM/DD	DESCRIPTION	DESIGN BY	DESIGN CHECK
REVISIONS / ISSUE				



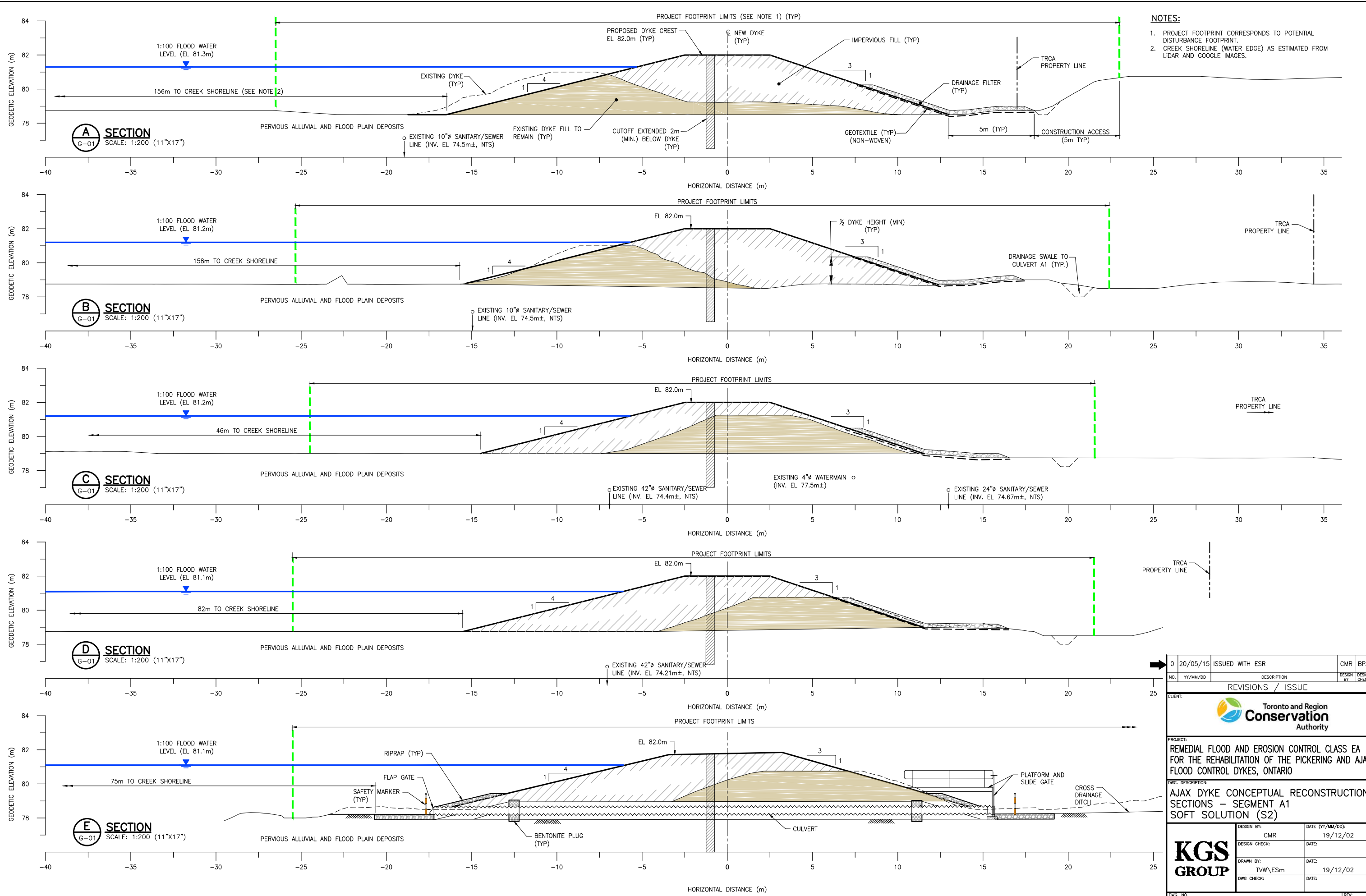
PROJECT:
REMEDIAL FLOOD AND EROSION CONTROL CLASS EA FOR THE REHABILITATION OF THE PICKERING AND AJAX FLOOD CONTROL DYKES, ONTARIO

DWG. DESCRIPTION:
AJAX DYKE CONCEPTUAL RECONSTRUCTION SECTIONS - SEGMENT A1 SOFT SOLUTION (S1)

DESIGN BY:	CMR	DATE (YY/MM/DD):	19/12/02
DESIGN CHECK:		DATE:	
DRAWN BY:	TWV\ESM	DATE:	19/12/02
DWG CHECK:		DATE:	

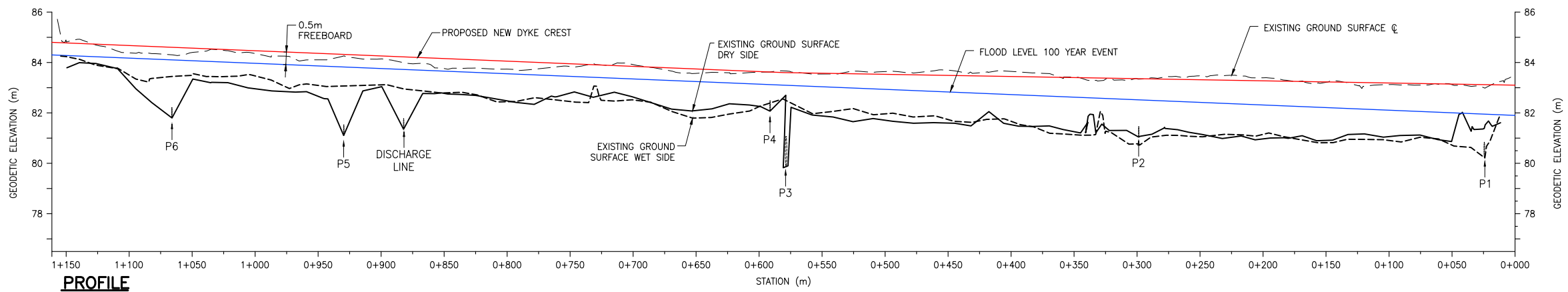
DWG. NO. **19-2939-003 G-02** REV: **0**

File name: \\192.168.0.226\1-data\Projects\2019\19-2939-003\DWG\Geo\Preliminary Design (30% Complete)\19-2939-003_G-03 - TabRev0 Plotted By: Tvanment 20/05/13 [Wed 11:10am]
 24 X36 PLOT SCALE:



- NOTES:**
- PROJECT FOOTPRINT CORRESPONDS TO POTENTIAL DISTURBANCE FOOTPRINT.
 - CREEK SHORELINE (WATER EDGE) AS ESTIMATED FROM LIDAR AND GOOGLE IMAGES.

0	20/05/15	ISSUED WITH ESR	CMR	BPA
NO.	YY/MM/DD	DESCRIPTION	DESIGN BY	DESIGN CHECK
REVISIONS / ISSUE				
CLIENT:				
PROJECT:				
REMEDIAL FLOOD AND EROSION CONTROL CLASS EA FOR THE REHABILITATION OF THE PICKERING AND AJAX FLOOD CONTROL DYKES, ONTARIO				
DWG. DESCRIPTION:				
AJAX DYKE CONCEPTUAL RECONSTRUCTION SECTIONS - SEGMENT A1 SOFT SOLUTION (S2)				
DESIGN BY:		CMR	DATE (YY/MM/DD): 19/12/02	
DESIGN CHECK:			DATE:	
DRAWN BY:		TWV_ESM	DATE: 19/12/02	
DWG CHECK:			DATE:	
DWS. NO. 19-2939-003 G-03 REV: 0				



- LEGEND:**
- ⊗ EXISTING CONTROL VALVE
 - EXISTING SANITARY/STORM MANHOLE
 - ⊕ EXISTING HYDRANT
 - EXISTING CATCH BASIN
 - SS — EXISTING SANITARY/SEWER SERVICE
 - STM — EXISTING STORM SEWER
 - WM — EXISTING WATERMAIN/WATER SERVICE
 - TW — EXISTING TELEPHONE CABLE SERVICE
 - — — PROPERTY LINE
 - — — DRAINAGE SWALE
 - — — TRAIL (SEE NOTE 3)
 - — — NEW TRAIL
 - — — PROJECT FOOTPRINT (SEE NOTE 7)
 - — — CULVERT/DRAINAGE FEATURE
 - — — EXISTING DYKE CENTRE LINE STATIONING
 - — — PROPERTY NOT OWNED BY TRCA
 - — — EXISTING DYKE FOOTPRINT
 - — — PROPOSED DYKE FOOTPRINT
 - — — PROPOSED VEGETATED ROCK BANK PROTECTION ON DYKE WET SLOPE
 - — — PROPOSED VEGETATED ROCK BANK PROTECTION ON DYKE WET SLOPE DOWN TO CREEK BED
 - — — PROPOSED ROCKFILL TRENCH
 - — — EXISTING OVERLAND FLOW PATTERN

- NOTES:**
1. LOCATION AND DEPTH OF UTILITIES TO BE CONFIRMED AND UTILITIES TO BE PROTECTED DURING CONSTRUCTION.
 2. ALL INTERNAL DRAINAGE TO BE DIRECTED TO DOUBLE GATED CULVERTS P1 TO P6.
 3. TRAIL MAY REMAIN ALONG TOE OF DYKE OR BE RELOCATED TO CREST OF DYKE.
 4. INSTALL NEW DOUBLE GATES AND EXTEND ALL EXISTING CULVERTS AND DISCHARGE PIPES.
 5. DYKE ALIGNMENT RELATIVE TO CREEK PROXIMITY AND TRANSITION FROM HARD TO SOFT DYKE SECTIONS TO BE OPTIMIZED DURING DETAILED DESIGN.
 6. REQUIREMENT FOR ACCESS RAMP TO BE CONFIRMED AS PART OF DETAILED DESIGN.
 7. PROJECT FOOTPRINT CORRESPONDS TO POTENTIAL DISTURBANCE FOOTPRINT.
 8. VEGETATED ROCK BANK PROTECTION PLACED ON WET SIDE DYKE SLOPE ALONG SEGMENT P1, AS WELL AS IN ACCORDANCE WITH RESTORATION PLAN. LOCATION OF ROCK BUTTRESS AND SURFACE TREATMENT OF THE WET SIDE DYKE SLOPE TO BE REFINED DURING DETAILED DESIGN, CONSIDERING EASE OF PEDESTRIAN AND EQUIPMENT ACCESS ACROSS THE DYKE.
 9. DRAWINGS BASED ON LIDAR DATA AND SUPPLEMENTED WITH TOPOGRAPHIC GROUND SURVEY OF THE EXISTING DYKES AS PROVIDED BY TRCA.

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NO.	YY/MM/DD	DESCRIPTION	DESIGN BY	DESIGN CHECK
REVISIONS / ISSUE				

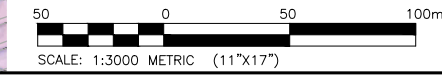
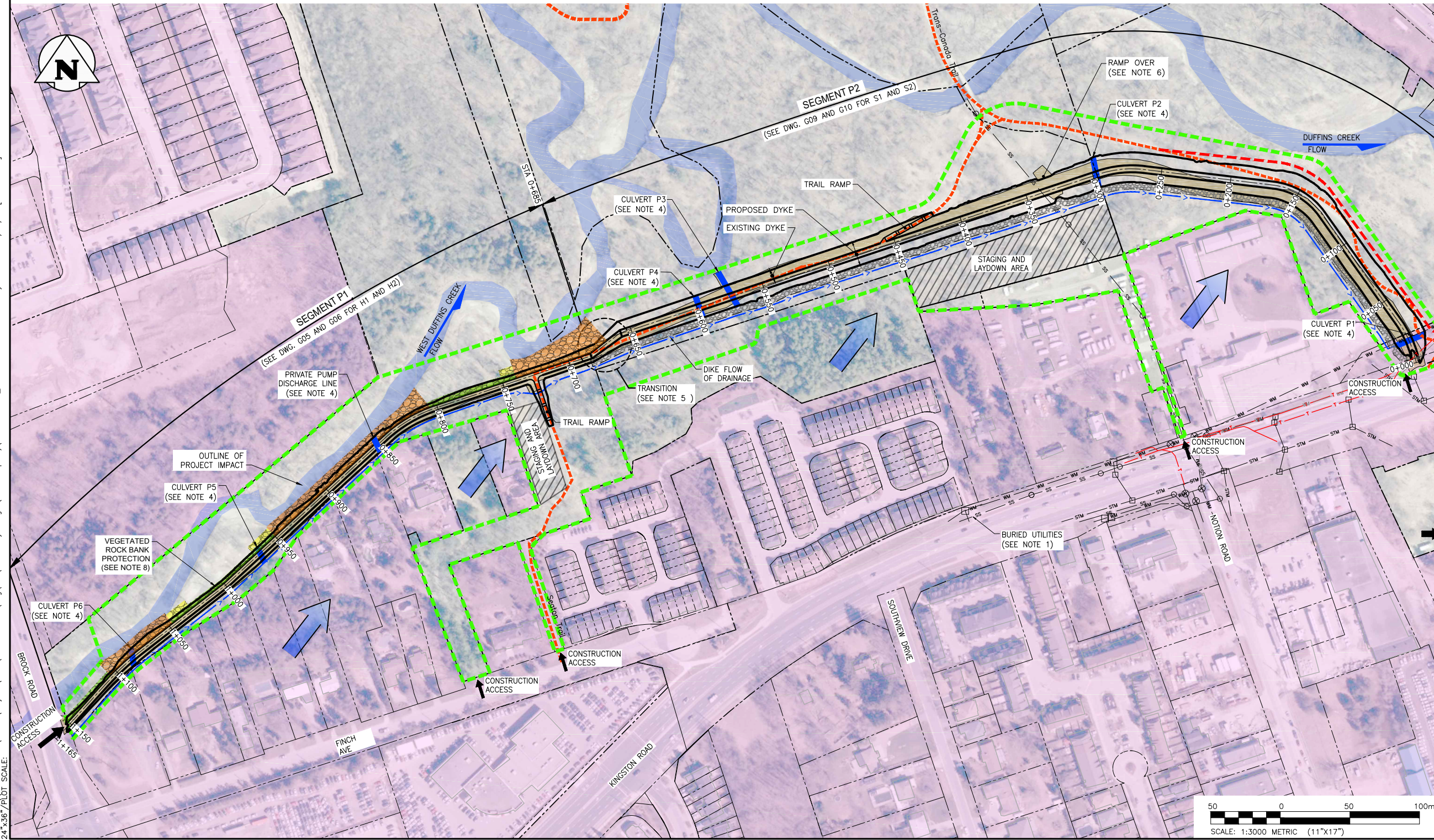


PROJECT:
 REMEDIAL FLOOD AND EROSION CONTROL CLASS EA FOR THE REHABILITATION OF THE PICKERING AND AJAX FLOOD CONTROL DYKES, ONTARIO

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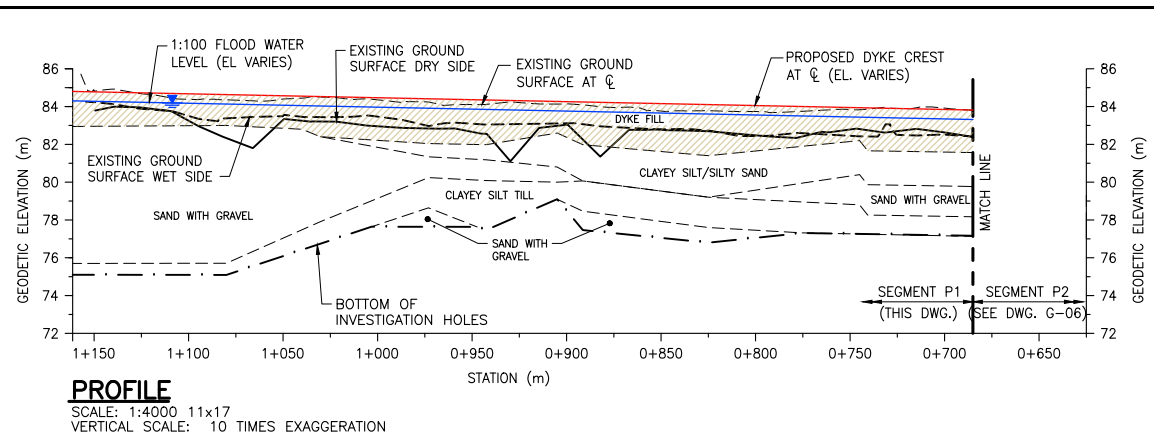
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DWG. NO. 19-2939-003 G-04 REV: 0



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File name: \\192.168.0.226\1-data\Projects\2019\19-2939-003\DWG\Geo\Preliminary Design (30% Complete)\19-2939-003_G-05 - TabRev0 Plotted By: Tvanment 20/05/14 [Fri 10:39am]
 4 336 / PLOT SCALE:



LEGEND:

- ⊗ EXISTING CONTROL VALVE
- EXISTING SANITARY/STORM MANHOLE
- ⊕ EXISTING HYDRANT
- EXISTING CATCH BASIN
- SS — EXISTING SANITARY/SEWER SERVICE
- STM — EXISTING STORM SEWER
- WM — EXISTING WATERMAIN/WATER SERVICE
- T — EXISTING TELEPHONE CABLE SERVICE
- — — PROPERTY LINE
- > — DRAINAGE SWALE
- > — TRAIL (SEE NOTE 3)
- — — NEW TRAIL
- — — PROJECT FOOTPRINT (SEE NOTE 5)
- — — CULVERT/DRAINAGE FEATURE
- — — EXISTING DYKE CENTRE LINE STATIONING
- — — PROPERTY NOT OWNED BY TRCA
- — — EXISTING DYKE FOOTPRINT
- — — PROPOSED DYKE FOOTPRINT
- — — PROPOSED VEGETATED ROCK BANK PROTECTION ON DYKE WET SLOPE
- — — PROPOSED VEGETATED ROCK BANK PROTECTION ON DYKE WET SLOPE DOWN TO CREEK BED
- — — PROPOSED ROCKFILL TRENCH
- — — EXISTING OVERLAND FLOW PATTERN

- NOTES:**
1. INSTALL NEW DOUBLE GATES AND EXTEND ALL EXISTING CULVERTS AND DISCHARGE PIPES.
 2. ALL INTERNAL DRAINAGE TO BE DIRECTED TO DOUBLE GATED CULVERTS P1 TO P6.
 3. TRAIL MAY REMAIN ALONG TOE OF DYKE OR BE RELOCATED TO CREST OF DYKE.
 4. LOCATION AND DEPTH OF UTILITIES TO BE CONFIRMED AND UTILITIES TO BE PROTECTED DURING CONSTRUCTION.
 5. PROJECT FOOTPRINT CORRESPONDS TO POTENTIAL DISTURBANCE FOOTPRINT.
 6. VEGETATED ROCK BANK PROTECTION PLACED ON WET SIDE DYKE SLOPE ALONG SEGMENT P1, AS WELL AS IN ACCORDANCE WITH RESTORATION PLAN. LOCATION OF ROCK BUTTRESS AND SURFACE TREATMENT OF THE WET SIDE DYKE SLOPE TO BE REFINED DURING DETAILED DESIGN, CONSIDERING EASE OF PEDESTRIAN AND EQUIPMENT ACCESS ACROSS THE DYKE.
 7. DRAWINGS BASED ON LIDAR DATA AND SUPPLEMENTED WITH TOPOGRAPHIC GROUND SURVEY OF THE EXISTING DYKES AS PROVIDED BY TRCA.

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REVISIONS / ISSUE				

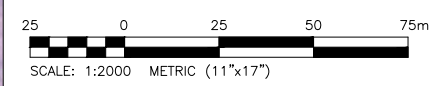


PROJECT:
 REMEDIAL FLOOD AND EROSION CONTROL CLASS EA FOR THE REHABILITATION OF THE PICKERING AND AJAX FLOOD CONTROL DYKES, ONTARIO

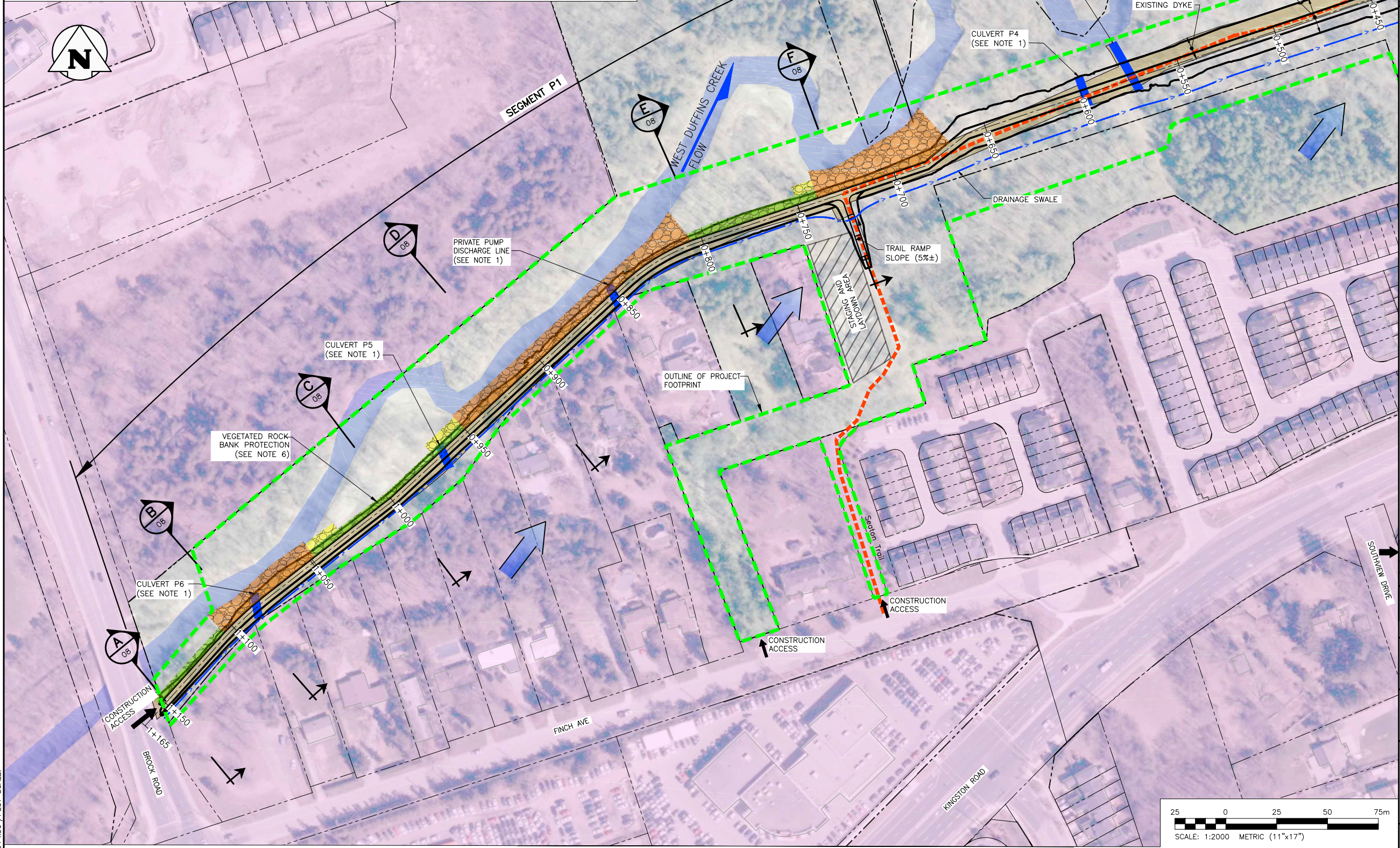
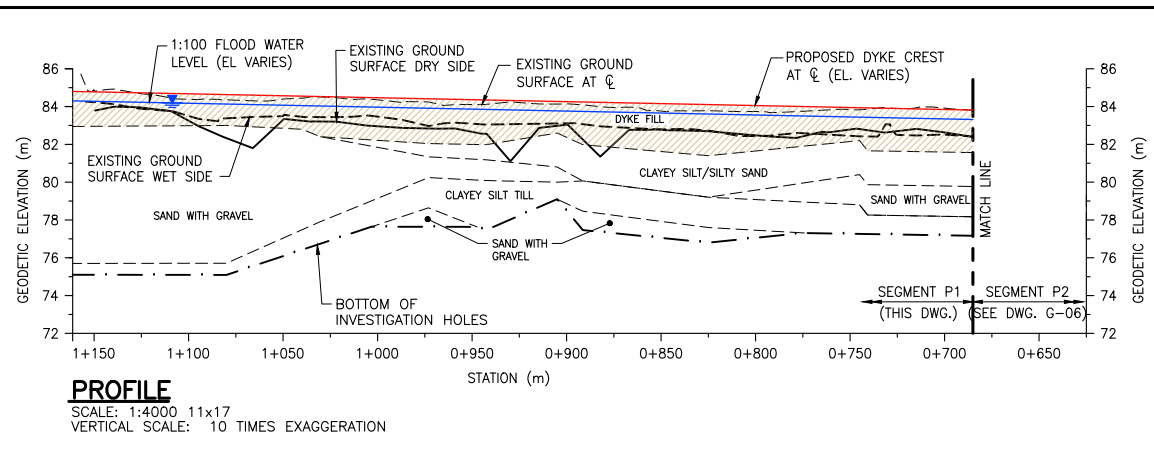
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DWG. NO. 19-2939-003 G-05 REV: 0



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 4 436 / PLOT SCALE:



LEGEND:

- ⊗ EXISTING CONTROL VALVE
- EXISTING SANITARY/STORM MANHOLE
- ⊕ EXISTING HYDRANT
- EXISTING CATCH BASIN
- SS — EXISTING SANITARY/SEWER SERVICE
- STM — EXISTING STORM SEWER
- WM — EXISTING WATERMAIN/WATER SERVICE
- T — EXISTING TELEPHONE CABLE SERVICE
- — — PROPERTY LINE
- > — DRAINAGE SWALE
- > — TRAIL (SEE NOTE 3)
- — — NEW TRAIL
- — — PROJECT FOOTPRINT (SEE NOTE 5)
- — — CULVERT/DRAINAGE FEATURE
- — — EXISTING DYKE CENTRE LINE STATIONING
- — — PROPERTY NOT OWNED BY TRCA
- — — EXISTING DYKE FOOTPRINT
- — — PROPOSED DYKE FOOTPRINT
- — — PROPOSED VEGETATED ROCK BANK PROTECTION ON DYKE WET SLOPE
- — — PROPOSED VEGETATED ROCK BANK PROTECTION ON DYKE WET SLOPE DOWN TO CREEK BED
- — — PROPOSED ROCKFILL TRENCH
- — — EXISTING OVERLAND FLOW PATTERN

- NOTES:**
1. INSTALL NEW DOUBLE GATES AND EXTEND ALL EXISTING CULVERTS AND DISCHARGE PIPES.
 2. ALL INTERNAL DRAINAGE TO BE DIRECTED TO DOUBLE GATED CULVERTS P1 TO P6.
 3. TRAIL MAY REMAIN ALONG TOE OF DYKE OR BE RELOCATED TO CREST OF DYKE.
 4. LOCATION AND DEPTH OF UTILITIES TO BE CONFIRMED AND UTILITIES TO BE PROTECTED DURING CONSTRUCTION.
 5. PROJECT FOOTPRINT CORRESPONDS TO POTENTIAL DISTURBANCE FOOTPRINT.
 6. VEGETATED ROCK BANK PROTECTION PLACED ON WET SIDE DYKE SLOPE ALONG SEGMENT P1, AS WELL AS IN ACCORDANCE WITH RESTORATION PLAN. LOCATION OF ROCK BUTTRESS AND SURFACE TREATMENT OF THE WET SIDE DYKE SLOPE TO BE REFINED DURING DETAILED DESIGN, CONSIDERING EASE OF PEDESTRIAN AND EQUIPMENT ACCESS ACROSS THE DYKE.
 7. DRAWINGS BASED ON LIDAR DATA AND SUPPLEMENTED WITH TOPOGRAPHIC GROUND SURVEY OF THE EXISTING DYKES AS PROVIDED BY TRCA.

0	20/05/15	ISSUED WITH ESR	CMR	BPA
NO.	YY/MM/DD	DESCRIPTION	DESIGN BY	DESIGN CHECK
REVISIONS / ISSUE				

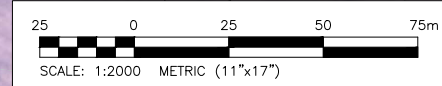


PROJECT:
 REMEDIAL FLOOD AND EROSION CONTROL CLASS EA FOR THE REHABILITATION OF THE PICKERING AND AJAX FLOOD CONTROL DYKES, ONTARIO

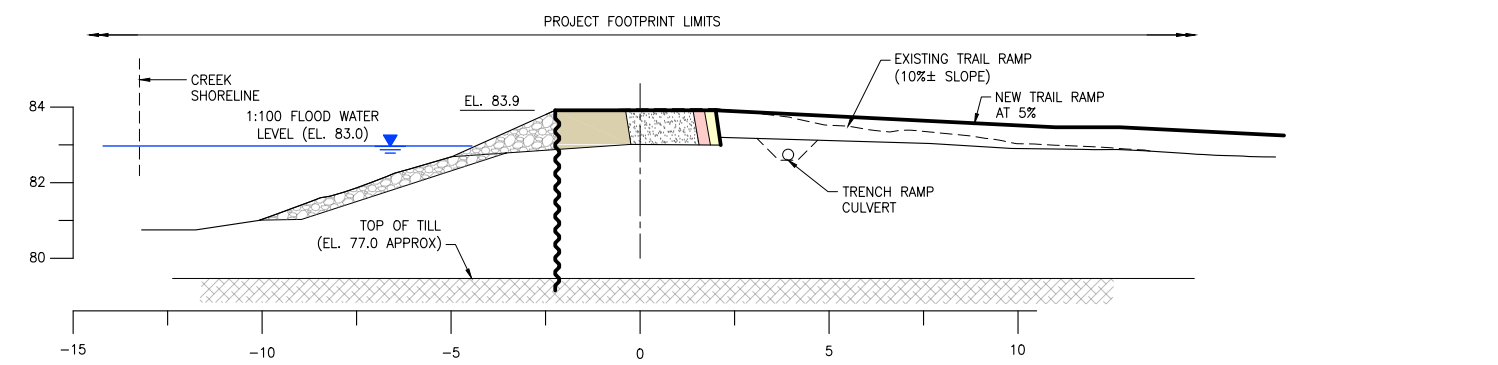
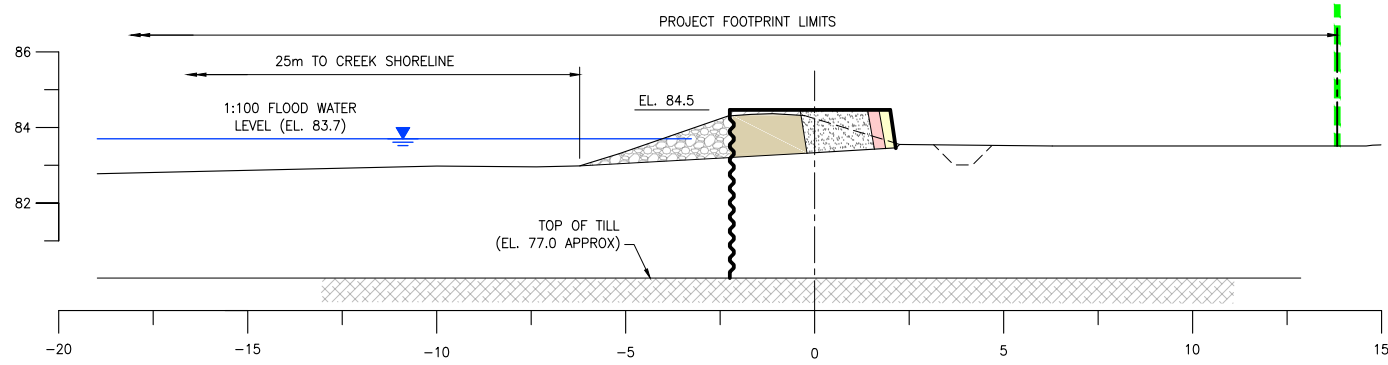
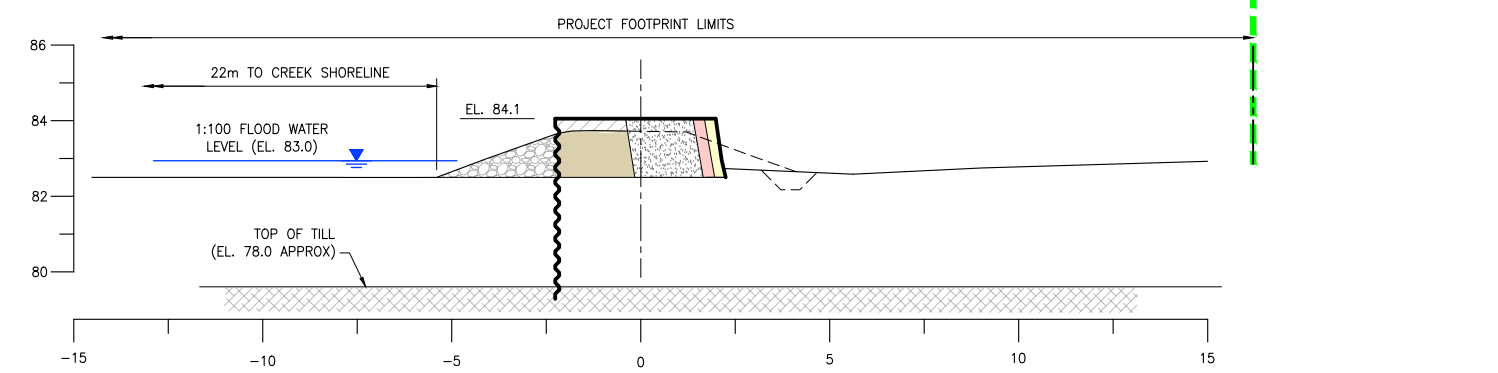
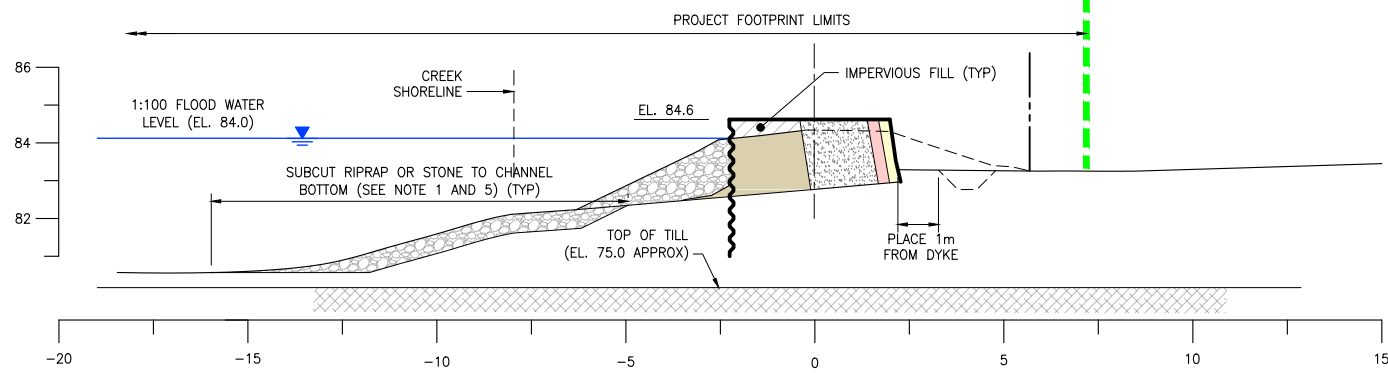
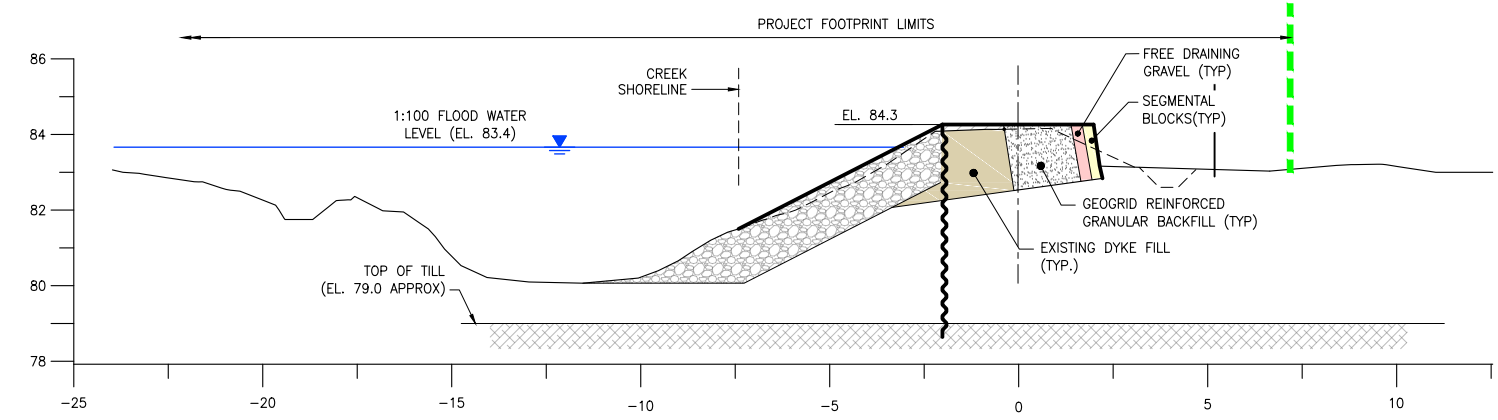
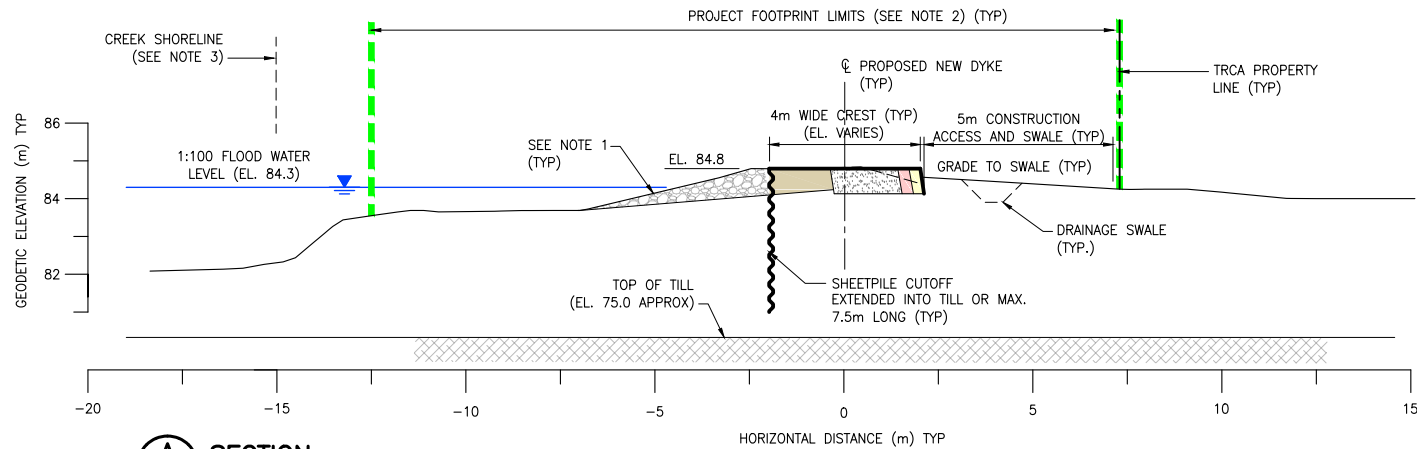
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DWG. NO. 19-2939-003 G-06 REV: 0

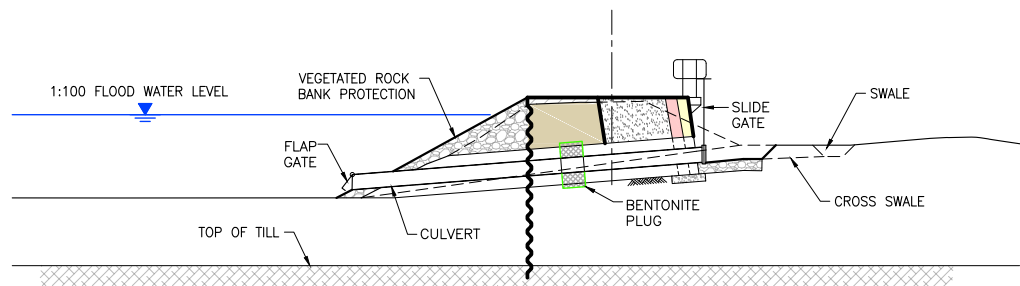


SEGMENT P1 (H1)

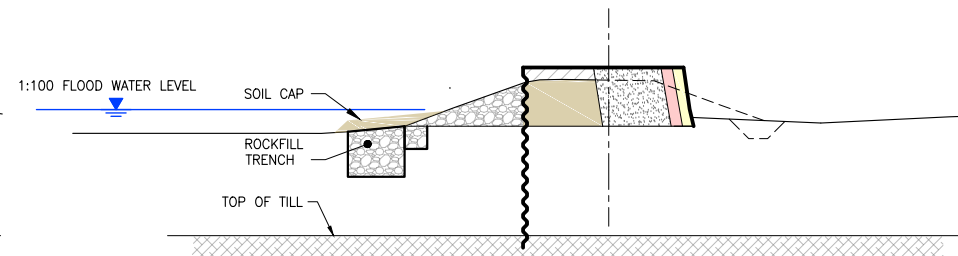


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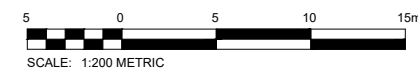
- VEGETATED ROCK BANK PROTECTION PLACED ON WET SIDE DYKE SLOPE ALONG SEGMENT P1, AS WELL AS IN ACCORDANCE WITH RESTORATION PLAN. LOCATION OF ROCK BUTTRESS AND SURFACE TREATMENT OF THE WET SIDE DYKE SLOPE TO BE REFINED DURING DETAILED DESIGN, CONSIDERING EASE OF PEDESTRIAN AND EQUIPMENT ACCESS ACROSS THE DYKE.
- PROJECT FOOTPRINT CORRESPONDS TO POTENTIAL DISTURBANCE FOOTPRINT.
- CREEK SHORELINE (WATER EDGE) AS ESTIMATED FROM LIDAR AND GOOGLE IMAGES.
- MAXIMUM LENGTH OF SHEETPILE TO BE REFINED IN DETAILED DESIGN.
- ROUND STONE CONSIDERED FOR SLOPE OF 2.5:1 (H:V) OR GENTLER. TO BE REFINED DURING DETAILED DESIGN.



TYPICAL SECTION WITH CULVERT
SCALE: 1:200 (11"x17")



TYPICAL SECTION WITH ROCKFILL TRENCH
SCALE: 1:200 (11"x17")



0	20/05/15	ISSUED WITH ESR	CMR	BPA
NO.	YY/MM/DD	DESCRIPTION	DESIGN BY	DESIGN CHECK
REVISIONS / ISSUE				



PROJECT:
REMEDIAL FLOOD AND EROSION CONTROL CLASS EA FOR THE REHABILITATION OF THE PICKERING AND AJAX FLOOD CONTROL DYKES, ONTARIO

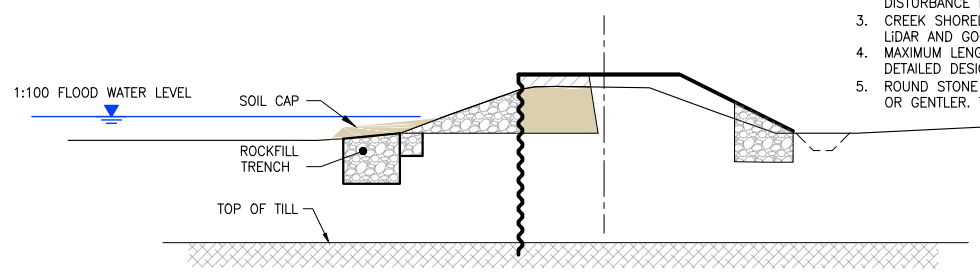
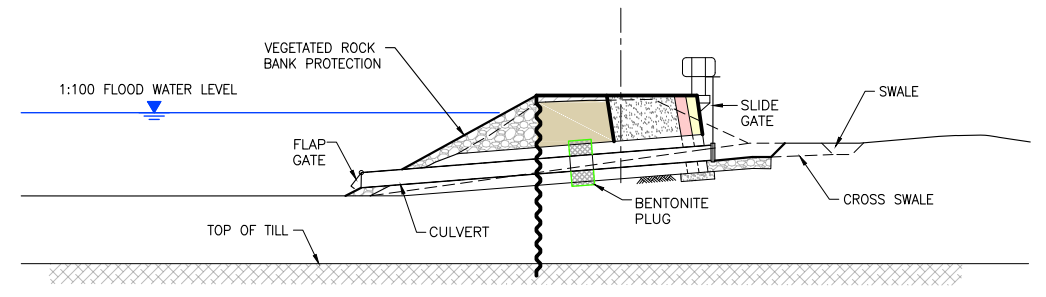
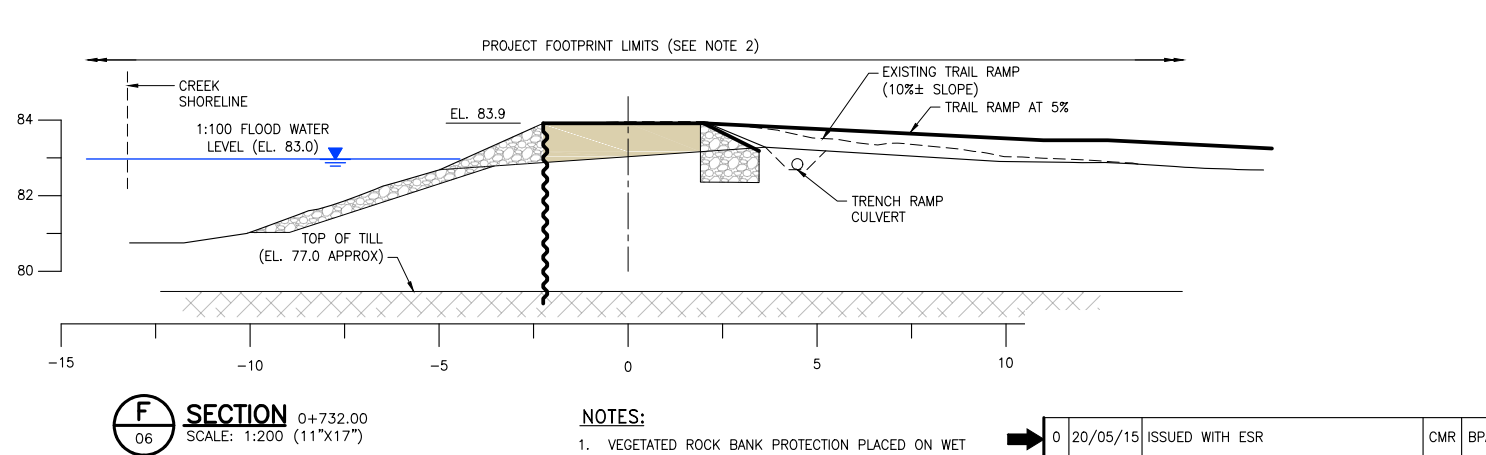
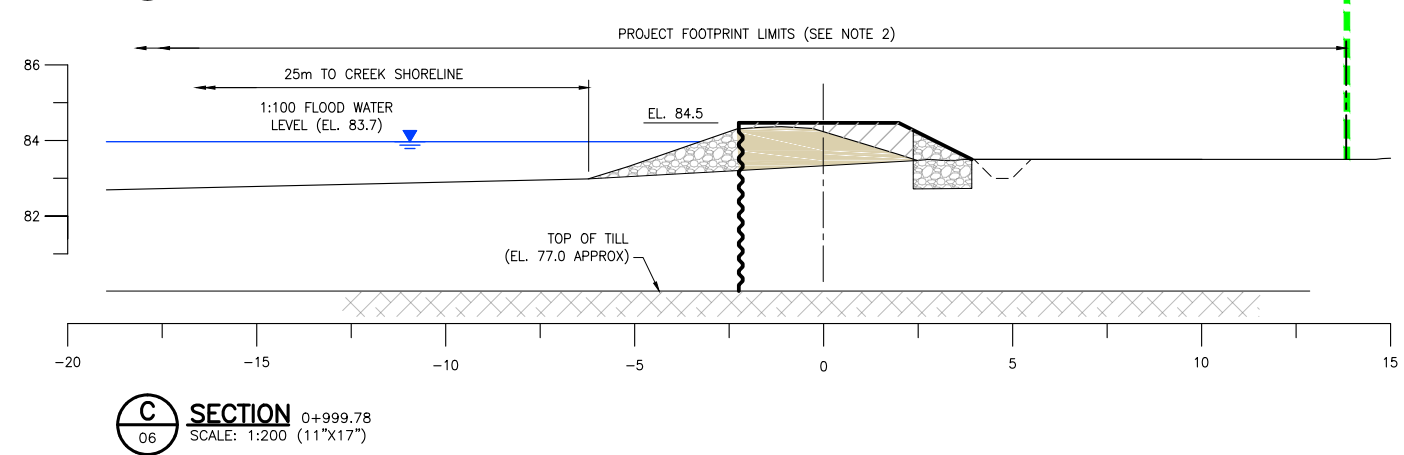
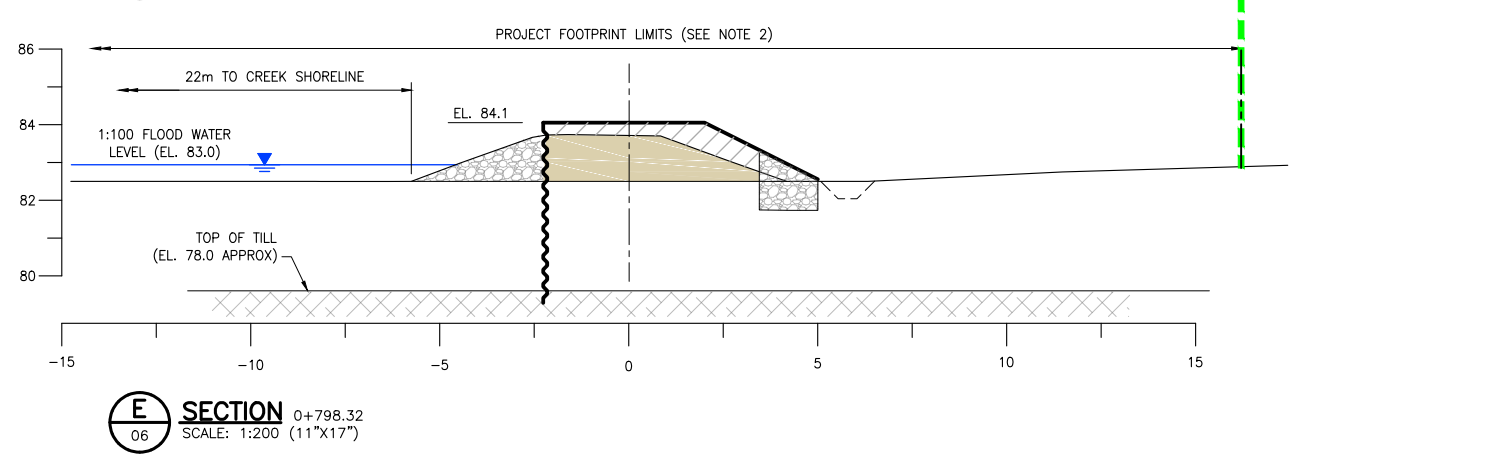
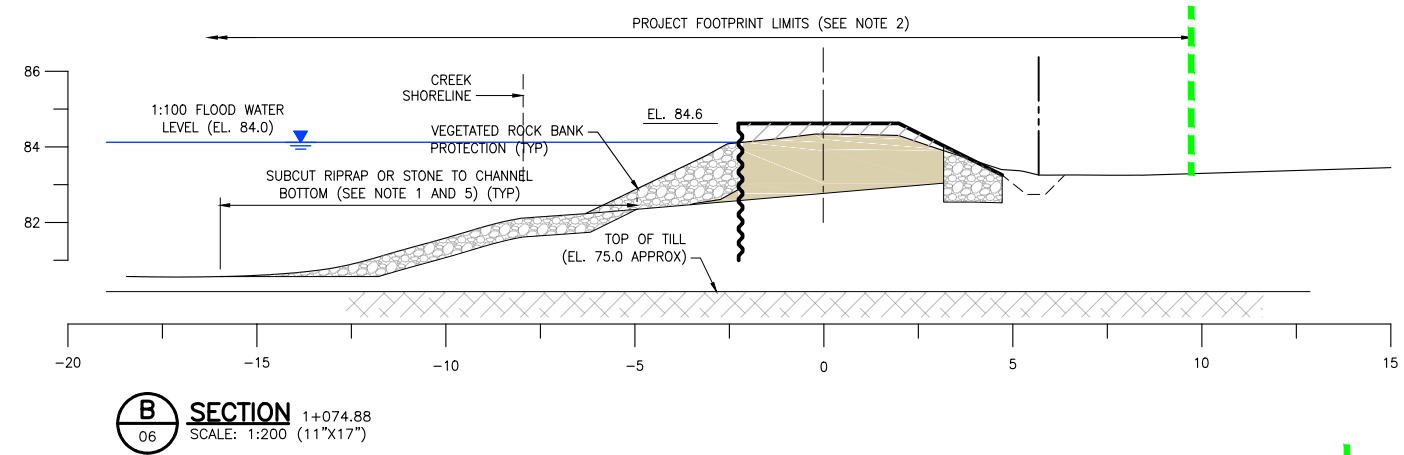
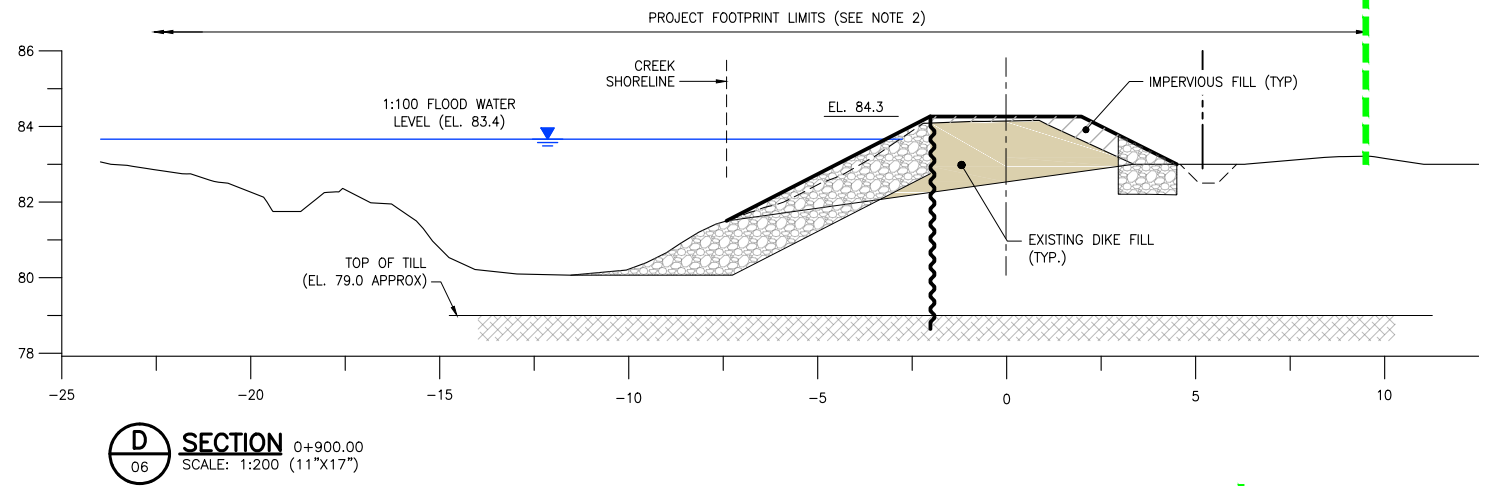
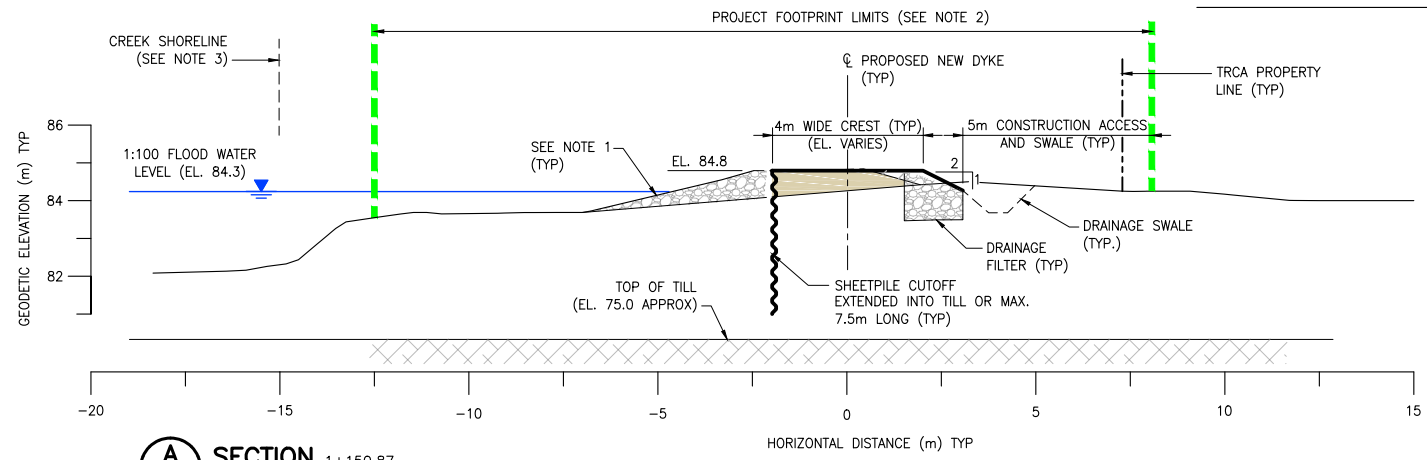
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KGS GROUP

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DESIGN CHECK:		DATE:	
DRAWN BY:	TVW/ESm	DATE:	19/12/02
DWG CHECK:		DATE:	

DWG. NO. 19-2939-003 G-07 REV: 0

SEGMENT P1 (H2)

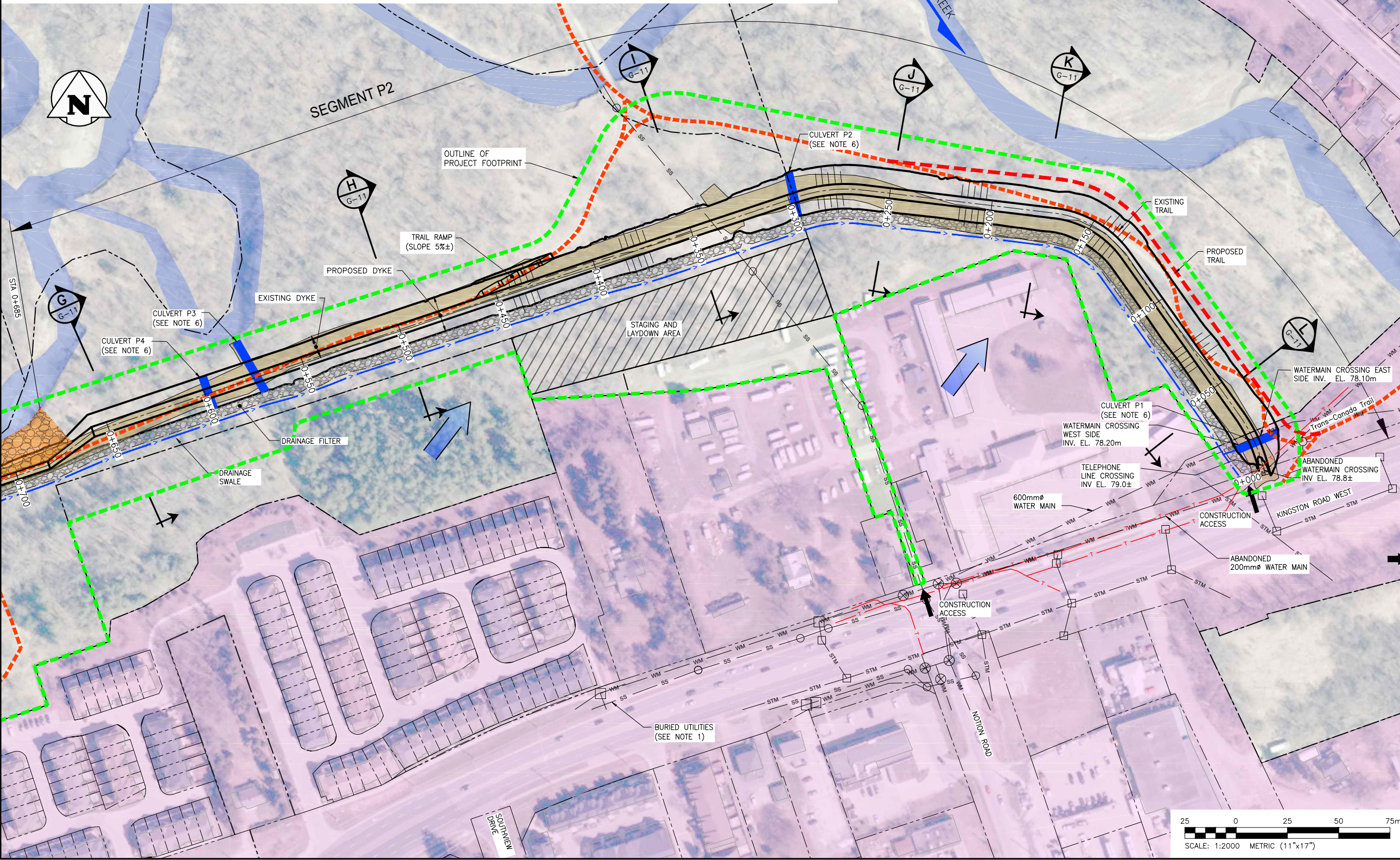
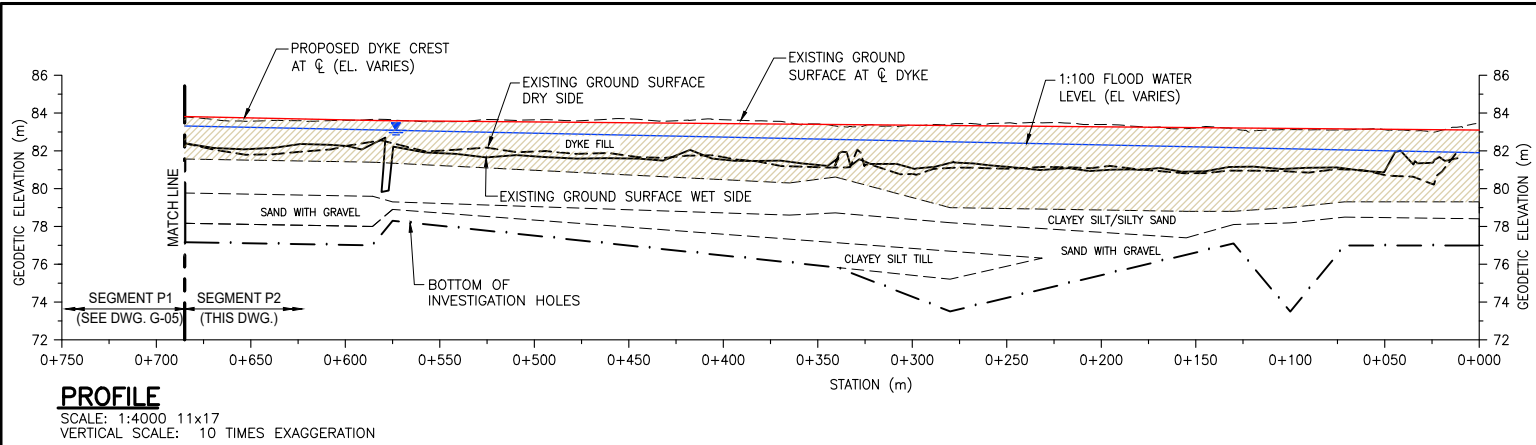


- NOTES:**
- VEGETATED ROCK BANK PROTECTION PLACED ON WET SIDE DYKE SLOPE ALONG SEGMENT P1, AS WELL AS IN ACCORDANCE WITH RESTORATION PLAN. LOCATION OF ROCK BUTTRESS AND SURFACE TREATMENT OF THE WET SIDE DYKE SLOPE TO BE REFINED DURING DETAILED DESIGN, CONSIDERING EASE OF PEDESTRIAN AND EQUIPMENT ACCESS ACROSS THE DYKE.
 - PROJECT FOOTPRINT CORRESPONDS TO POTENTIAL DISTURBANCE FOOTPRINT.
 - CREEK SHORELINE (WATER EDGE) AS ESTIMATED FROM LIDAR AND GOOGLE IMAGES.
 - MAXIMUM LENGTH OF SHEETPILE TO BE REFINED IN DETAILED DESIGN.
 - ROUND STONE CONSIDERED FOR SLOPE OF 2.5:1 (H:V) OR GENTLER. TO BE REFINED DURING DETAILED DESIGN.

0	20/05/15	ISSUED WITH ESR	CMR	BPA
NO.	YY/MM/DD	DESCRIPTION	DESIGN BY	DESIGN CHECK
REVISIONS / ISSUE				
CLIENT:				
PROJECT: REMEDIAL FLOOD AND EROSION CONTROL CLASS EA FOR THE REHABILITATION OF THE PICKERING AND AJAX FLOOD CONTROL DYKES, ONTARIO				
DWG. DESCRIPTION: PICKERING DYKE CONCEPTUAL RECONSTRUCTION SECTIONS SEGMENT P1 (H2)				
DESIGN BY: CMR		DATE (YY/MM/DD): 19/12/02		
DESIGN CHECK:		DATE:		
DRAWN BY: TVW/ESrm		DATE: 19/12/02		
DWG CHECK:		DATE:		
DWS. NO. 19-2939-003 G-08 REV: 0				

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 24 X36 PLOT SCALE:



- LEGEND:**
- ⊗ EXISTING CONTROL VALVE
 - EXISTING SANITARY/STORM MANHOLE
 - ⊕ EXISTING HYDRANT
 - EXISTING CATCH BASIN
 - SS — EXISTING SANITARY/SEWER SERVICE
 - STM — EXISTING STORM SEWER
 - WM — EXISTING WATERMAIN/WATER SERVICE
 - T — EXISTING TELEPHONE CABLE SERVICE
 - — — PROPERTY LINE
 - > — DRAINAGE SWALE
 - > — TRAIL (SEE NOTE 5)
 - — — NEW TRAIL
 - — — PROJECT FOOTPRINT (SEE NOTE 3)
 - — — CULVERT/DRAINAGE FEATURE
 - — — EXISTING DYKE CENTRE LINE STATIONING
 - — — PROPERTY NOT OWNED BY TRCA
 - — — EXISTING DYKE FOOTPRINT
 - — — PROPOSED DYKE FOOTPRINT
 - — — PROPOSED VEGETATED ROCK BANK PROTECTION ON DYKE WET SLOPE DOWN TO CREEK BED
 - — — EXISTING OVRERLAND FLOW PATTERN

- NOTES:**
1. LOCATION AND DEPTH OF UTILITIES TO BE CONFIRMED AND UTILITIES TO BE PROTECTED DURING CONSTRUCTION.
 2. BASED ON 1:100 YEAR DESIGN EVENT PLUS 0.5m FREEBOARD.
 3. PROJECT FOOTPRINT CORRESPONDS TO POTENTIAL DISTURBANCE FOOTPRINT.
 4. DRAWINGS BASED ON LIDAR DATA AND SUPPLEMENTED WITH TOPOGRAPHIC GROUND SURVEY OF THE EXISTING DYKES AS PROVIDED BY TRCA.
 5. TRAIL MAY REMAIN ALONG TOE OF DYKE OR BE RELOCATED TO CREST OF DYKE.
 6. INSTALL NEW DOUBLE GATES AND EXTEND ALL EXISTING CULVERTS AND DISCHARGE PIPES.

0	20/05/15	ISSUED WITH ESR	CMR	BPA
NO.	YY/MM/DD	DESCRIPTION	DESIGN BY	DESIGN CHECK
REVISIONS / ISSUE				

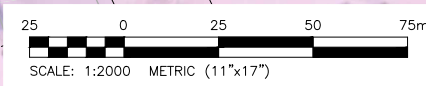


PROJECT:
 REMEDIAL FLOOD AND EROSION CONTROL CLASS EA FOR THE REHABILITATION OF THE PICKERING AND AJAX FLOOD CONTROL DYKES, ONTARIO

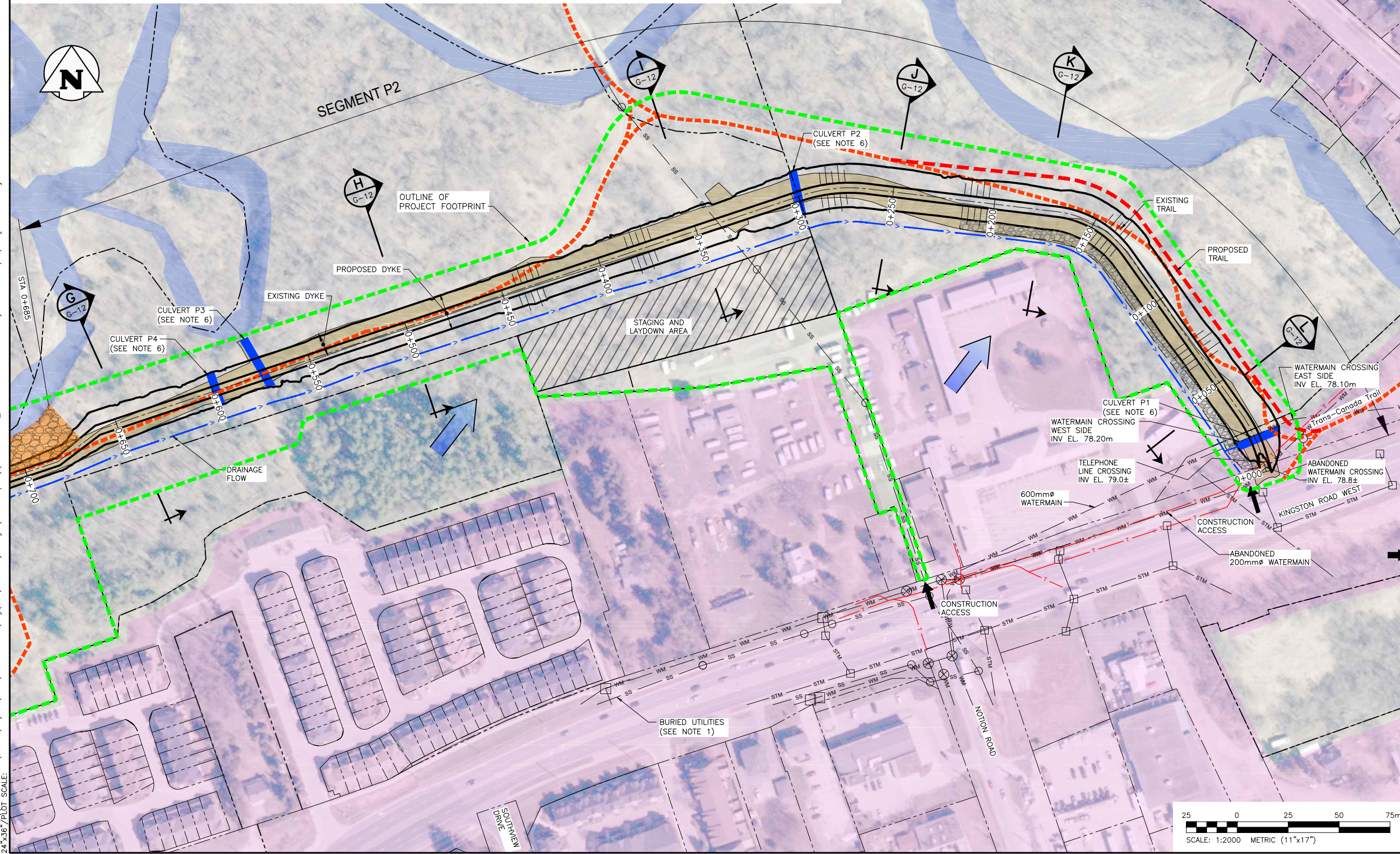
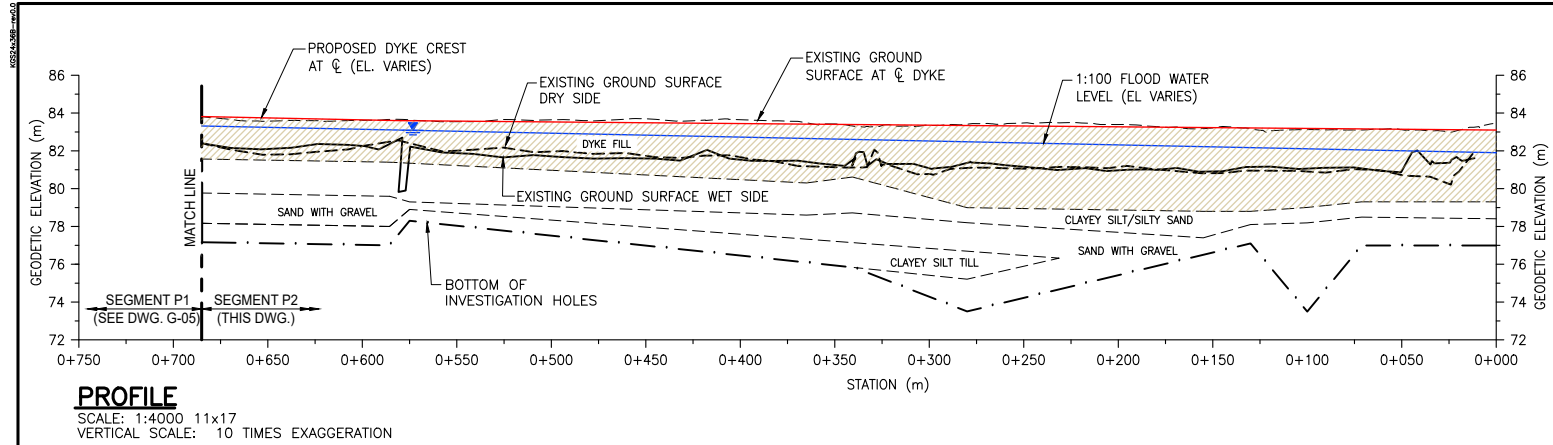
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 PICKERING DYKE CONCEPTUAL RECONSTRUCTION SEGMENT P2 (S1) PLAN AND PROFILE

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	DESIGN CHECK:		DATE:	
	DRAWN BY:	TWV	DATE:	19/12/02
	DWG CHECK:		DATE:	

DWG. NO. 19-2939-003 G-09 REV: 0



File name: \\192.168.0.226\y-data\Projects\2019\19-2939-003\DWG\Geo\Preliminary Design (30% Complete)\19-2939-003_G-10 - TabRev0 Plotted By: Trivernat 20/05/13 [Wed 11:16am]
 24 X36 PLOT SCALE:



- LEGEND:**
- ⊗ EXISTING CONTROL VALVE
 - EXISTING SANITARY/STORM MANHOLE
 - ⊕ EXISTING HYDRANT
 - EXISTING CATCH BASIN
 - SS — EXISTING SANITARY/SEWER SERVICE
 - STM — EXISTING STORM SEWER
 - WM — EXISTING WATERMAIN/WATER SERVICE
 - T — EXISTING TELEPHONE CABLE SERVICE
 - — — PROPERTY LINE
 - > — DRAINAGE SWALE
 - > — TRAIL (SEE NOTE 5)
 - > — NEW TRAIL
 - > — PROJECT FOOTPRINT (SEE NOTE 3)
 - > — CULVERT/DRAINAGE FEATURE
 - > — EXISTING DYKE CENTRE LINE STATIONING
 - > — PROPERTY NOT OWNED BY TRCA
 - > — EXISTING DYKE FOOTPRINT
 - > — PROPOSED DYKE FOOTPRINT
 - > — PROPOSED VEGETATED ROCK BANK PROTECTION ON DYKE WET SLOPE DOWN TO CREEK BED
 - > — EXISTING OVRERLAND FLOW PATTERN

- NOTES:**
- LOCATION AND DEPTH OF UTILITIES TO BE CONFIRMED AND UTILITIES TO BE PROTECTED DURING CONSTRUCTION.
 - BASED ON 1:100 YEAR DESIGN EVENT PLUS 0.5m FREEBOARD.
 - PROJECT FOOTPRINT CORRESPONDS TO POTENTIAL DISTURBANCE FOOTPRINT.
 - DRAWINGS BASED ON LIDAR DATA AND SUPPLEMENTED WITH TOPOGRAPHIC GROUND SURVEY OF THE EXISTING DYKES AS PROVIDED BY TRCA.
 - TRAIL MAY REMAIN ALONG TOE OF DYKE OR BE RELOCATED TO CREST OF DYKE.
 - INSTALL NEW DOUBLE GATES AND EXTEND ALL EXISTING CULVERTS AND DISCHARGE PIPES.

0	20/05/15	ISSUED WITH ESR	CMR	BPA
NO.	YY/MM/DD	DESCRIPTION	DESIGN BY	DESIGN CHECK
REVISIONS / ISSUE				

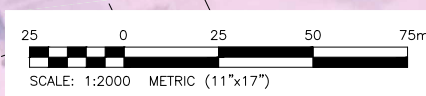


PROJECT:
 REMEDIAL FLOOD AND EROSION CONTROL CLASS EA FOR THE REHABILITATION OF THE PICKERING AND AJAX FLOOD CONTROL DYKES, ONTARIO

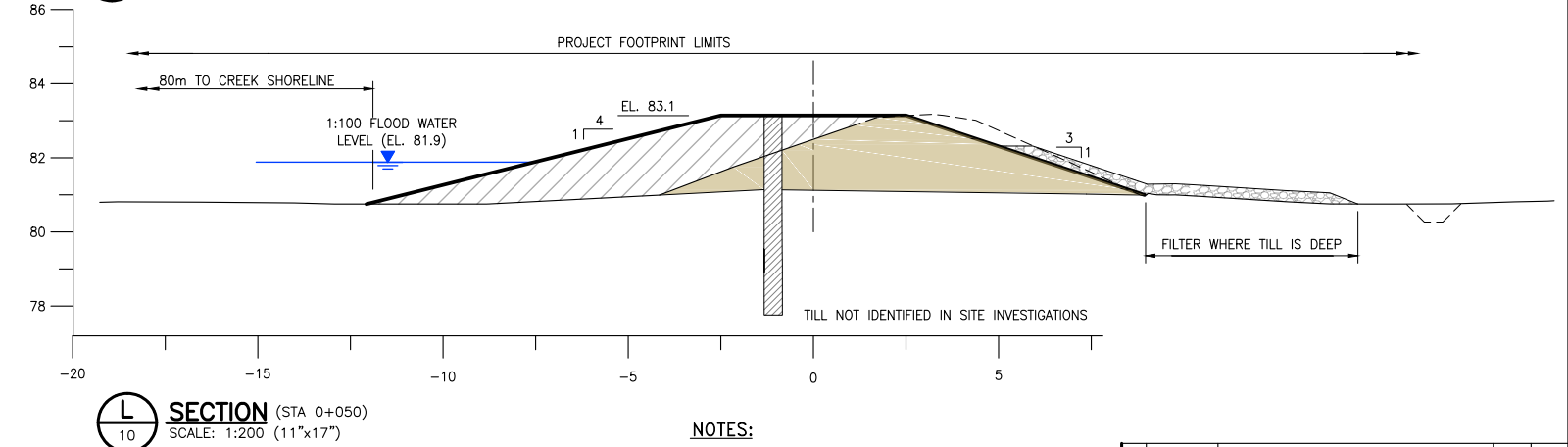
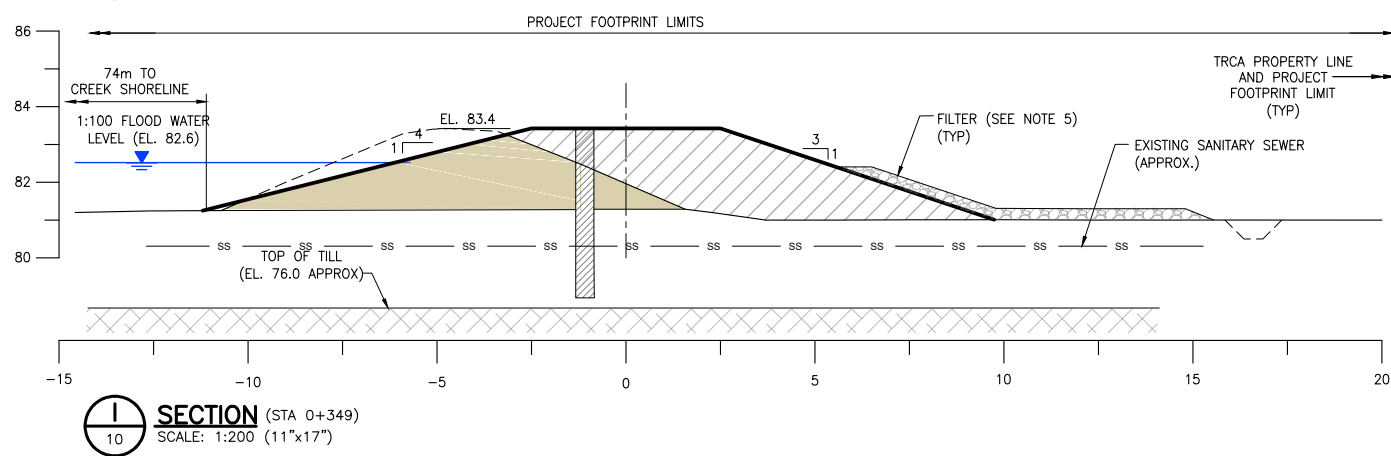
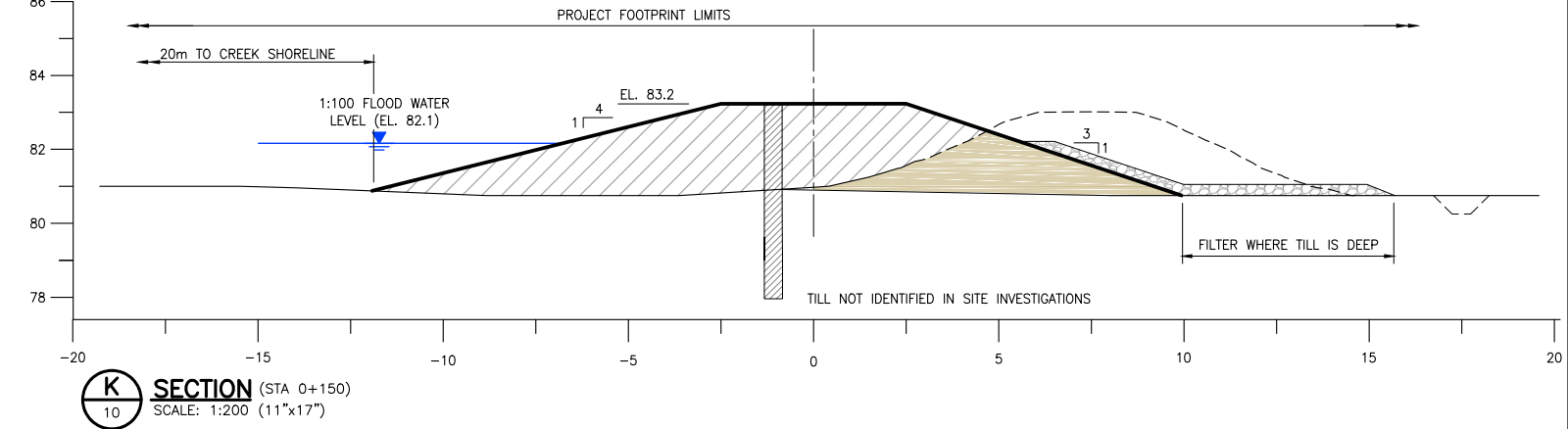
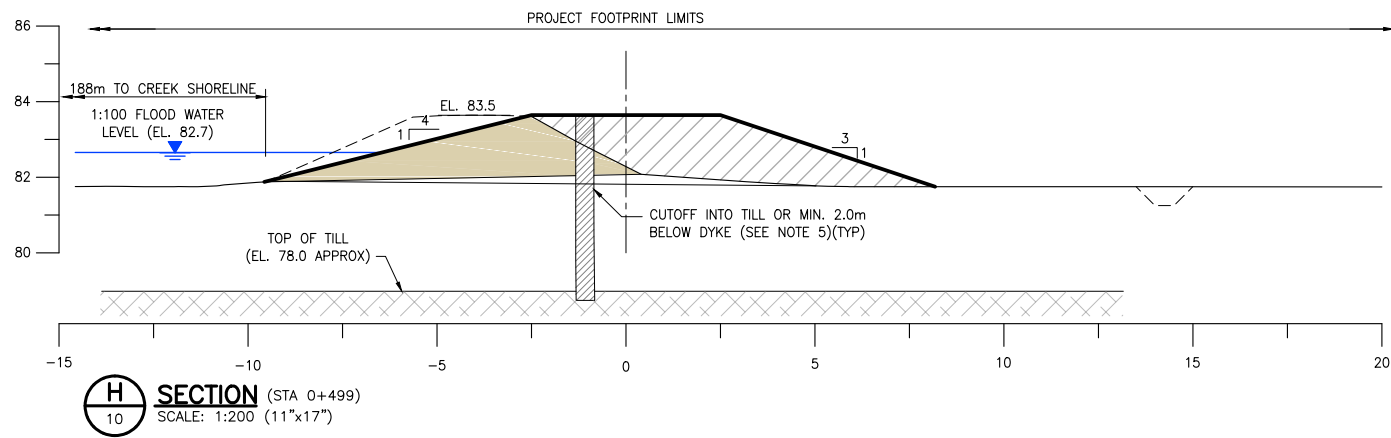
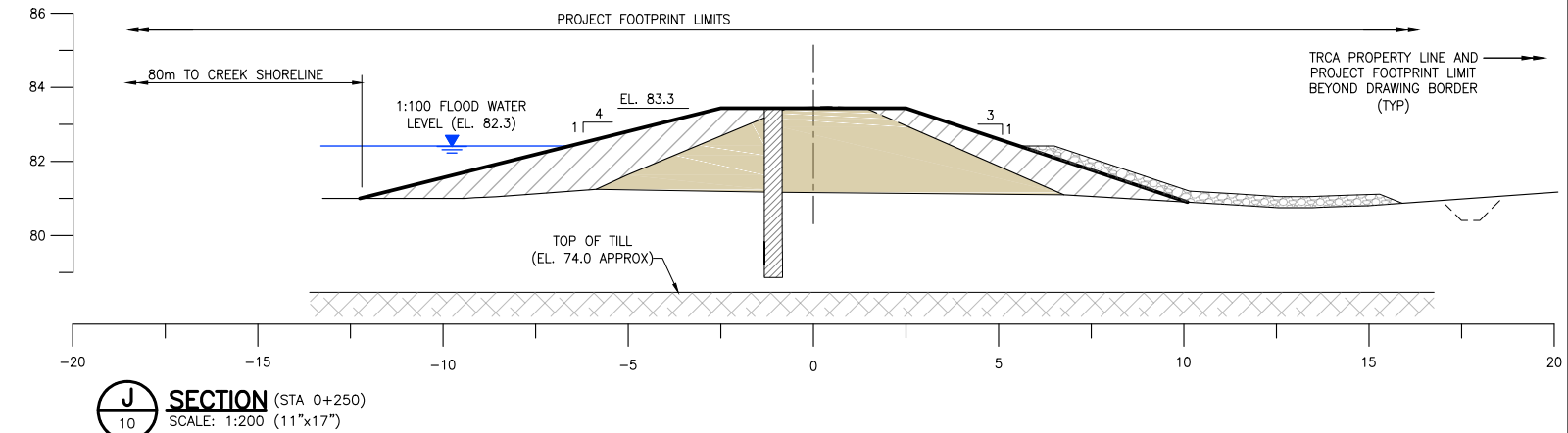
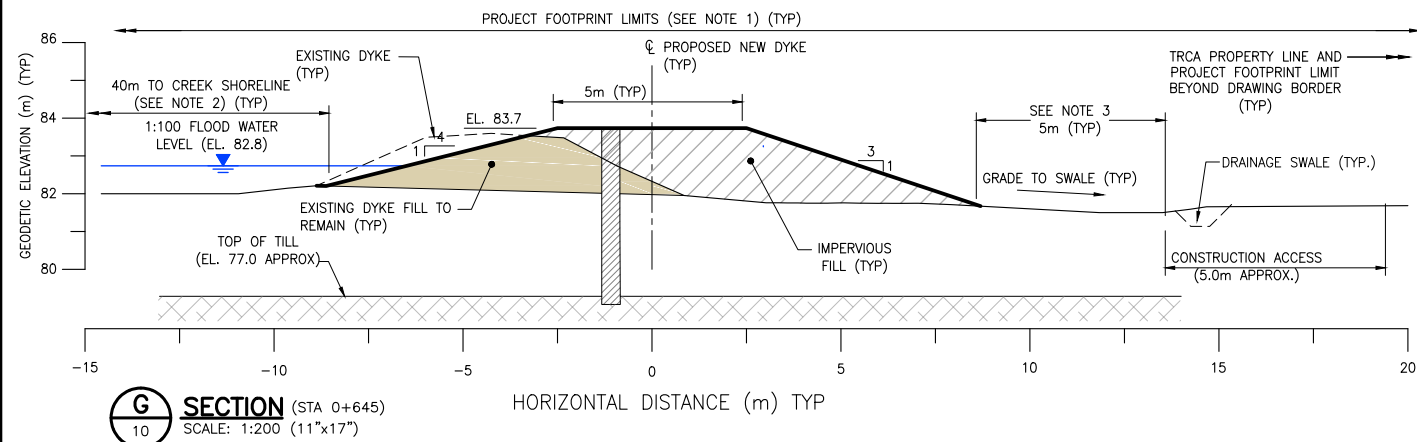
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 PICKERING DYKE CONCEPTUAL RECONSTRUCTION SEGMENT P2 (S2) PLAN AND PROFILE

KGS GROUP	DESIGN BY:	CMR	DATE (YY/MM/DD):	19/12/02
	DESIGN CHECK:		DATE:	
	DRAWN BY:	TWV	DATE:	19/12/02
	DWG CHECK:		DATE:	

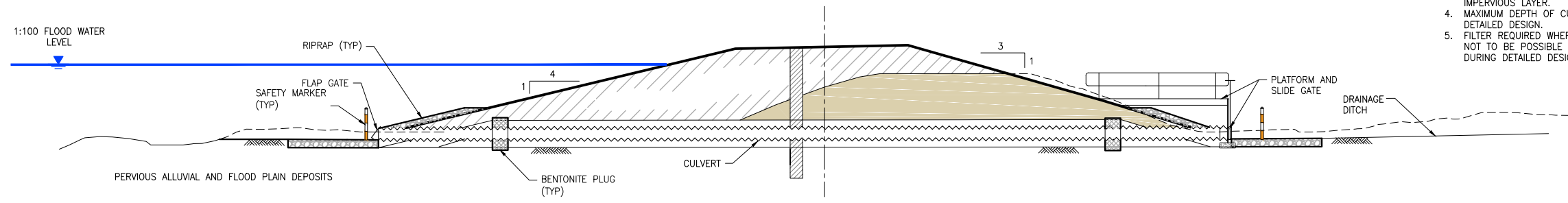
DWG. NO: 19-2939-003 G-10 REV: 0



SEGMENT P2 (S2)



- NOTES:**
- PROJECT FOOTPRINT CORRESPONDS TO POTENTIAL DISTURBANCE FOOTPRINT.
 - CREEK SHORELINE (WATER EDGE) AS ESTIMATED FROM LIDAR AND GOOGLE IMAGES.
 - SPACE FOR DRAINAGE FILTER IF NECESSARY, AT LOCATIONS WHERE CUTOFF DOES NOT REACH IMPERVIOUS LAYER.
 - MAXIMUM DEPTH OF CUTOFF TO BE REFINED IN DETAILED DESIGN.
 - FILTER REQUIRED WHERE CUTOFF IN TILL IS DETERMINED NOT TO BE POSSIBLE OR PRACTICAL. TO BE REFINED DURING DETAILED DESIGN.



0	20/05/15	ISSUED WITH ESR	CMR	BPA
NO.	YY/MM/DD	DESCRIPTION	DESIGN BY	DESIGN CHECK
REVISIONS / ISSUE				
PROJECT: REMEDIAL FLOOD AND EROSION CONTROL CLASS EA FOR THE REHABILITATION OF THE PICKERING AND AJAX FLOOD CONTROL DYKES, ONTARIO				
DWG. DESCRIPTION: PICKERING DYKE CONCEPTUAL RECONSTRUCTION SECTIONS SEGMENT P2 (S2)				
KGS GROUP	DESIGN BY:	CMR	DATE (YY/MM/DD):	19/12/02
	DESIGN CHECK:		DATE:	
	DRAWN BY:	TVW	DATE:	19/12/02
	DWG CHECK:		DATE:	
DWG. NO. 19-2939-003		G-12		REV: 0

Filepath: \\192.168.0.226\... \19-2939-003\Drawings\03_Preliminary Design (30% Complete)\19-2939-003_G-12 - TabRev0 Plotted By: Tvanwert 20/05/14 [Thu 12:57pm] 24"x36" PLOT SCALE:

Memorandum

Date: March 26, 2020

Project #: 1903602

To: Fuad Curi, Tony Gallo – KGS Group

From: Austin Adams

cc: Dirk Janas

Re: Proposed Restoration Plantings and Recommendations for the Ajax and Pickering Dykes

1. Introduction

Restoration of the Ajax and Pickering Dykes will be implemented following the completion of dyke construction works. The following restoration recommendations follow the practical objectives for the dyke designs and the restoration methods in the *TRCA Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018). Within the *Guideline*, the “Enhanced Reforestation Planting” typical design has been used as a basis for planning. Restoration efforts will aim to restore the natural areas that have been cleared by the construction works. The staging and construction access areas have been recommended for both seeding and tree/shrub plantings. However, only seeding without tree or shrub planting has been proposed for dyke components, as a limited amount of soil (100 mm) is to be overlain.

This memorandum provides general guidelines and includes Drawings R-01 through R-05 and the TRCA “Vegetated Rock Buttress” Typical Drawing. The provisions of the memorandum and the drawings are to be refined as part of the detailed design.

2. Construction Mitigation - Butternut

It is recommended that a complete Erosion and Sediment Control (ESC) plan be created and implemented for the construction of the project, following the *Erosion and Sediment Control Guidelines for Urban Construction* (Greater Golden Horseshoe Conservation Authorities, 2006). Within this ESC plan, ESC fencing should be established to avoid the introduction of construction sediments into Duffins Creek.

For the Ajax dyke, Tree Protection Fencing (TPF) is to be erected around the 25 m habitat of a Butternut (*Juglans nigra*) tree identified nearby. Butternut is considered *Endangered* in Ontario, and individuals and their habitats are protected under the *Endangered Species Act* (ESA). TPF has been proposed within the Project Area (**see attached mark-up – Ajax Dyke**). This TPF should be tied into ESC fencing, or could be achieved by appropriate placement of ESC fencing without additional fencing requirements. The establishment has been considered feasible, as the habitat area will not be required for dyke construction.

The installation of this fencing avoids the 25 m habitat of this *Endangered* species, thereby avoiding further obligations and requirements under the ESA.

3. Construction Mitigation – Redside Dace and Aquatic Species

The design must recognize the presence of aquatic species, particularly Redside Dace and American Eel. In-water works are anticipated for Pickering Dyke Segment P1, but not for Pickering Dyke Segment P2 and Ajax Segment A1. Based on the approximate delineation of the meander belt by Geomorphic Solutions (2009), the Project Footprint is within the Duffins Creek/West Duffins Creek meander belt areas.

As the main Duffins Creek is considered “Occupied” Redside Dace habitat, works within the Duffins Creek meanderbelt are to be conducted in accordance with the MNRF *Guidance for Development Activities in Redside Dace Protected Habitat* recommendations for terrestrial work near water (MNRF, 2016). In particular, the ESC plan (above) to be created and implemented for construction, including fencing, should be located as close as feasible to the project area to avoid potential inputs to Duffins Creek. While not anticipated to be required, if necessary, all in-water and near-water works should be completed during the recommended timing window for this area (i.e. July 1 to September 15) (Ministry of Natural Resources and Forestry, 2014). To protect other aquatic species (e.g. American Eel), best industry practices should be followed for in-water works.

Note that West Duffins Creek is currently not considered Redside Dace habitat. Should correspondence with the MECP during detailed design indicate that it is to be considered habitat, the above measures for Duffins Creek are to be applied for West Duffins Creek, in particular where in-water works will be required (Pickering Dyke Segment P1).

4. Soils and Seeding

All areas are to be overlain with topsoil and seeded with a native seed mixture generally suited for lowland areas such as riparian corridors. Most dyke components will be seeded; however, the wet slope side for the Pickering “P1” Dyke area is to be fitted with a vegetated rock buttress and will be restored using only live shrub stakes. Additionally, a portion of the Pickering dyke crest and the Ajax dyke crest are to be paved for the re-establishment of the walking trail (Trans Canada Trail).

A mid-grain loamy topsoil is recommended to be overlain on the dyke structures, as a general soil type favourable for ground cover species establishment. Soil volumes of 100 mm are anticipated for all dyke areas. The construction access and staging areas are recommended to be spread with a 500 mm cover of topsoil for tree/shrub restoration.

Most dyke feature areas will be seeded with a native seed mixture appropriate for seasonally flooded areas such as the Duffins Creek/West Duffins Creek riparian zone. The seed mix recommended follows native species identified in the *TRCA Seed Mix Guidelines* (Toronto and Region Conservation Authority, 2004). For most dyke areas, a **seasonally flooded areas** seed mix should be hydroseeded at a rate of 25 kg/h. The swale and dyke drainage filter/toe drain areas require a seed mix that are ideal to control water flow. Therefore, a native seed mixture ideal for retention basins and requiring little maintenance as been selected. The **retention basins** seed mix should be hydroseeded at a rate of 25 kg/h. To assist in the

establishment of the seed mixes, all areas should also be seeded with a nurse crop of Common Oats (*Avena sativa*) or Buckwheat (*Fagopyrum esculentum*) at a rate of 25 kg/ha. All seed mix compositions are to be defined as part of detailed design.

5. Tree and Shrub Planting

The staging area and construction access areas are also to be planted with native trees and shrubs. The planting recommendations will be designed to match the 3,000 stems/ha of the Enhanced Reforestation Planting typical design of the *Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018).

The species to be planted as part of the restoration efforts will be native to the region, suitable to the site conditions, and will represent species that are suitable and/or recorded within the vegetation community in which the restoration efforts are being completed (**Tables 4 to 6**). For the Ajax dyke, the predominant ecosite is a Fresh – Moist Lowland Deciduous Forest (FOD7) type (Lee, et al., 1998). Trees and shrubs selected for this area should reflect this ecosite type, with a focus on the more shade-tolerant species, as this is reflective of general site conditions on the “dry” side of the dyke. For the Pickering dyke, the dominant ecosite types are FOD7 and cultural woodlands and thickets (CUW, CUT). As the dominant *natural* ecosite, the tree/shrub species characteristic of the FOD7 ecosites should be used; however, with a focus on full sun to partially shady preferring species, as this dyke receives more insolation than the Ajax dyke. A recommended planting species composition for each dyke component is outlined in **Table 1**.

Following the *Guideline for Determining Ecosystem Compensation*, trees should be planted in groups of 10 at a minimum 2.45 m x 2.45 m (6 m²) spacing, while shrubs are to be planted in groups of 10/species at a minimum 1 m x 1m (1 m²) spacing. Final tree and shrub numbers to plant, planting design and methods are to be defined in detailed design of the solution.

Table 1: Recommended Percent Composition for Tree and Shrub Plantings

Common Name	Scientific Name	Dyke Component		
		A1	P1	P2
<i>Tree Plantings</i>				
Basswood	<i>Tilia americana</i>	30	25	30
Black Maple	<i>Acer nigra</i>	20		
Black Walnut	<i>Juglans nigra</i>		30	20
Eastern White Cedar	<i>Thuja occidentalis</i>	20		
Eastern White Pine	<i>Pinus strobus</i>		12	10
Hackberry	<i>Celtis occidentalis</i>	10	7	8
Red Maple	<i>Acer rubrum</i>	10	7	10
Sugar Maple	<i>Acer saccharum</i>	10		
White Birch	<i>Betula papyrifera</i>		7	7
White Spruce	<i>Picea glauca</i>		12	15

Total		100	100	100
<i>Shrub Plantings</i>				
Alternate-leaved Dogwood	<i>Cornus alternifolia</i>	30		
Mapleleaf Viburnum	<i>Viburnum acerifolium</i>	25		
Pussy Willow	<i>Salix discolor</i>		20	20
Red-berried Elder	<i>Sambucus pubens</i>	20		
Red-osier Dogwood	<i>Cornus sericea</i>		30	35
Silky Dogwood	<i>Cornus amomum ssp. obliqua</i>		20	20
Smooth Serviceberry	<i>Amelanchier laevis</i>		30	25
Witch-hazel	<i>Hamamelis virginiana</i>	25		
Total		100	100	100

5.1 Pickering Dyke “P1” Wet Side Slope Planting

The Pickering “P1” Wet Side Slope is to be completed using a vegetated rock buttress, and can be naturalized using live stakes planted between stones (See **Vegetated Rock Buttress Typical Details**). Recommended species composition for live stakes along the slope are detailed in **Table 2**. Live stakes are to be planted in groups of 10 at 1 m x 1 m (1 m²) intervals (Toronto and Region Conservation Authority, 2018). Live stakes are recommended to be 25 – 75 mm diameter stakes, to be hand placed between the dyke stone revetment/rip-rap. Stakes should be buried >0.5 m below the rip-rap, using certified soils to fill the remaining space in each planting hole. Final live-stake numbers to plant, planting design and methods are to be defined in detailed design of the solution. Additionally, during detailed design, the rock size and shape should be defined giving preference to round or sub-rounded stones over angular ones wherever technically feasible.

Table 2: Recommended Composition for Pickering Dyke “P1” Wet Side Slope Live-Stake Restoration Species

Common Name	Scientific Name	Composition (%)
Alternate-leaved Dogwood	<i>Cornus alternifolia</i>	25
Alleghany Blackberry	<i>Rubus allegheniensis</i>	20
Balsam Poplar	<i>Populus balsamifera</i>	20
Sandbar Willow	<i>Salix exigua</i>	20
Bebb’s Willow	<i>Salix bebbiana</i>	15

6. Wildlife Habitat Features

Wildlife habitat features are to be considered in detailed design in accordance with the *Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018). Nesting structures (bird houses/boxes, bat boxes), natural woody debris piles, logs and other features are to be placed strategically within TRCA lands but outside the dyke and filter footprints.

7. In-Stream Restoration

There are several sections of the P1 Dyke area that will require in-stream works to upgrade or install vegetated rock buttress revetment to the stream banks. Geomorphological analysis of Duffins Creek indicates that the bed quality along this section of Duffins Creek is composed of primarily cobbles and stones, affording fish habitat potential.

Any disturbances to the stream bed should be restored via replacement of cobbles and stones of an analogous quantity, size and composition. All imported material should be verified as “Certified Clean Fill”.

8. Potential Compensation

As the dykes are not proposed to be planted with trees or shrubs, compensation for loss of ecosystem area may be required by the TRCA as per the *Guideline* (Toronto and Region Conservation Authority, 2018). The basal area of the area is to be assessed in detailed design to determine the compensation ratio. For this design concept, a 3:1 area compensation ratio was used as an example, which corresponds to an average basal area between 10 and 20 m²/ha.

Drawings R-01, R-02 and R-03 show (red dashed line) the limits of the project footprint and maximum disturbance area. It is unlikely that all this area would be impacted. The areas indicated in **Drawings -01, R-02 and R-03** as “*seeding only*” will be permanently impacted by the project, as trees and shrubs will not be allowed to grow on the dyke footprint or on its associated filters, drains and swales. The areas shown in the drawings as “*seeding and tree/shrub planting*” are anticipated to be temporarily impacted, as trees removed from these areas will be restored on-site.

The total area of forest/wetland/ticket removed is estimated to be 4.1 ha (2.7 for the Pickering dyke and 1.4 ha for the Ajax dyke). Of that, 1.4 ha would be restored on-site (0.4 h of the Ajax Dyke and 1.0 ha of the Pickering dyke), and 2.7 ha would require off-site compensation.

The 2.7 ha area not to be tree/shrub planted results from an estimated 1.0 ha on the Ajax Dyke, and 1.7 ha for the Pickering Dyke (P1 and P2). This includes area to *be seeded only*, and does not include areas of no treatment that are currently paved trails and will be returned to a similar condition. Using the 3:1 area replacement example, approximately 8.1 ha would be required in compensation. Approximately 13,500 trees would be required to plant this area following a 2.45 m x 2.45 m (6 m²) spacing using potted trees, as per the Enhanced Reforestation Typical drawing in the *Guideline* (Toronto and Region Conservation Authority, 2018). Note, this calculation does not include dyke crests that will be re-established as walking trails, returning to current conditions.

Compensation should aim to restore FOD7 lowland area using the native tree species recommended (**Table 1**); however, the ultimate species selected and specific quantities of each should account for the site specific conditions, such as insolation, moisture conditions and soil types.

Memorandum

Page 6 | March 26, 2020 March 26, 2020

Proposed Restoration Plantings and Recommendations for the Ajax and Pickering Dykes
1903602



References

Greater Golden Horseshoe Conservation Authorities. (2006). *Erosion and Sediment Control Guidelines for Urban Construction*. Retrieved from <http://www.trca.on.ca/dotAsset/40035.pdf>

Lee, H. T., Bakowsky, W. D., Riley, J., Bowles, J., Puddister, M., Uhlig, P., & McMurray, S. (1998). *Ecological Land Classification for Southern Ontario: First Approximation and its Application*. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch.

Toronto and Region Conservation Authority. (2004). *Seed Mix Guidelines*. Retrieved from <http://trca.on.ca/dotAsset/40025.pdf>

Toronto and Region Conservation Authority. (2018, June). *Guideline for Determining Ecosystem Compensation*. Retrieved from Toronto and Region Conservation Authority:
<https://laserfiche.trca.ca/WebLink/0/edoc/1499894/Guideline%20for%20Determining%20Ecosystem%20Compensation,%20June%202018.pdf>

Restoration and Ecology Notes

The following restoration recommendations follow the practical objectives for the dyke designs and the restoration methods in the *TRCA Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018). Restoration concept includes areas of expected disturbance within Project footprint. Where not specified otherwise, disturbed areas are to be restored to pre-construction conditions.

Construction Mitigation - Butternut

- A complete Erosion and Sediment Control (ESC) plan is to be created and implemented for the construction of the project, following the *Erosion and Sediment Control Guidelines for Urban Construction* (Greater Golden Horseshoe Conservation Authorities, 2006).
- Tree Protection Fencing (TPF) is to be erected around the 25 m habitat of a Butternut (*Juglans nigra*) tree identified nearby (see plan).
- This TPF should be tied into ESC fencing, or could be achieved by appropriate placement of ESC fencing without additional fencing requirements.

Construction Mitigation – Redside Dace and Aquatic Species

- In-water works are not anticipated for Ajax Dyke Segment A1.
- The Ajax Dyke Segment A1 is within the Duffins Creek valley bottom and potentially within the meander belt limits that define Redside Dace habitat. The meander belt limits are to be confirmed as part of detailed design.
- If confirmed, works are to be conducted in accordance with the *MNRF Guidance for Development Activities in Redside Dace Protected Habitat* (MNRF, 2016).
- The ESC plan (above) to be created and implemented for construction, including fencing, should be located as close as feasible to the project area to avoid potential inputs to Duffins Creek.

Soils and Seeding

- A mid-grain loamy topsoil is to be overlain on the dyke structures, as a general soil type favourable for restoration. NOTE: A minimum of 1 m of the Drainage Filter area should be left uncapped.
- Soil depths of 100 mm are to be spread on all "Seeding Only" areas.
- Soil depths of 500 mm to be spread on "Seeding and Tree/Shrub Planting" areas
- NOTE: Half of the Ajax dyke crest is to be resurfaced for the re-establishment of the walking trail (Trans Canada Trail). To be determined at detailed design.

- Seed mixes are to follow native species identified in the *TRCA Seed Mix Guidelines* (Toronto and Region Conservation Authority, 2004).
- For most Dyke Structures, to promote a restoration ground cover a native **seasonally flooded areas** seed mix is recommended, to be hydroseeded at a rate of 25 kg/h.
- For the Drainage Filter and Swale areas, to allow for drainage to be promoted and maintained, a native **retention basins** seed mix is recommended, to be hydroseeded at a rate of 25 kg/h.

Tree and Shrub Planting

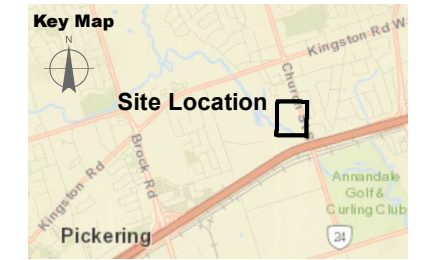
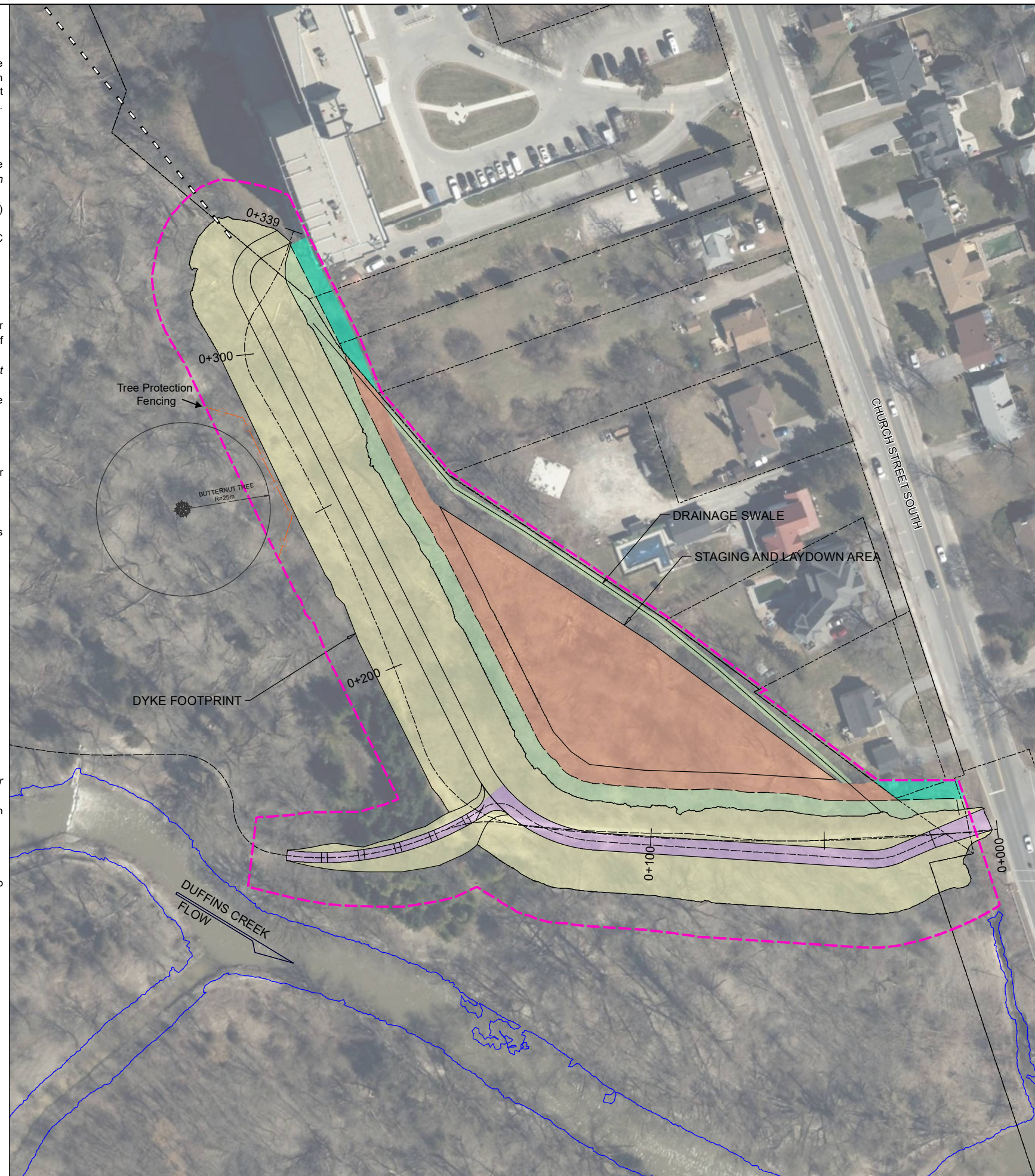
- The staging area and construction access areas are to be planted with native trees and shrubs following the Enhanced Reforestation Planting typical design of the *Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018).

Wildlife Habitat Features

- Wildlife habitat features to be considered in detailed design, in accordance with the *Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018).
- Nesting structures (bird houses/boxes) and any other features are to be appropriately placed within TRCA lands, but outside the Dyke and Filter footprints.

Private Property and Utilities

- Private property and utilities to be temporarily disturbed for construction are to be restored to preconstruction conditions.



LEGEND:

— Butternut Protection Fencing

Project Footprint and Maximum Potential Disturbance Area

Based on Minimum Disturbance Area

Seeding Only - Seasonally Flooded Mix

Seeding Only - Retention Basins Mix - with exception of 1 m strip on filter area (see notes)

Seeding and Tree/Shrub Planting

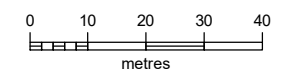
Trail

Private Property - Restore to Existing Conditions

Approximate Redside Dace Habitat Limit - to be refined in detailed design (based on Geomorphic Solutions, 2009)¹

Notes:

- Geomorphic Solutions (2009) Duffins Creek Flood Protection Dyke, Erosion Risk, Level of Service Assessment and Maintenance and Improvement Study



PROJECT: Pickering-Ajax Dykes EA

PROJECT NO. 1903601 REVISION: 3

DATE: Mar 26, 2020 SCALE: 1:1300

DRAWN: CV DATUM: NAD 1983

CHECKED: AA PROJECTION: UTM zone 17

CLIENT:

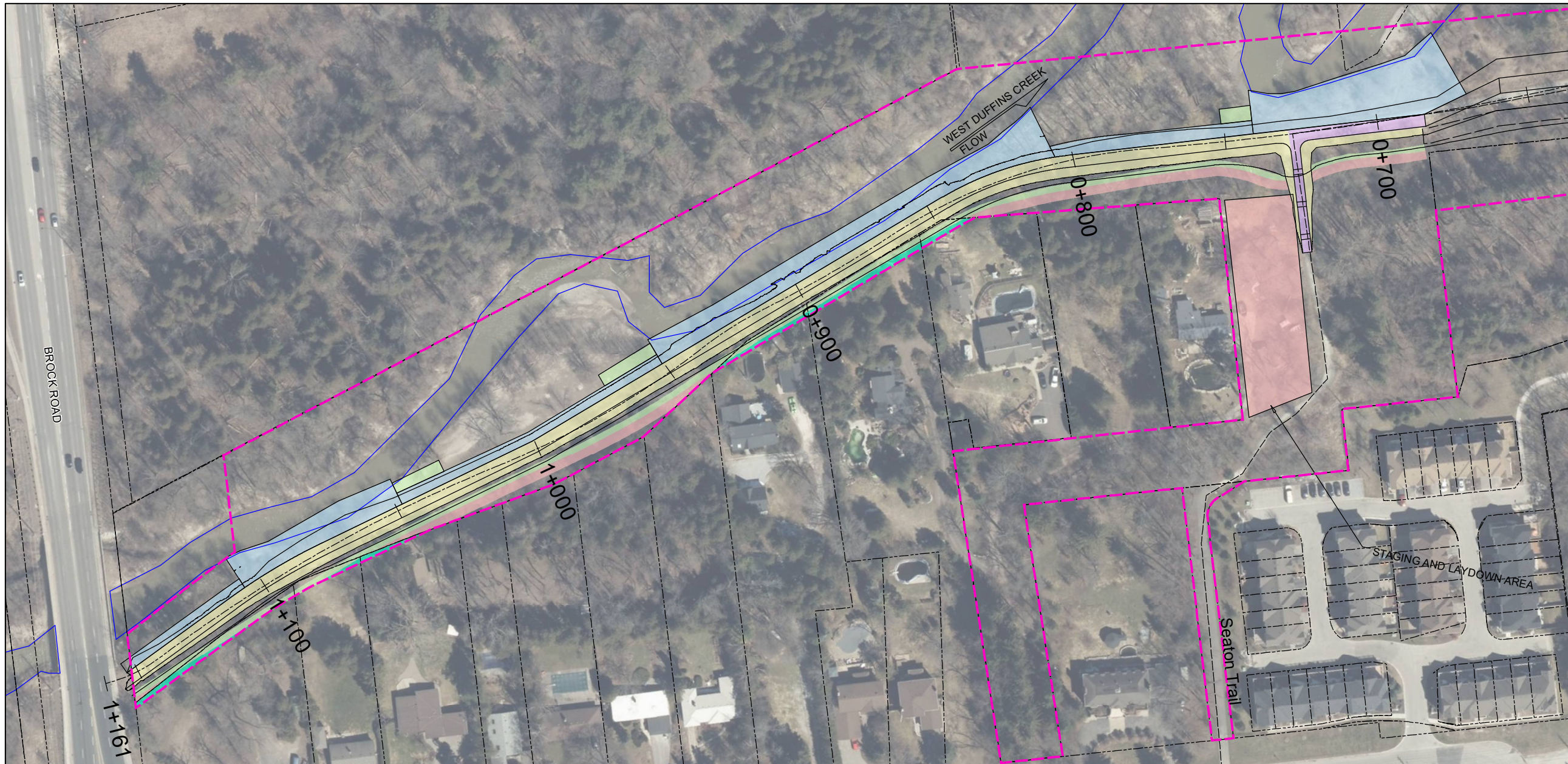
KGS GROUP

PREPARED BY:

Palmer™

**Ajax Dyke Segment A1
Dyke Rehabilitation
Concept S1
Restoration Plan**

Drawing R-01



- LEGEND:
- Project Footprint and Maximum Potential Disturbance Area
 - Based on Minimum Disturbance Area**
 - Seeding Only - Seasonally Flooded Mix
 - Seeding Only - Retention Basins Mix, with exception of Toe Drain
 - Seeding and Tree/Shrub Planting
 - Trail
 - Live Staking Area - No Seeding
 - Private Property - Restore to Existing Conditions



PROJECT: Pickering-Ajax Dykes EA	
PROJECT NO. 1903601	REVISION: 3
DATE: Mar 26, 2020	SCALE: 1:1500
DRAWN: CV	DATUM: NAD 1983
CHECKED: AA	PROJECTION: UTM zone 17

CLIENT:

KGS GROUP

PREPARED BY:

Palmer™

**Pickering Dyke Segment P1
Dyke Rehabilitation
Concept H2
Restoration Plan**

Drawing R-02

Restoration and Ecology Notes

The following restoration recommendations follow the practical objectives for the dyke designs and the restoration methods in the *TRCA Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018). Restoration concept includes areas of expected disturbance within Project footprint. Where not specified otherwise, disturbed areas are to be restored to pre-construction conditions.

Construction Mitigation – General

- A complete Erosion and Sediment Control (ESC) plan is to be created and implemented for the construction of the project, following the *Erosion and Sediment Control Guidelines for Urban Construction* (Greater Golden Horseshoe Conservation Authorities, 2006).

Construction Mitigation – Redside Dace and Aquatic Species

- Based on the approximate delineation of the meander belt by Geomorphic Solutions (2009), the Project Footprint of the Pickering Dyke Segment P1 is within the West Duffins Creek meander belt.
- In-water works are anticipated for Pickering Dyke Segment P1.
- West Duffins Creek is currently not considered Redside Dace habitat. However, should correspondence with the MECP during detailed design, works are to be conducted in accordance with the MNRF *Guidance for Development Activities in Redside Dace Protected Habitat* (MNRF, 2016).
- The ESC plan (above) to be created and implemented for construction, including fencing, should be located as close as feasible to the project area to avoid potential inputs to Duffins Creek.
- Coffer dams are to be installed as per Best Practices to isolate the work areas.

Soils and Seeding

- A mid-grain loamy topsoil is to be overlain on the dyke structures, as a general soil type favourable for restoration. NOTE: The toe drain area of the proposed dyke should be left uncapped, but it can be covered with decorative stone.
- Soil depths of 100 mm are to be spread on all "Seeding Only" areas.
- Soil depths of 500 mm to be spread on "Seeding and Tree/Shrub Planting" areas
- NOTE: the Pickering "P1" Dyke Wet Slope area (see Plan) is to be fitted with a vegetated rock buttresses and will be restored using only live shrub stakes, and will not be seeded (see below).
- Areas of walking trails are to be resurfaced to re-establish trail conditions. To be determined at detailed design.
- Seed mixes are to follow native species identified in the *TRCA Seed Mix Guidelines* (Toronto and Region Conservation Authority, 2004).
- For most Dyke Structures, to promote a restoration ground cover a native **seasonally flooded areas** seed mix is recommended, to be hydroseeded at a rate of 25 kg/h.
- For the Swale areas, to allow for drainage to be promoted and maintained, a native **retention basins** seed mix is recommended, to be hydroseeded at a rate of 25 kg/h.

Tree and Shrub Planting

- The staging area and construction access areas are to be planted with native trees and shrubs following the Enhanced Reforestation Planting typical design of the *Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018).

Pickering Dyke "P1" Wet Side Slope Planting

- The Pickering "P1" Wet Side Slope is to be completed using a vegetated rock buttresses, and can be naturalized using live stakes planted between stones (see typical).

Wildlife Habitat Features

- Wildlife habitat features to be considered in detailed design, in accordance with the *Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018).
- Nesting structures (bird houses/boxes) and any other features are to be appropriately placed within TRCA lands, but outside the Dyke and Filter footprints.

In-Stream Restoration

There are several sections of the P1 Dyke area that will require in-stream works to upgrade or install vegetated rock buttresses to the stream banks. Geomorphological analysis of Duffins Creek indicates that the bed quality along this section of Duffins Creek is composed of primarily cobbles and stones, affording fish habitat potential.

- For the Dyke, rounded stones are to be considered instead of rock buttresses wherever technically feasible. To be refined at detailed design.
- Any disturbances to the stream bed should be restored via replacement of cobbles and stones of an analogous quantity, size and composition. All imported material should be verified as "Certified Clean Fill".

Private Property and Utilities

- Private property and utilities to be temporarily disturbed for construction are to be restored to preconstruction conditions.



LEGEND:

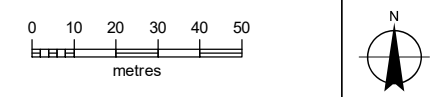
- Project Footprint and Maximum Potential Disturbance Area

Based on Minimum Disturbance Area

- Seeding Only - Seasonally Flooded Mix
- Seeding Only - Retention Basins Mix - with exception of 1 m strip on filter area (see notes)
- Seeding and Tree/Shrub Planting
- Trail

Approximate Redside Dace Habitat Limit - to be refined in detailed design (based on Geomorphic Solutions, 2009)¹

Notes:
 1. Geomorphic Solutions (2009) Duffins Creek Flood Protection Dyke, Erosion Risk, Level of Service Assessment and Maintenance and Improvement Study



PROJECT: Pickering-Ajax Dykes EA	
PROJECT NO. 1903601	REVISION: 3
DATE: Mar 26, 2020	SCALE: 1:1800
DRAWN: CV	DATUM: NAD 1983
CHECKED: AA	PROJECTION: UTM zone 17



PREPARED BY:
Palmer™

**Pickering Dyke Segment P2
 Dyke Rehabilitation
 Concept S1
 Restoration Plan**

Drawing R-03

Restoration and Ecology Notes

The following restoration recommendations follow the practical objectives for the dyke designs and the restoration methods in the *TRCA Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018). Restoration concept includes areas of expected disturbance within Project footprint. Where not specified otherwise, disturbed areas are to be restored to pre-construction conditions.

Construction Mitigation - General

- A complete Erosion and Sediment Control (ESC) plan is to be created and implemented for the construction of the project, following the *Erosion and Sediment Control Guidelines for Urban Construction* (Greater Golden Horseshoe Conservation Authorities, 2006).

Construction Mitigation – Redside Dace and Aquatic Species

- In-water works are not anticipated for Pickering Dyke Segment P2.
- Based on the approximate delineation of the meander belt by Geomorphic Solutions (2009), the Project Footprint of the Pickering Dyke Segment P2 is within the Duffins Creek meander belt.
- Works are to be conducted in accordance with the *MNRF Guidance for Development Activities in Redside Dace Protected Habitat* (MNRF, 2016).
- The ESC plan (above) to be created and implemented for construction, including fencing, should be located as close as feasible to the project area to avoid potential inputs to Duffins Creek.
- Note that West Duffins Creek is currently not considered Redside Dace habitat. Should correspondence with the MECP during detailed design indicate that it is to be considered habitat, the above measures for Duffins Creek are to be applied for West Duffins Creek.

Soils and Seeding

- A mid-grain loamy topsoil is to be overlain on the dyke structures, as a general soil type favourable for restoration. NOTE: A minimum of 1 m of the Drainage Filter area should be left uncapped.
- Soil depths of 100 mm are to be spread on all “Seeding Only” areas.
- Soil depths of 500 mm to be spread on “Seeding and Tree/Shrub Planting” areas
- Areas of walking trails are to be resurfaced to re-establish trail conditions (Trans Canada Trail). To be determined at detailed design.

- Seed mixes are to follow native species identified in the *TRCA Seed Mix Guidelines* (Toronto and Region Conservation Authority, 2004).
- For most Dyke Structures, to promote a restoration ground cover a native **seasonally flooded areas** seed mix is recommended, to be hydroseeded at a rate of 25 kg/h.
- For the Drainage Filter and Swale areas, to allow for drainage to be promoted and maintained, a native **retention basins** seed mix is recommended, to be hydroseeded at a rate of 25 kg/h.

Tree and Shrub Planting

- The staging area and construction access areas are to be planted with native trees and shrubs following the Enhanced Reforestation Planting typical design of the *Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018).

Tree and Shrub Planting

- The staging area and construction access areas are to be planted with native trees and shrubs following the Enhanced Reforestation Planting typical design of the *Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018).

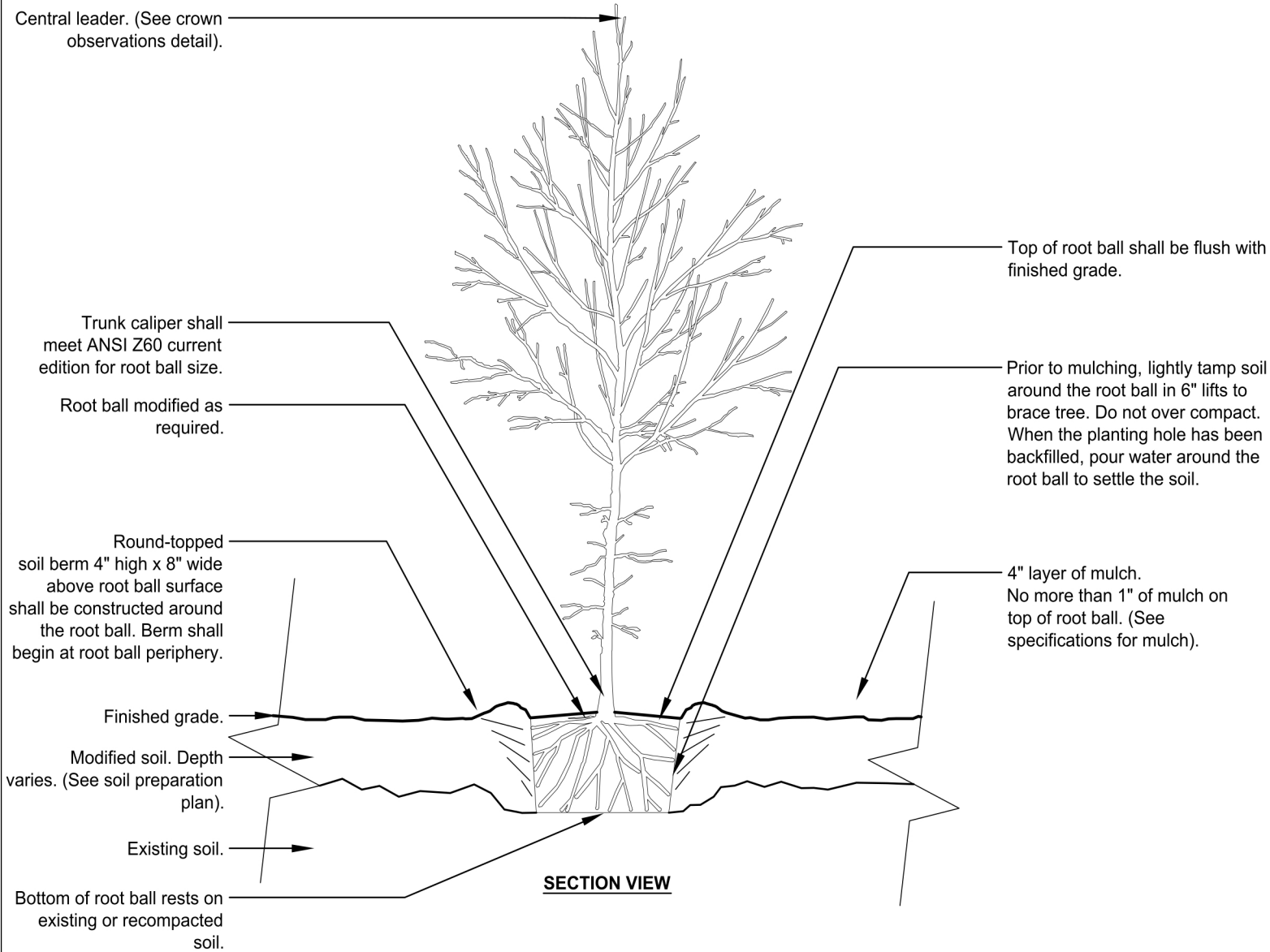
Wildlife Habitat Features

- Wildlife habitat features to be considered in detailed design, in accordance with the *Guideline for Determining Ecosystem Compensation* (Toronto and Region Conservation Authority, 2018).
- Nesting structures (bird houses/boxes) and any other features are to be appropriately placed within TRCA lands, but outside the Dyke and Filter footprints.

Private Property and Utilities

- Private property and utilities to be temporarily disturbed for construction are to be restored to preconstruction conditions.

NOTES:
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PROJECT NO.	1903601	REVISION:	1
DATE:	Mar 26, 2020	SCALE:	NTS
DRAWN:	CV		
CHECKED:	AA		

CLIENT:
 KGS Group

PREPARED BY:
Palmer™

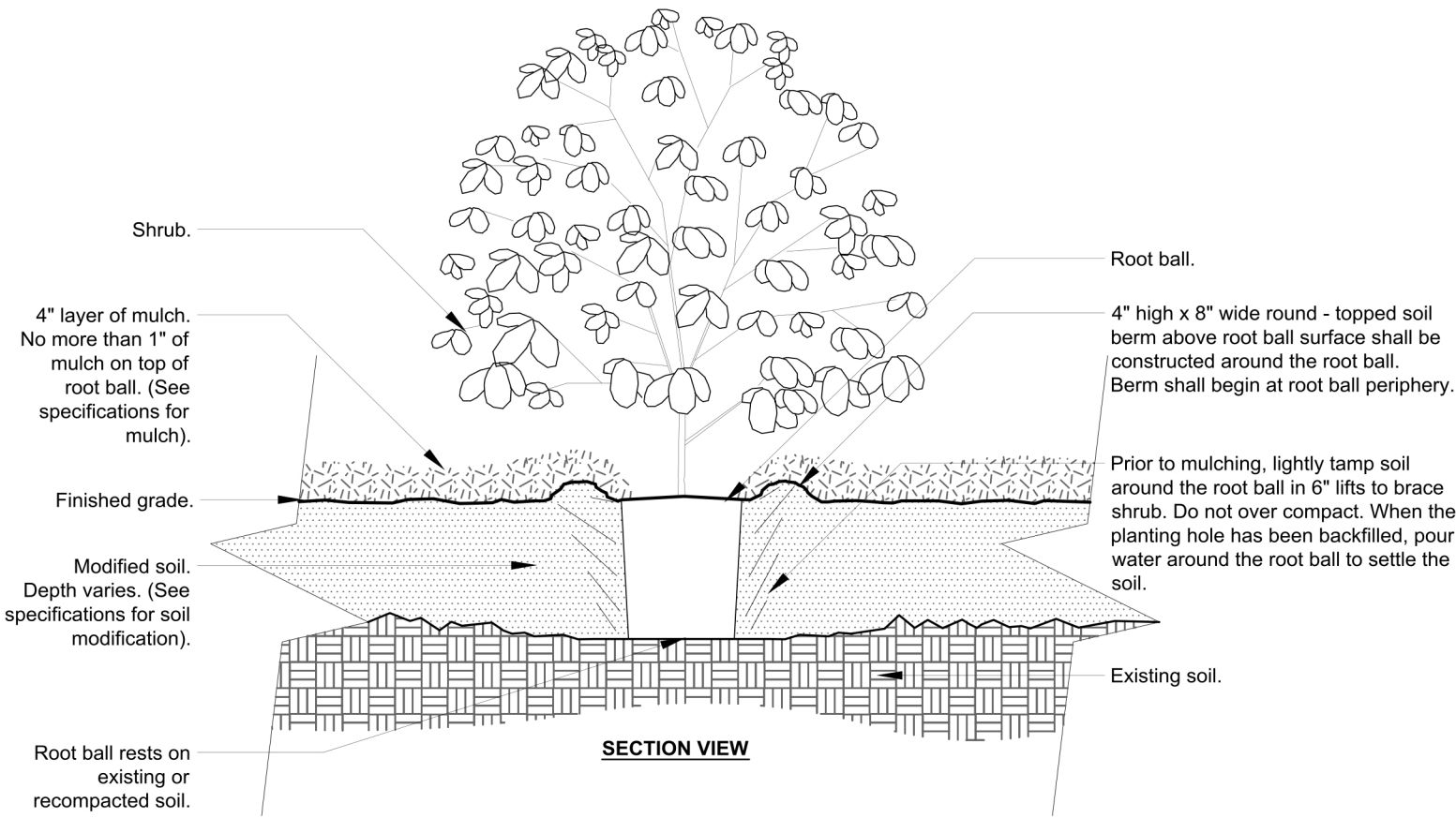
PROJECT:
 Pickering-Ajax Dykes EA

TITLE:
Tree Planting Detail

Drawing R-04

Document Path: W:\Egnyta\Shared\Projects\Active\19036 - KGS Group\1903601 - Pickering-Ajax Dykes EA\Mapping\Figures5_AccGIS\Restoration\1903601_R04-1_Tree Planting Detail.mxd

NOTES:
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SECTION VIEW

PROJECT NO.	1903601	REVISION:	1
DATE:	Mar 26, 2020	SCALE:	NTS
DRAWN:	CV		
CHECKED:	AA		

CLIENT:	PREPARED BY:
KGS Group	Palmer™

PROJECT: Pickering-Ajax Dykes EA

TITLE: **Shrub Planting Detail**

Drawing R-05

Document Path: W:\Egnyta\Shared\Projects\Active\19036 - KGS Group\1903601 - Pickering-Ajax Dykes EA\Mapping\Figures_5_AccGIS\Restoration\1903601_R05-1_Shrub Planting Detail.mxd

KEY MAP
N.T.S.



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ISSUED / REVISIONS

REV.	DATE	DESCRIPTION
A	20180815	FOR REVIEW

DESIGN/PREPARE: SR APPROVED

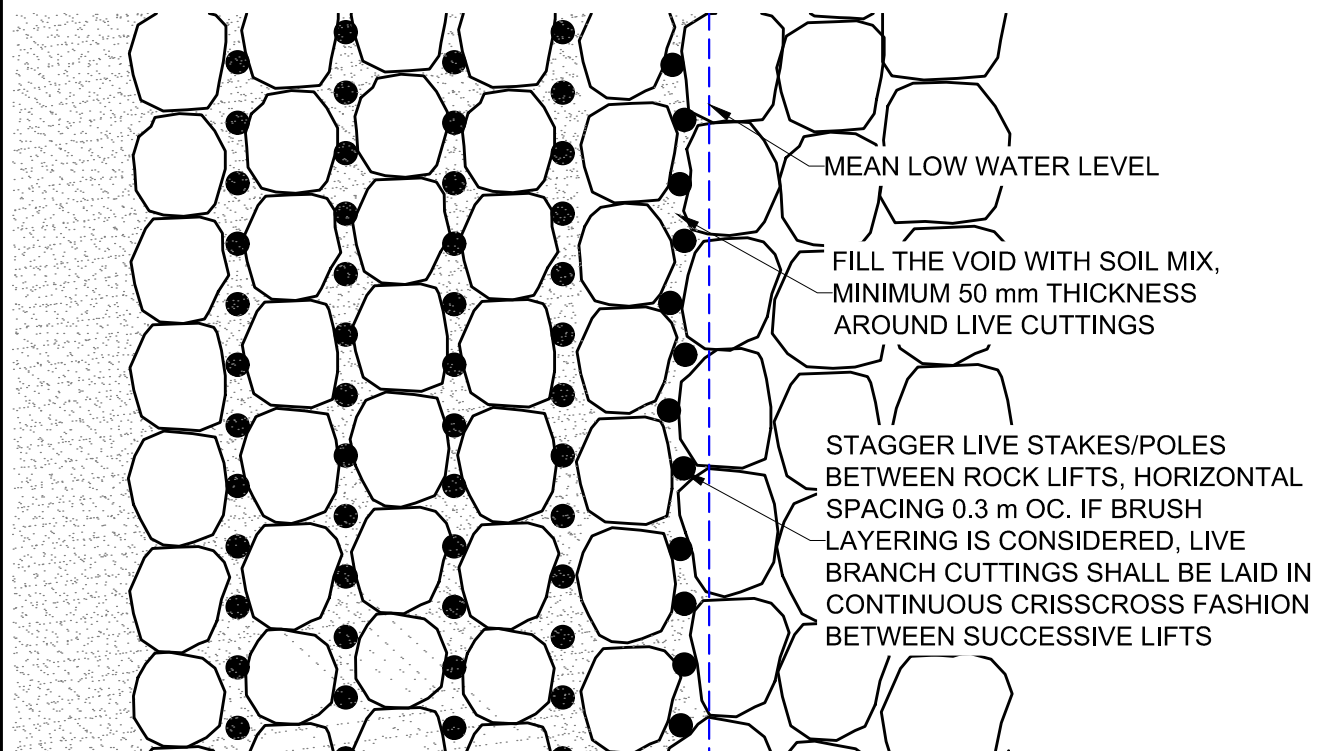
PROJECT TITLE
**STREAM BANK RESTORATION
TYPICAL DETAILS**

DRAWING TITLE
VEGETATED ROCK BUTTRESS

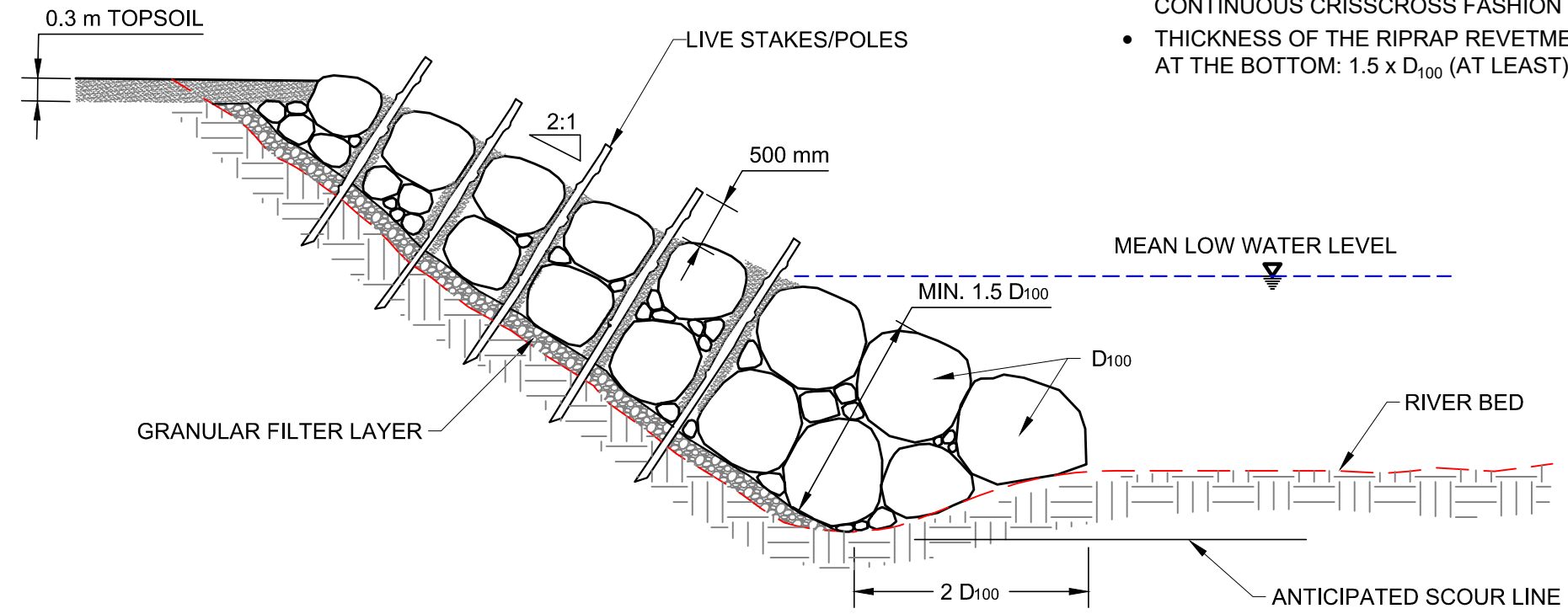
FILE NAME: Typical VRB.dwg	1 OF 1
DATE: 2018-08-14	REV. A
SCALE: N.T.S.	

NOTES FOR VEGETATED RIPRAP:

- RIPRAP REVETMENT CAN BE VEGETATED WITH LIVE STAKING, POLE PLANTING AND BRUSHLAYERING
- LIVE CUTTINGS SHALL BE INSTALLED DURING RIPRAP PLACEMENT TO ENSURE GOOD CONTACT WITH GROUND AND SOIL FILL
- THE RIPRAP REVETMENT SHALL BE CONSTRUCTED WITH WELL GRADED STONES DISTRIBUTED EVENLY THROUGHOUT THE MASS
- STONES SHALL BE PLACED IN LIFTS
- STONE SIZE AND GRADATION SHALL BE DETERMINED FROM THE DESIGN VELOCITY OR SLOPE STABILITY ANALYSIS
- STONES SHALL BE HARD, DURABLE, AND RESISTANT TO THE WEATHERING AND WATER ACTION, AND MEET THE SPECIFIED GRADATION
- TOE STONES SHALL BE KEYED INTO THE CHANNEL BED BELOW THE SCOUR DEPTH
- RIPRAP VOIDS SHALL BE FILLED WITH COBBLE, GRAVEL AND SOIL MIX
- A FILTER LAYER OF GRADED AGGREGATE SHALL BE PLACED UNDER THE RIPRAP TO PREVENT THE WASHOUT (PIPING) OF FINES THROUGH THE BUTTRESS
- LENGTH OF THE CUTTINGS SHALL DEPEND ON THE DEPTH THROUGH THE RIPRAP AND FILTER LAYER. LIVE WILLOW STAKES AND POLES CAN BE INCLUDED WITH 25-50 mm DIAMETRE AND LONG ENOUGH TO REACH BEYOND THE RIPRAP AND FILTER LAYER AND IN THE GROUND
- LIVE CUTTINGS SHALL BE INSERTED IN THE RIPRAP DURING CONSTRUCTION SO THAT THE BUTT ENDS ARE IMBEDDED IN THE SOIL BEHIND THE COVER TO A DEPTH OF 0.3-0.5 m OR INTO THE SEASONAL WATER TABLE OR CAPILLARY FRINGE
- ROOTS SHALL BE FULLY BURIED IN THE SOIL MATRIX
- THE BRANCH TIPS SHOULD PROTRUDE FOR APPROXIMATELY 0.5M FROM THE STONE LAYER AND FACE AT AN OBLIQUE ANGLE DOWNSTREAM
- IF BRUSHLAYERING IS CONSIDERED, LIVE BRANCH CUTTINGS SHALL BE LAID IN CONTINUOUS CRISSCROSS FASHION BETWEEN THE SUCCESSIVE LIFTS
- THICKNESS OF THE RIPRAP REVETMENT:
AT THE BOTTOM: 1.5 x D₁₀₀ (AT LEAST); AT THE TOP: 1.0 x D₁₀₀



PLAN VIEW
(N.T.S.)



CROSS-SECTION
(N.T.S.)