Arborist Report
Tree Preservation Plan – William Hawrelak Park

Development Permit No: 426720802-002
April 20, 2023

REVISION HISTORY				
Revision #	**Date**	**Revision Reason**	**Reviewed By**	**Approving Body**
0	March 8, 2023	Original Document	Dylan Buchanan, CHANDOS Construction	Erin Bayus, Urban Forester Natural Areas Laurie Lacey, Urban Forester Open Spaces
1	April 20, 2023	Includes all Areas 1 through 19	Dylan Buchanan, CHANDOS Construction	Erin Bayus, Urban Forester Natural Areas Laurie Lacey, Urban Forester Open Spaces

Prepared for:

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April 20, 2023

Dylan Buchanan
Project Manager
CHANDOS Construction Ltd.
9604 20th Avenue,
Edmonton, Alberta
T6N 1G1

Dear Mr. Buchanan:

RE: Tree Preservation Plan – William Hawrelak Park
(Project No: ECN 6.1. 2023)

This report summarizes our field observations of existing tree locations, their condition, and details of potential damage or injury related to the rehabilitation project at William Hawrelak Park.

Plans produced in this report combine GIS layers provided from other parties including Watt Consulting Group, PFS Studio, The Marc Boutin Architectural Collaborative, Williams Engineering and Marker Geomatics Inc. This report identifies likely conflicts between existing trees and construction related to the rehabilitation of Hawrelak Park. Preliminary recommendations are provided to mitigate those conflicts prior to construction and post construction. All final decisions of tree protection or tree removal will be made at site on an ongoing basis engaging CHANDOS and City of Edmonton Urban and Natural Areas representatives.

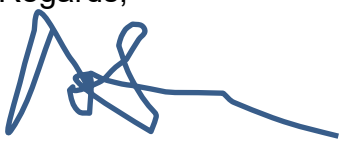
The Tree Preservation Plan outlines preliminary tree protection requirements for open spaces and natural areas. Amendments or updates to this plan will be submitted on as needed basis.

As of April 13th, 2023 the protection status is summarized below:

	Numbers of Trees
Total number of open space trees impacted – within Tree Protection Zone (TPZ)	741
Total estimated number of trees to protect	544
Total estimated number of trees to remove	112
Trees impacted by current grading and COE protection requirements	85
Commemorative trees identified within the development site	35

Please get back to me if you have any questions or concerns with this report.

Regards,



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1.0 Introduction

The purpose of this report is to inventory locations and tree information from site observations of City of Edmonton trees within William Hawrelak Park (Figure 1). Recommendations for trees are consistent with tree preservation requirements in the Public Tree Bylaw 18825, and the associated June 2022 Tree Preservation Guidelines. This tree preservation plan has been requested by the City of Edmonton in support of Development Permit application 426720802-002.

The property addresses and legal descriptions are as follows:

9330 – Groat Road NW Plan 6075AM Blk X
9350 – Groat Road NW – Plan 6075AM Blk X
9330 Groat Road NW – Plan EDMONTON Lot 1

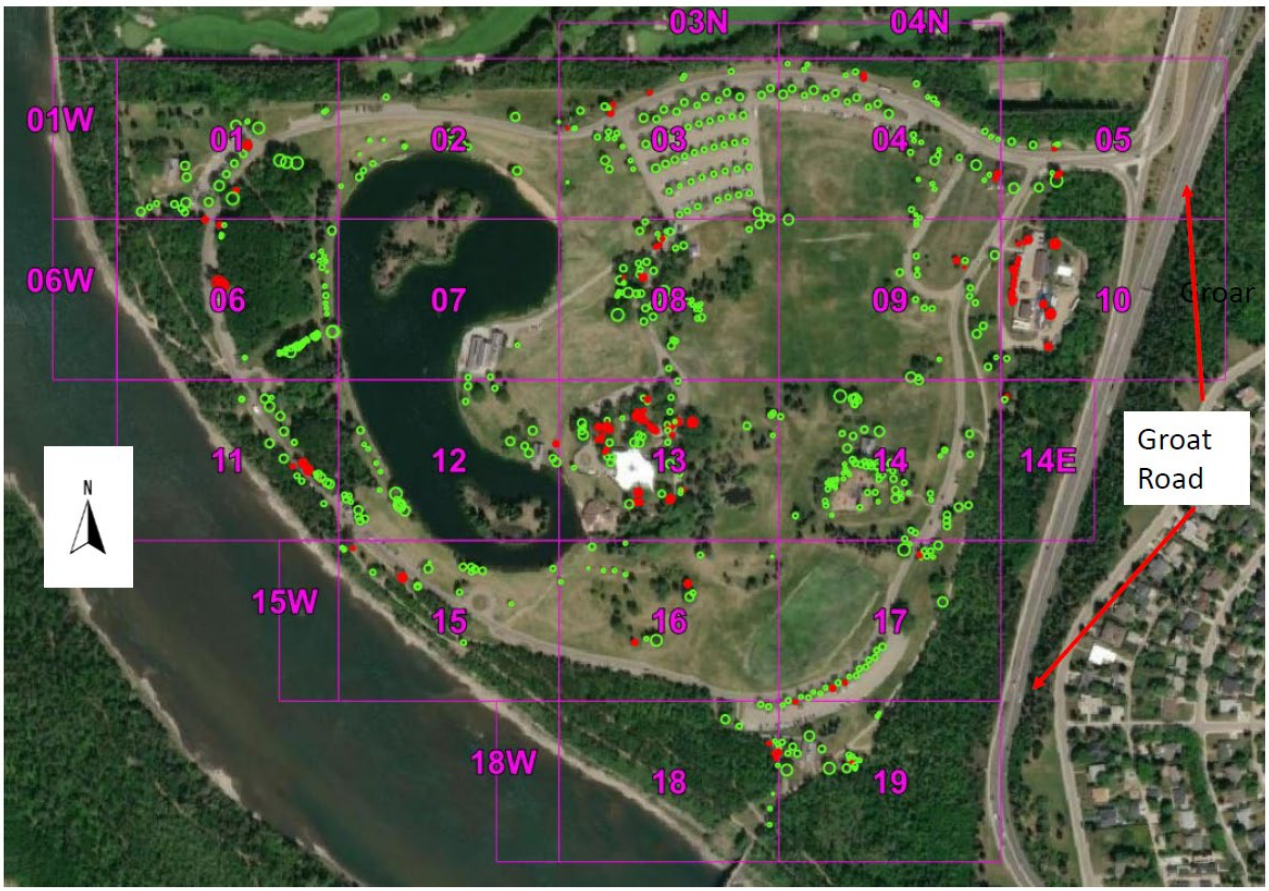


Figure 1. Hawrelak Park – Development Site.

2.0 Demolition and Construction

Plans provided for the rehabilitation of Hawrelak Park indicate demolition and construction activities in open spaces and natural areas including the removal and replacement of surface and underground infrastructure.

Rehabilitation work will involve the following

Utilities

- Replacing the entire storm sewer systems
- Upgrading power, gas and telecommunication infrastructure
- Replacing the irrigation system
- Replacing the entire water distribution system within the park

Facilities

- Updating the main pavilion, plaza, boathouse, washroom shelters, 2 buildings in the service yard as well as an extension to the main building
- Adding a new storage facility for the Heritage Amphitheatre

Open spaces

- Replacing the paddle boat dock, playground
- Adding shared use paths
- Regrading to improve drainage
- Repaving all roads and replacing all road curbing
- Adding lighting for security

The projected start date is April 2023 with subsequent construction ending in winter 2025/2026.

2.1 Material Stockpiling and Equipment Access Plan

Equipment access and egress routes, and areas designated for staging of equipment and materials are located in the **Appendix 1** Material Stockpiling and Equipment Access Plan. There are 2 designated stockpiling areas and 1 area identified for hazardous materials recycling for this project.

The main access and egress route will be the existing ring road. Three additional routes have also been identified in **Appendix 1.**

3.0 Site Assessment and Mapping

3.1 Methods

The methods used to benchmark the condition of the natural areas and the open space trees is outlined below.

3.11 Natural Areas

The 2015 City of Edmonton Urban Primary Land and Vegetation Inventory (uPLVI) was used as the basis to classify the natural areas within Hawrelak Park (**Figure 2, Table 1**). The field work included establishing 1 transect throughout each of the 5 polygons from **Table 1** to assess stand composition and condition. Every effort was made to ensure representativeness of the average condition of the natural area and minimize influence of edge effects.

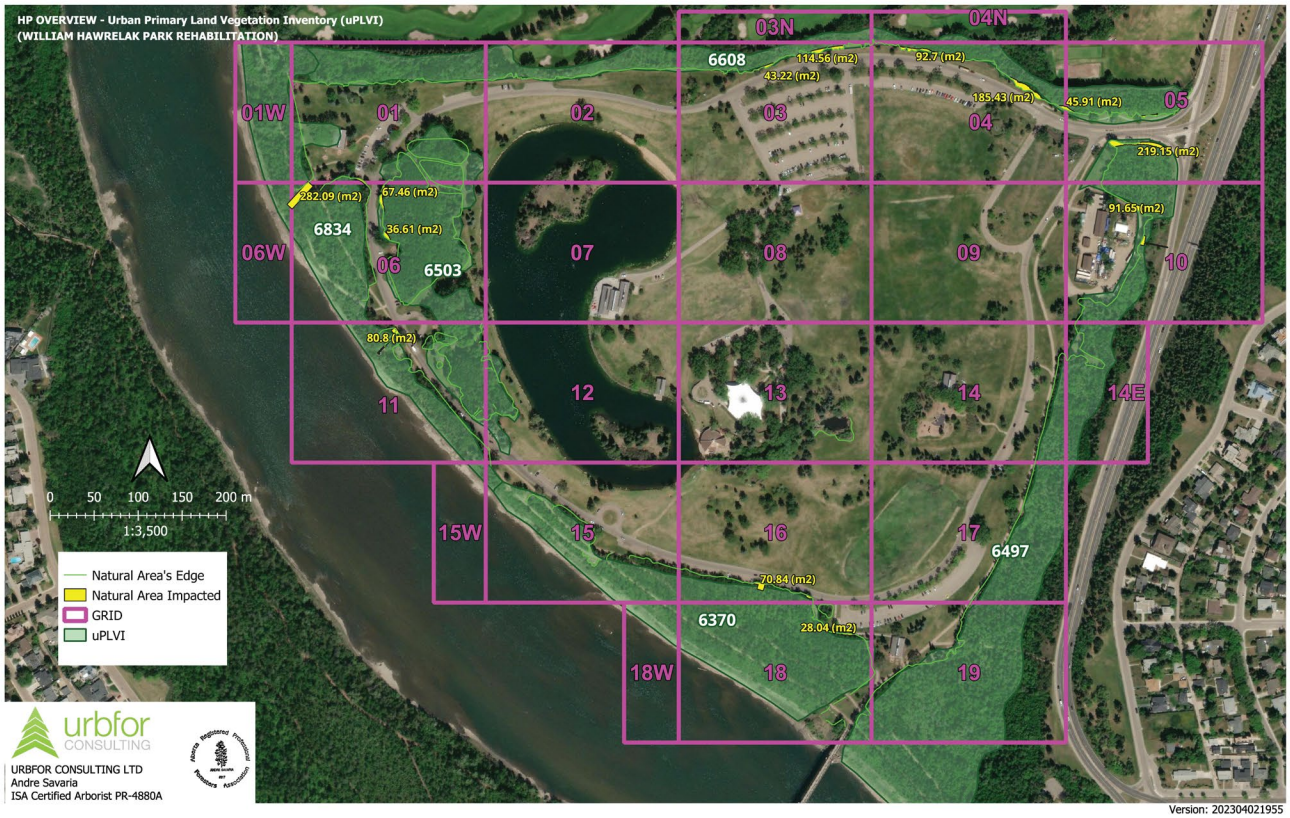


Figure 2. Natural Area Polygons as per Urban Primary Land and Vegetation Inventory (uPLVI).

This inventory identified 5 key forested site types.

Table 1. Summary of Key Forested Types within Natural Areas.

Polygon ID	Stand Type	Density Class %	%Coniferous Tree Species	Leading Tree Species	Pioneer Succession Stage
6834	Balsam Poplar	51 – 70	10	Balsam poplar	Mature
6370	Balsam Poplar/ Trembling Aspen	71 – 100	0	Balsam poplar/ white birch	Mature
6503	Balsam Poplar/Trembling Aspen	71 – 100	10	Balsam poplar/ white birch	Mature
6608	Coniferous Leading Mixedwood	51 - 70	70	White spruce	Mature
6497	Balsam Poplar	51 - 70	0	Balsam poplar	Breakup

The Rangeland Health Assessment for Grassland, Forest and Tame Pasture Field Workbook (Adams, 2016) was used to determine the current status and condition of identified forest types within natural areas. This assessment served as a visual system to readily see changes in forest and natural area health. A scoring system is used to quantify condition.

Forested types within natural areas were assessed in the field to confirm:

- Dominant tree and shrub species and condition
- Current seral stage (status)
- Forest plant community structure (i.e., vegetation layers)
- Changes in surface organic layer (LFH thickness and compaction)
- Drainage direction and erosion and sedimentation concerns
- Areas of high use showing vegetation decline and/or compacted soils
- Environmental sensitivity, including unique or rare species/landforms
- Presence of prohibited noxious and/or noxious weeds

Changing weather conditions limited stand observations to a minor extent due to snow cover and leaf off conditions. This includes site visits to map all polygons on April 1 and 2, 2023.

3.12 Open Space Trees

The original tree inventory produced for this report was completed in July and August of 2020.

<u>Open Areas</u>:

i. Unique tree identifier
ii. Trees defined as >60 mm at breast height
iii. Conifer vs deciduous
iv. Species; common and scientific name
v. Diameter at breast height (DBH) in Millimetres (mm)

vi. crown width in Metres (m) – open trees only; 1 measurement of average crown
vii. shrubs [1]
viii. Comments – as required

[1] A **shrub** is a small- to medium-sized perennial woody plant. Unlike herbaceous plants, **shrubs** have persistent woody stems above the ground. They are distinguished from trees by their multiple stems and shorter height

The trees were mapped using a GEO7x explorer GPS with a data accuracy of 0.1 to 0.3 metres.

In early January 2023, further assessment field work was initiated and included:

i) Documenting existing site conditions
ii) Confirming the inventory of affected City of Edmonton (COE) trees in open spaces, updating the following
    i. Trunk diameter at breast height (1.4 m) above ground
    ii. Tree species, common name and scientific name
    iii. Tree height in metres (m)
    iv. Crown length in metres (m)
    v. Trees cut since 2020
iii) Trees to be removed
iv) Proposed soil mitigation measures to prevent root damage/ impacts as well as potential soil compaction
v) Site factors that may impact tree health and survival (i.e., existing versus final grade)
vi) Overall tree health including abiotic impacts to tree roots, trunk and crown
vii) Current condition code for crown, branch, trunk, roots and root collar as per City of Edmonton Guidelines for Evaluation of Trees and **Table 2** below.

Table 2. Summary of Tree Condition Codes.

Percent (%)	Description
100	Perfect tree or specimen quality
90	Excellent Tree
80	Very Good Tree
70	Above Average Tree
60	Good or Average Tree
50	Below Average Tree
40	Fair Tree
30	Poor Tree
20	Very Poor Tree

The chemical properties of the soil were not assessed.

4.0 Trees and Construction Conflict Analysis

Construction disturbances and working area buffers were represented as GIS polygons. These GIS polygons were used to calculate the area (m^2) of disturbances.

4.1 Methods

All of the most recent design plans were obtained and used to generate overlays onto the natural area boundary in the park. These data sources are summarized in **Table 3.**

Table 3. Summary of Data Type and Source.

DATA TYPE	FILENAME	Source
New Electrical	0042566.00-A0-E_POWER.dxf	Williams Engineering
New Electrical Equipment	0042566.00-A0-E_POWER.dxf	Williams Engineering
New Electrical Lights	0042566.00-A0-E_POWER.dxf	Williams Engineering
New Sanitary	3776.E01.C-106 - SANITARY SEWERS SERVICING PLAN-Model.dxf	Watt Consulting Group
New Storm	3776.E01.C-105 - STORM SEWERS SERVICING PLAN-Model.dxf	Watt Consulting Group
New Water	NEW 3776.E01.C-107 - WATER MAINS SERVICING PLAN-Model (exported).dxf	Watt Consulting Group
New Catch Basin/Manhole	3776.E01.C-105 - STORM SEWERS SERVICING PLAN-Model.dxf	Watt Consulting Group
New Paths	20015 HAWRELAK PARK - Landscape Base.dxf	PFS Studio
New_Roads_Curb	20015 HAWRELAK PARK - Landscape Base.dxf	PFS Studio
Staircase	20067-TOPO-102821-CLIENT.dxf	Marker Geomatics
Natural Area Boundary	20067-TOPO-102821-CLIENT.dxf	Marker Geomatics
Ski trails	20015 HAWRELAK PARK - Landscape Base.dxf	PFS Studio
Retaining Walls	20015 HAWRELAK PARK - Landscape Base.dxf	PFS Studio
BBQ's	20015 HAWRELAK PARK - Landscape Base.dxf	PFS Studio
Outfall Areas	20015 HAWRELAK PARK - Landscape Base.dxf	PFS Studio
Grading	3776.E01.C-102 - OVERALL SITE GRADING PLAN.dxf	Watt Consulting Group

The applicable disturbance width and working area buffer for each disturbance type is outlined in **Table 4**.

Table 4. Summary of Disturbance Types, Applicable Widths and Working Area Buffers.

Disturbance Type	Disturbance Width Applied (m)	Working Area Buffer (m)	Comments
New Electrical	**1.0**	**0.5**	From the identified electrical line in CAD, a 0.5 meter buffer was applied to the line resulting in an area of disturbance of 1.0 meters across; delete new electrical in AREA 10 as per Nikirk email of March 3, 2023; See Table 2 for source
New Electrical Equipment	**variable**	**3.0**	A 3.0 meter buffer was applied to the footprint of the new equipment provide from CAD. Eg a 2.0x2.0 equipment would end up as 5.0 x 5.0 to allow for installation; See Table 2 for source
New Electrical Lights	**variable**	**3.0**	3.0 meters from around the identified light standard location in CAD; See Table 2 for source
New Sanitary	**6.0**	**3.0**	From the identified sanitary line in CAD a 3.0 meter buffer was applied to the line resulting in an area of disturbance of 6.0 meters across.; See Table 2 for source
New Storm	**8.0**	**4.0**	From the identified storm line in CAD, a 4.0 meter buffer was applied to the line resulting in an area of disturbance of 8.0 meters across; See Table 3 for source
New Water	**6.0**	**3.0**	From the identified sanitary line in CAD, a 3.0 meter buffer was applied to the line resulting in an area of disturbance of 6.0 meters across.; deleted new water in AREA 10,14 and 17 as per Buchanan email of March 2, 2023; See Table 3 for source
New Catch Basin/Manhole	**variable**	**3.0**	a 3.0 meter buffer was applied to the footprint of the new catch basin from CAD. Eg a 1.0x1.0 catch basin would end up as 5.0 x 5.0 to allow for installation; See Table 3 for source
New Paths	**variable**	**0.3**	From the identified back of curb line in CAD a 0.3 meter buffer was applied to allow for the installation of the new curb form; See Table 3 for source
New_Roads_Curb	**variable**	**0.5**	From the identified back of curb line in CAD a 0.3 meter buffer was applied to allow for the installation of the new curb form.; See Table 3 for source
Staircase	**none**		No disturbance anticipated with current construction methods
Ski trails	**none**		No disturbance anticipated
Retaining Walls			Retaining walls still under design; this work will not be in 2023; it is a remove and replace so impacts should not be substantial (see Buchanan email of March 2, 2023)
BBQ's	**none**		No disturbance anticipated
Outfall Areas			See 3590 Hawrelak Park Foliage Removal 230112 (NW); 3590 Hawrelak Park Foliage Removal (South)
Grading	**variable**		Intersected latest March 3, 2023 grading plan over natural area boundary to determine aera (m2) impacted.

All of the most recent point, line and polygon data sets were imported to QGIS Ver.3.28 from a CAD (dxf) file format.

The intersected data was compiled with the following assumptions:

i. The **natural area boundary line** – The boundary line used in this analysis was originally collected in 2020 from Marker Geomatics (file: 20067-TOPO-102821-CLIENT)

ii. The **area disturbed** was comprised of
   - New installations of utilities including storm water, water, sanitary and electrical; grading

- All new paths within the park

iii. This analysis excluded all **trails** west of the ring road

iv. All **existing utilities** are to be abandoned and do not constitute a potential disturbance

v. Installation of **new utilities** that involve trenchless technology can further reduce this area of disturbance

vi. The **natural area boundary** line used was likely collected in 2020 which was the date of the initial inventory; therefore, there may be new areas of tree/ shrub encroachment into the park as well as areas recently groomed that are outside of the original boundary

4.2 Open Space Trees

A GIS buffer tool was utilized to generate a 5 m tree protection zone (TPZ) radius polygon around each individual tree in open spaces. Construction plans for new utilities or infrastructure overlapping these individual tree buffers (**Figure 3**) triggers recommendations for tree assessment, protection, or removal.

Figure 3. Example of GIS Utility Overlay for Identifying Conflicts.

This preservation plan will only address those “planned disturbances” that fall within the identified TPZ using **Table 5** minimum protection distance multipliers.

Table 5. Tree Protection Zone Calculation Table.

TREE PROTECTION ZONE CALCULATION TABLE		
TRUNK DIAMETER (DBH)	TRUNK CIRCUMFERENCE	MIN. PROTECTION DISTANCE
< 10cm	< 31cm	1.2 METERS
11 - 30cm	34 - 94cm	1.8 METERS
31 - 40cm	97 - 125cm	2.4 METERS
41 - 50cm	129 - 157cm	3.0 METERS
51 - 60cm	160 - 189cm	3.6 METERS
61 - 70cm	192 - 220cm	4.2 METERS
71 - 80cm	233 - 251cm	4.8 METERS
> 80cm	> 251cm	5.0 METERS

- MIN PROTECTION DISTANCE IS MEASURED FROM OUTSIDE EDGE OF TREE TRUNK FROM EACH SIDE.
- DBH = DISTANCE AT BREAST HEIGHT

5.0 Results

5.1 Natural Area Assessment

The estimated total area to be disturbed within the natural area is approximately 1,512 m^2. The following is a breakdown of natural area disturbed (m^2) by disturbance type previously shown in **Table 3**.

Table 6. Summary of Impacts to Natural Areas (NA) by Disturbance Type.

Natural Area ID	Area Disturbed Inside NA (m^2)	Area Disturbed Outside of NA (m^2)	Conflict	Comments
0		143.81	New_Storm	Outfall #25; case bore, no excavation or disturbance in NA
1		148.65	New_Sanitary	no disturbance to NA, existing pipe to be lined
4		177.88	New_Water	water line to be DD, small receiving pit in ditch
5	70.84		New_Electrical, New_Electrical_Equipment	
6	36.61		New_Electrical	
8	114.56		CUT_Fill, New_Electrical, New_SUP	
9	92.7		CUT_Fill, New_Electrical, New_SUP	
10	185.43		CUT_Fill, New_Electrical, New_Electrical_Equipment, New_SUP	
11	45.91		CUT_Fill	
12	23.38		New_Electrical, New_Electrical_Equipment	
13	219.5		CUT_Fill, New_SUP, New Storm	
14	91.65		New_Electrical	
15	65.71		New_Electrical, New_Electrical_Equipment	
16		1386.25	New_Electrical, New_SUP, CUT_Fill	electrical moved under path; no NA disturbance
17		29.3	New_Electrical, CUT_Fill	electrical moved under path; no NA disturbance
18		274.04	New_Electrical, CUT_Fill	electrical moved under path; no NA disturbance
19	28.04		CUT_Fill, New_SUP	
20	20.02		New_Electrical, New_CBAS_Manhole	
21	80.8		New_Electrical, New_Electrical_Equipment	
22	67.46		CUT_Fill, New_Electrical, New_SUP	
23	44.82		CUT_Fill, New_Electrical, New_Water, New_Storm, New_CBAS_Manhole, New SUP	
24	282.09		New_Storm	
25	43.22		New_Electrical, CUT_Fill, New_SUP	
Total (m^2)	**1512.74**	**2159.93**		

Recommendations to mitigate the impact of these disturbances is further outlined in section 6.1 of this report and Appendix 6, 7 and 8.

5.1.1. Natural Area Health Assessment Results

The results of the natural area health assessment are summarized below by polygon ID provided in **Table 1**.

6834 – This stand is largely comprised of mature ~14-meter-tall balsam poplar (*Populus balsamifera*) in the overstory at an approximate density of 70% with pockets of white spruce (*Picea glauca*). A small number of white birch (*Betula papyrifera*) were also noted in both the overstory and understory. There is a dense understory of red osier dogwood (*Cornus stolonifera*) in the 2 – 4 meter height range as well as prickly rose (*Rosa acicularis*). Smaller white spruce seedlings/ saplings ranging in height from 0.5 to 5.5 metres were noted where canopy gaps occur. Trembling aspen (*Populus tremuloides*) was also noted in the understory. The stand is relatively flat on the east side and slopes gradually west towards the Saskatchewan River. There are two pedestrian trails that extend north and southeast through this stand.
The plant community type was assessed as “PB. 3 red-osier dogwood” as per the Urban Ecological Field Guide for the City of Edmonton. The overall forest health assessment score was in the “healthy” range at ~ 86 %.

6370 - This stand is largely comprised of 2 layers with a mature ~13 meter-tall balsam poplar (*Populous balsamifera*) in the overstory at an approximate density of 70% with some standing dead balsam poplar. Aspen trees (*Populus tremuloides*) at ~ 10 metres tall are growing under existing balsam poplar. Mountain ash (*Sorbus americana*) stems reach 5 metres in height and Manitoba Maple (*Acer negundo*) was recorded at 9 metres. Oak (*Quercus sp.*) was noted in the understory as well. There is a well established understory of low bush cranberry (*Viburnum trilobum*) in the 2-meter height range. White spruce (*Picea glauca*) seedlings/saplings were noted in the southeast corner of this stand. There is significant dead fall throughout the central portions of the stand – some resulting from wind events. Protective metal cages were noted on selected balsam poplar. Chewing injury was observed on multiple balsam poplar trees from beavers at the southwest portion of the stand. The site is relatively flat and stable and there are slopes of up to 25 percent towards the South Saskatchewan River. Two distinct walking trails extend southeast and northwest in this stand.

The plant community type was then assessed as “PB. 1 mixed shrubs” as per the Urban Ecological Field Guide for the City of Edmonton. The overall forest health assessment score was in the “healthy with problems” range at ~ 65%. This is largely due to the dieback observed with poplar, the lack of species diversity and regenerating conifer/ deciduous species.

6503 – This stand lies west of the lake and east of the ring road. The overstory trees species include balsam poplar (*Populus balsamifera*) at 70% with white spruce (*Picea glauca*) (10%) and some small concentrations of white birch (*Betula papyrifera*). Red osier dogwood (*Cornus stolonifera*), beaked hazelnut (*Corylus cornuta*), prickly rose (*Rosa acicularis*) and mountain

ash (*Sorbus americana*) were all found in the understory. Relative to the previous stand 6834 and 6370, there is a larger concentration of mature Manitoba maple (*Acer negundo*) in both the overstory and understory which is considered a significant invader species in Alberta (Invasive Alien Plants in Canada, 2008). Caragana (*Caragana arborescens*) stems were noted along trail edges. Black knot on cherry was noted.

There are at least 3 prominent vehicle trails that were encountered and many pedestrian trails, BBQ sites are also present throughout the southwest end of this stand. The poplar appears older at an estimated age of 60 to 65 years with younger white spruce in the 45 – 50 year age class.

The plant community type was assessed as “PB. 3 red-osier dogwood” as per the Urban Ecological Field Guide for the City of Edmonton. The overall forest health assessment score was in the “healthy with problems” range at ~ 55%. This is largely due to cumulative impacts of soil compaction from trail use, significant presence of Manitoba Maple and caragana as well as low numbers of regenerating stems.

6608 - This stand lies north of the ring road and extends towards Royal Mayfair Golf Club. UrbFor could only assess the portion of the stand to the south of the existing fence. The overstory trees species include balsam poplar (*Populus balsamifera*) (70%) with more abundant white spruce (*Picea glauca*) (20%) to the east end of the stand and some aspen (*Populus tremuloides*) (10%). There are many standing dead spruce throughout. The understory species include beaked hazelnut (*Corylus cornuta*) and red osier dogwood (*Cornus stolonifera*). There is reduced structural diversity: regeneration is less prominent than stands 6834 and 6370 and saplings are in much lower density and distribution. Caragana *Caragana arborescens*) covers a large area on the south edge that extends ~ 100 metres in length. Siberian elm (*Ulmus pumila*) and Manitoba maple (*Acer negundo*), which are both invasive species in some parts of Canada when they escape cultivation, were noted. There were bird cages nailed to trees in this stand and older containers against the fence line. There are many concentrations of dead ladder fuels and this combined with standing snags may pose a fire risk during dry conditions. This stand has the largest concentration of thistle (*Asteraceae* family) on the south perimeter.

The plant community type was classified as “CLM. 3 mixed shrubs” as per the Urban Ecological Field Guide for the City of Edmonton. The overall forest health assessment score was in the “unhealthy” range at ~ 30%. This is largely due to the dieback observed in the spruce and large extent of invasive species, namely caragana, Siberian elm and thistle.

6497 - This stand lies east of the ring road and extends toward Groat Road, almost covering the entirety of the eastern perimeter of the park. The overstory consists of mostly balsam poplar (*Populus balsamifera*) (60%) and trembling aspen (*Populus tremuloides*) (30%), with white spruce (*Picea glauca*) and balsam fir (Abies balsamea) making up the remaining species composition. The balsam poplar reaches up to ~ 15 metres and has aspen growing 2

meters below at 13 metres tall. The small amount of spruce and fir reach 10 metres. The understory consists mostly of red-osier dogwood (*Cornus stolonifera*) (40%) and beaked hazelnut (*Corylus cornuta*) (30%), with a small amount of prickly rose (*Rosa acicularis*) (10%) and high bush-cranberry (*Viburnum trilobum*) (10%). Manitoba maple (*Acer negundo)* was found in the stand but was mostly concentrated around the edges around the City of Edmonton compound. Caragana (*Caragana arborescens*) was also located in small batches in the stand extending to an inclining slope leading to Groat Road in the south-eastern portion of the stand. There is a significant amount of spruce and fir saplings spread throughout the stand ranging between 0.5 metres to 5 m height. A 10% mortality of the crown was also observed in the northern portion of the stand and large portions of dead fall were seen throughout.

There are two trails that cut through the stand, a horseback trail and a trail leading to stairs ascending the slope up to Groat Road, as well as a cutline leading from the City of Edmonton compound. The poplar is estimated to be older at 50 to 60 years old than the spruce in the overstory at ~ 40 years old.

The plant community type was assessed as “PB. 3 red-osier dogwood” as per the Urban Ecological Field Guide for the City of Edmonton. The overall forest health assessment score was in the “healthy” range at ~ 85%.

All forest health assessment score sheets are attached as **Appendix 2** Forest Health Assessment Scores.

5.2 Impacts to Open Space Trees

Analysis of construction plans and a comparison using GIS buffers around individual open space trees (**Appendix 3**) has identified a total of 741 conflicts (**Table 7**). These conflicts or disturbances have potential to cause injury to individual trees. The mechanisms of those injuries could include:

- Soil compaction/ contamination
- Root cutting or damage
- Grade changes that redirect surface water
- Crown injury including broken branches / burns to foliage
- Trunk damage / wounds
- Excessive fill over roots, against trunk
- Damage during installation of surface infrastructure

The results of the initial overlay exercise identified the following:

Table 7. Summary of Impacts to Open Space Trees.

	Numbers of Trees	Comments
Total number of open space trees impacted – within TPZ	741	The City of Edmonton requires that all trees that fall within 5 metres of any boulevard and open space tree (as measured from the edge of the trunk of the tree) be identified
Total estimated number of trees to protect	544	The final number of trees to protect may change subject to further field assessment.
Total estimated number of trees to remove	112	The final number of trees to remove may change subject to further field assessment.
Trees impacted by current grading and COE protection requirements	85	Follow specifications as per the Design and Construction Standards. 2022. Volume 5 Landscape.
Commemorative trees identified within the development site	35	These trees may not have any planned disturbances within 5 meters. However, they are identified specifically on the Overview Maps.

Scaled maps showing the required protection for each of the impacted trees in open spaces have been drafted for 19 areas – see **Appendix 4** Overview Maps.

5.3 Grading/ Cut and Fill Plan

A final cut and fill plan was produced by Watt Consulting Group on March 3, 2023. The Cut and Fill Plan (Watt Consulting Group) was layered over the open space tree inventory (UrbFor) for analysis of grading conflicts with individual open space trees. This analysis identified potential injury to 85 individual open space trees due to proximity to planned grading.

6.0 Recommendations

Recommendations for the preservation and protection of natural areas and open space trees is based on key objectives for

i. Controling erosion and sediment loss
ii. Limiting drainage impacts
iii. Soil stabilization of cut and fills
iv. Mitigating soil compaction

The best management practices to meet these objectives for natural areas and open space trees are outlined below.

6.1 Natural Areas

6.1.1 Erosion and Sediment Control

Erosion and sediment control mitigation measures for natural areas included in this report draws from the Temporary Erosion and Sediment Control Plan (TESCP) prepared by CPP Environmental in March 2023.

The fundamental objective of that plan is as follows:

"*to prevent erosion and manage eroded sediments associated with project works. More specifically, this TESCP provides erosion and sediment control measures over the underground utilities construction and stripping and grading period from mid-March 2023, to end of October 2023*."

The general best management principles to be followed throughout this project include the following:

- Plan in phases to avoid having large areas of exposed soils. This involves stages of construction activities
- Limit the timespan of the vegetation clearing phase as ground cover is the most important factor in controlling erosion and preventing soil loss/movement
- Revegetate cut and fill slopes as soon as possible and as work progresses
- Stabilize areas after final grading; mechanical (e.g., track pack), vegetative (hydro seed) or a combination (hay/seed track crimping) can be used
- Plan to minimize water velocities and contributing areas. Avoid long slopes of low (<5%) to moderate (<10%) grade
- Break up extended slopes with benches, terraces, or installation of diversion structures (e.g., berms/silt fences/siltsox)

- Install check dams in lower lying areas of concentrated runoff prior to revegetation to reduce water velocity and prevent rill/sheet erosion
- Use existing vegetative buffers or grassed areas to contain and filter sediment laden water from any pumping or temporary drainage activities. In some cases, lined channels may be needed to prevent scour
- Install sediment fences on the downslope side of piled or exposed soil surfaces to intercept sediment and runoff
- Protect stockpiles of soils from erosion by immediately covering them with tarps prior to or during rain and revegetating to an annual crop. If stored for > 1 season, consider more permanent cover and/or top dressing with the salvaged Organic layers to promote natural establishment of vegetation.
- Store soils away from watercourses and away from areas that would normally flow into waterways or storm sewers during periods of snowmelt or rainfall.
- If possible, ensure vegetated buffers are maintained or silt fences are installed around stock piles to prevent erosion and soil loss.
- Ensure vegetative buffers are clearly marked and equipment is prevented from clearing/disturbing or damaging integrity of buffer strips.
- Ensure that all workers are educated on objectives and measures in place to reduce erosion and prevent sedimentation. Have a copy of the erosion and sediment control plans on site.
- Ensure enough materials are on site to properly protect soils once work is commenced.
- Be aware of expected weather forecasts and take appropriate steps to ensure projects are not left with exposed soils or unprotected areas during heavy periods of rainfall.
- Install stormwater filters at inlets to prevent sediment from entering storm sewers; install catch basins at outlets to allow for any introduced sediment to be recaptured.
- Ensure all structures and erosion control methods are inspected after rainfall, snowmelt and/or freeze-thaw cycles to ensure structures are functional and in good repair.
- Follow City of Edmonton Erosion and Sedimentation Control Field Manual (January 2005)

An erosion and sediment control matrix (**Appendix 6**) was created to identify those specific practices to be carried out by the following activity type:

- Deep trench
- Shallow trench
- Surfaces including flat areas, roads, trails, parking lots and final grading/ landscaping
- Soil stockpile/ laydown areas
- Outfall
- Storm water management areas

Relevant best management practices (**Appendix 7**) have also been provided for specific BMPs identified below.

Table 8. Recommended Best Management Practices for Erosion and Sediment Control.

BMP Number	Description
1	Sediment control – Silt fence
4	Sediment control – Continuous perimeter control structures
5	Sediment control – Berm Interceptor
6	Sediment control – Storm drain inlet sediment barrier
7	Erosion and sediment control – Rock check dam
10	Erosion and sediment control – Synthetic permeable barrier
13	Erosion control – Rolled erosion products
22	Erosion control – Seeding
23	Erosion control – Mulching
24 a	Erosion and sediment control – Hydroseeding
27 a	Streambank stabilization – Live staking
27 b	Streambank stabilization – Brush layering
30	Erosion and sediment control – Riparian zone preservation
31	Erosion and sediment control – Silt control systems
32	Erosion and sediment control – Scheduling
33	Erosion and sediment control – Stabilized worksite entrances
34 (a-c)	Sediment control – Slope texturing
37	Erosion control – Compost blankets
38	Streambank stabilization and erosion control – Rolls
45	Streambank stabilization – Vegetated riprap
M3*	In-stream sediment control – Cofferdams
M4*	In-stream sediment control – Instream silt barrier
*BMPs (M3, M4) only for in-stream works, consult QAES and ensure proper approvals are in place for in-stream works and activities. Source: AB transportation Fish Habitat Manual: guidelines for watercourse crossings in Alberta (August, 2009)	

The following tree care recommendations are outlined for planned disturbances within or adjacent to natural areas:

i. Retain a project arborist to oversee all planned disturbances and operations within the natural areas.
ii. All disturbances are to be staked in the field and reviewed by project arborist prior to construction.
iii. All exposed roots > 2.5 cm diameter to be pruned by an ISA Certified Arborist
iv. Any tree that is destabilized due to root injury from excavation must be assessed by a qualified ISA TRAQ assessor; Arborist recommendations for tree removal require the authorization of a City of Edmonton Forester prior to removal work being conducted.

v. All anti compaction within TPZ should be rig mats or equivalent and all anti compaction between TPZ and specified distances should be 20 cm (8 in) mulch with plywood on top.
vi. Boring equipment shall be outside the 5 meter/10-meter distances unless anti-compaction measures are in place
vii. Site specific watering of trees in natural areas will be prescribed during the construction phase and will be subject to soil and weather conditions at the time including temperatures, relative humidity and windspeeds.

A summary of site-specific erosion and sediment control measures as well as mitigation for each of the planned disturbances within the natural area is included in **Appendix 8. Natural Area Preservation Plan.** This includes the new storm installation for Outfall #27 in the north-west part of the park.

6.2 Open Space Trees

A summary of disturbance and injury mitigation measures for excavation and grading includes the following:

i. Avoid cuts and fills within the TPZ if possible
ii. Use of top soil high with 5% organic matter for fills as this allows for water infiltration and gas exchange
iii. Do not use low permeability soils (e.g., clay) for fill
iv. Preserve at least 70% of the root system to maintain a healthy tree
v. Any roots > 2.5 cm diameter must be pruned by a qualified arborist
vi. Avoid all soil compaction within the TPZ (e.g., prevent staging or movement of machinery within the TPZ)
vii. Install root zone disturbance/root injury mitigation measures where major grade changes are required (e.g., tree wells, retaining walls, or tree islands).
viii. All curb and asphalt removal will comply with Asphalt Milling and Curb Removal Procedures (**Appendix 10**)

Generic tree protection designs have been drafted to guide the work within or adjacent to tree roots. They are outlined in **Table 9.**

Table 9. Summary of Design Drawings to Guide Construction Practices Within TPZ.

#	Title	Version (year/mm/dd)
T1	Pavement and Curb Replacement – One Side	20230327
T2	Pavement and Curb Replacement – Two Sides	20230327
T3	Shared Use Path (SUP) - Gravel	20230327
T4	Directional Drill/ Case Boring	20230327
T5	Open Cut	20230327
T6	Trench Box	20230327
T7	Air and Hand Tools (Path construction/Utility Installation)	20230327
T8A	Light Standard - Existing	20230327
T8B	Light Standard – New Install	20230327
T9A	Catch Basin/Manhole – Abandon in Place or Remove	20230327
T10	Grading	20230327

Trees potentially impacted by the cut and fill plan are to be protected. The T10 Grading design included in **Appendix 9** will provide the guidance for protection of these trees. This grading design considers the following species and soil interactions:

i. Species tolerance to development impacts
ii. Rooting patterns and depth
iii. Fill type and soil texture
iv. Tree vigor
v. Depth of fill

The following outlines tree preservation procedures by phase.

6.3 Pre-Construction

i. Appoint a project arborist (PA) to monitor tree protection; this is a third-party ISA Certified Arborist with a minimum 5 years experience monitoring trees through construction activities
ii. Site walk throughs will be arranged by the Site Superintendent and include key project stakeholders including City of Edmonton Urban Forester, Engineers, and

Construction Lead Hands. Site walk throughs will discuss projected site phases and works 4-6 weeks in advance of work commencing.

iii. During the 'walkthroughs', site specific open space trees and natural area impacts as well as mitigation options will be discussed. Key decisions will be recorded by the city forester and the project arborist

iv. If project scheduling allows, document all trees under full "leaf out" condition with photographs to assess tree crown health and tree vitality

v. Record the presence of insects or pathogen in populations or densities known to be damaging to the host species

vi. Label all trees with metal tags prior construction; tree tags to be nailed using minimum 2.5" aluminum nails within 10 cm of grade on the north side of trunks and are to remain attached until final landscaping phase. This includes both trees to be protected and removed; tree labels must match all those on the overview maps

vii. Ensure that tree protection fencing dimensions/specifications meet those as approved by the City of Edmonton and the spring of 2023 Tree Preservation/ Protection Plan prepared by UrbFor Consulting Ltd.; confirm that all fencing is installed at the locations shown on the tree protection plan

viii. Metal fencing (**Figure 4)** is being used until soil conditions allow for more permanent anchoring.

Figure 4. Metal Fencing Design for Open Space Trees and Natural Area Perimeter.

ix. There will be no breaks in the fencing as this will provide compaction avoidance.
x. Fencing posts should be installed in the ground for the duration of the construction period
xi. The PA will periodically inspect that tree protection signage is present on all trees requiring protection measures
xii. The PA will recommend tree crown pruning for clearance on trees identified as having above-ground conflicts with construction activities or installations
xiii. Adhere to City of Edmonton Bylaw 14600: Community Standards Bylaw, Part V (elm tree removal, elm tree pruning)
xiv. Establish a concrete spoil area away from tree root zones and without flow paths into tree protection areas; alternatively, use a containment system to prevent contamination of the TPZ; ensure there is compliance monitoring during construction
xv. Pending weather conditions, the PA will pre-condition trees using injection watering on as needed basis
xvi. Before any of the site clearance or demolition work begins, key project stakeholders including: the PA, a developer's representative, civil engineer, the contractor's site superintendent and City of Edmonton (COE) Urban Forester, will attend a pre-commencement meeting
xvii. The PA is to review the form and location of the fencing and ground protection used as barriers for the construction exclusion zone
xviii. Chandos Construction Ltd. is to get agreement by COE on fencing locations prior to any development

6.4 Tree Protection During Construction

i. The PA is to inspect the worksite bi-weekly (or at an agreed to interval) to ensure that the integrity of the tree protection zones (TPZ) are maintained and plans are being adhered to, including:
   a. no equipment, vehicles or materials are stored within the TPZ
   b. no service installation or excavation
   c. there is no deposition of concrete wash materials in the TPZ
   d. there are no grade changes, trenches or root cuts in the TPZ
ii. During the 2023 to 2027 growing seasons, the PA will monitor Environment Canada historical weather data and assess soil moisture throughout the TPZ's; schedule watering as required throughout the 2023 to 2027 growing seasons
iii. Soil moisture will be sampled by the PA throughout the project area where potential root impacts may be experienced; low impact soils sampling methods will be used (e.g., Dutch auger) along with manual texturing to assess existing soil moisture and subsequent watering requirements

iv. The PA will recommend to the COE Urban Forester branch pruning for clearance from construction activities and installations as required
v. The PA will be on site at time of utility removal and new construction and where injuries to roots > 2.5 cm diameter to a depth of 50 cm are required, perform pruning where City of Edmonton Forester authorization is granted
vi. The PA will monitor tree health, changes in tree stability and/or tree damage (trunk or branches); further, impacts to trees during construction will be documented. Tree health and condition monitoring will focus on the following indicators: short annual shoot elongation and small yellow leaves, thin foliage and leaf scorch, wilting, early fall coloration and defoliation, epicormic shoots; twig / branch dieback, wounds from equipment damage on trunks and lower branches, attack by borers and other stress related pests, decay at wound sites (long term)
vii. Inspections of trees after major wind events for branch or full tree failures will be carried out by the PA and remedial treatments including pruning, bracing/cabling and removal will be recommended to the City of Edmonton Urban Forester
viii. Written records of monitoring summaries will be circulated as needed to relevant parties including the City of Edmonton urban foresters by the PA
ix. Deliverables to the Senior Project Manager of Chandos Construction (Dylan Buchanan) include:
    a. Inspection results and photographs of impacted trees associated with each site visit; this will be in email form with attachments
    b. Annual summary of monitoring reports by year for 2023 to 2027 (all field reports to be numbered sequentially)
    c. Report any condition requiring attention that is beyond the original scope of work to the Site Superintendent and directly to the City of Edmonton urban foresters

6.5 Landscape Phase

Implementation of natural area and tree protection plans shall be continued through the landscape phase. The project arborist will continue to monitor or follow up on

i. Removal of tree protection fencing and any temporary irrigation systems
ii. Minimizing tree and root damage during installation of the landscape plants, hardscape, irrigation, drainage, and lighting infrastructure
iii. Mitigation of damaged plants, including but not limited to pruning, watering, mulching or removal and replacement

Any prescribed treatments will be put forward to the City of Edmonton Urban and Natural Area Foresters for consideration and review.

6.6 Post Construction

At completion of the construction phase, trees identified as impacted in this report and those trees identified as impacted during the course of construction phases shall be inspected by the project arborist for any change in condition. Any remedial treatments shall be prescribed and undertaken by an ISA Certified Arborist. This work including removals, pruning, stump grinding as well as possible cabling/bracing will be coordinated by the City of Edmonton Urban Forestry at the cost of the project as per Corporate Tree Management Policy C456C.

All tree tags to be removed.

7.0 Construction Schedule

A comprehensive 6-week lookahead schedule and Gant chart (**Appendix 11**) has been provided.

The 6-week lookahead describes all tasks for site services, paving, site walks and tree removal to May 21, 2023. The Gant chart represents all tasks by start date and finish date for the entire project including Final Acceptance Certificate in September of 2026.

As of April 13th, and in accordance with Public Tree Permit issued for Phase 1 (**Appendix 12**), there has been work carried out including deep utility installations, selective demolition within the amphitheater and maintenance yard. Asphalt milling has been completed for the ring road.

Further tree removal work however is contingent on the submission and review of this tree preservation plan that encompasses the entire work area.

LIMITATIONS

This report has been prepared for the use of Chandos Construction Ltd. relative to the proposed project described in the report. The quality of the information and the conclusions are based on information at the time of preparation of the report. This includes data supplied by third party sources.

The Consultant makes no representation of fact or opinion of any nature whatsoever to any person or entity other than the company, organization or individual to whom this report is addressed. UrbFor Consulting Ltd. denies any liability whatsoever to other parties who may obtain access to this report for any injury, loss or damage suffered by such parties arising from their use of, or reliance upon, this report or any of its contents without the express written consent of the author and the client.

Subject to the following conditions and limitations, the investigation described in this report has been conducted in a manner consistent with a reasonable level of care and skill normally exercised by members of the urban forestry consulting profession currently practicing under similar conditions in the area.

The assessment described in this report has been limited to the scope of work described in discussions between UrbFor Consulting Ltd. and Chandos Construction Ltd. in March 2023.

The possibility of contamination from past activities on the property and the impact to tree root systems and future tree health, or other public safety risks, were not included in this assessment.

UrbFor Consulting Ltd. assumes no liability for the trees that may be impacted by construction activity involved with this development. UrbFor Consulting Ltd will not be held responsible for any damage to the trees on site or any replacement costs.

CLOSURE

This report has been prepared and submitted by UrbFor Consulting Ltd as documented above. We trust that the information presented is suitable for your needs. Should you have any questions, please contact the undersigned at (780) 288-8680.

Sincerely,
UrbFor Consulting Ltd.

Andre Savaria RPF #317
ISA Certified Arborist PR-4880A

List of Appendices

(Appendix 1 through 13 were submited separately to this report)

Appendix 1. Material Stockpiling and Equipment Access Plan

Appendix 1. Material Stockpiling and Equipment Access Plan

Appendix 2. Forest Health Assessment Scores

Appendix 2. Forest Health Assessment Scores [1]

urbfor CONSULTING

Date: 01-Apr **Crew:** AS/JS **Polygon No:** 6834

Location: Hawrelak Park

Special Observations: some snow patches; frozen soils and leaf off conditions; could not assess grass and forbs or LFH thickness did not include LFH component in the total scoring calculation below

1. What kind of plants are on the site? What is the plan community?

Dominant Species

Grass	Cover %		Forbs	Cover %		Shrubs	Cover %		Trees	Cover %
						prickly rose	30		Balsam poplar	50
						dogwood	70		White spruce	40
									Whie birch	5

Subregion/Plant Community (PC) Name (code): PB. 3 red-osier dogwood

Ecological Status					Comments:				Score
1A Native Forest:	18 12 6 0								
1B Modified Forest:	9 5 0 -			5	2 pedestrian trails included				5

2. Are the expected plant layers present?

				Comments:			Score
Community Structure:	18 12 6 0		18	yes layers present			18

3. Thickness of surface organic layer (LFH)?

LFH thickness	9 6 3 0		--	Comments:			Score
				could not assess; frozen soils			0

4. Is there accelerated soil erosion? Site Stability

Stable

Site Stability			Comments:			Score
4.1 Erosion	3 2 1 0	3	Human caused bare soil (%)		n/a	3
4.2 Bare Soil	6 4 2 0	4	Moss & Lichen cover(%)		n/a	4
			very little exposed soil observed			

5. Are noxious weeds present?

Noxious Weeds							
5.1 Cover	3 2 1 0	3	Dominant Species	% Cover	Comments	Score
5.2 Density Distribution	3 2 1 0	3	none observed			6

Site Score (total score) 36

Forest Health % 86

Actual Score /42 *100 = % Health Rating

Healthy = 75 - 100%; Health with Problems = 50 - 74%; Unhealthy < 50%

Points	6	12	18	24	30	36	42	45	48	54
%	10	20	30	40	50	60	70	75	80	90
	Unhealthy			/	Healthy with Problems	/		Healthy		

[1] Adapted From the Rangeland Health Assessment For Forest Field Workbook.

Forest Health Assessment [1]

urbfor CONSULTING

Date: 01-Apr **Crew:** AS/JS **Polygon No:** 6370

Location: Hawrelak Park

Special Observations: some snow patches; frozen soils and leaf off conditions; could not assess grass and forbs or LFH thickness did not include LFH component in the total scoring calculation below

1. What kind of plants are on the site? What is the plan community?

Dominant Species

Grass	Cover %	Forbs	Cover %	Shrubs	Cover %	Trees	Cover %
				low bush cranberry	30	Balsam poplar	70
				beaked hazelnut	5	Trembling aspen	10
				elderberry	2	white birch	5

some top die back on the mature balsam poplar

Subregion/Plant Community (PC) Name (code): PB. 1 mixed shrubs

Ecological Status				Comments:			Score
1A Native Forest:	18 12 6 0						
1B Modified Forest:	9 5 0 -	5	2 pedestrian trails included				5

Manitoba Maple present growing under poplar canopy

2. Are the expected plant layers present?

			Comments:		Score
Community Structure:	18 12 6 0	12	yes layers present		12

3. Thickness of surface organic layer (LFH)?

LFH thickness			Comments:		Score
9 6 3 0	--				
		could not assess; frozen soils			0

4. Is there accelerated soil erosion? Site Stability

Stable

Site Stability			Comments:			Score
4.1 Erosion	3 2 1 0	2	Human caused bare soil (%)		n/a	2
4.2 Bare Soil	6 4 2 0	4	Moss & Lichen cover(%)		n/a	4

more bare soil to the southwest

5. Are noxious weeds present?

Noxious Weeds						
5.1 Cover	3 2 1 0	2	Dominant Species	% Cover	Comments	Score
5.2 Density Distribution	3 2 1 0	2	only a few stems observed			4

Site Score (total score) 27

Forest Health % 64

Actual Score /42 *100 = % Health Rating

Healthy = 75 - 100%; Health with Problems = 50 - 74%; Unhealthy < 50%

Points	6	12	18	24	30	36	42	45	48	54
%	10	20	30	40	50	60	70	75	80	90
	Unhealthy			/	Healthy with Problems	/		Healthy		

[1] Adapted From the Rangeland Health Assessment For Forest Field Workbook.

Forest Health Assessment [1]

Date: 02-Apr **Crew:** AS/JS **Polygon No:** 6503

Location: Hawrelak Park

Special Observations: some snow patches; frozen soils and leaf off conditions; could not assess grass and forbs or LFH thickness did not include LFH component in the total scoring calculation below

1. What kind of plants are on the site? What is the plan community?

Dominant Species

Grass	Cover %	Forbs	Cover %	Shrubs	Cover %	Trees	Cover %
				red osier dogwood	40	Balsam poplar	50
				beaked hazelnut	15	White spruce	35
				high bush cranberry	15	White birch	5
						Mountain ash	5

Subregion/Plant Community (PC) Name (code): PB. 3 red-osier dogwood

Ecological Status				Comments:			Score
1A Native Forest:	18 12 6 0						
1B Modified Forest:	9 5 0 -	2	many pedestrian & vehicle trails included				2

2. Are the expected plant layers present?

			Comments:			Score
Community Structure:	18 12 6 0	8	yes layers present			8
			Manitoba maple in understory and overstory; Caragana also present			

3. Thickness of surface organic layer (LFH)?

LFH thickness				Comments:			Score
	9 6 3 0	--	could not assess; frozen soils				0

4. Is there accelerated soil erosion? Site Stability

Stable

Site Stability			Comments:			Score
4.1 Erosion	3 2 1 0	3	Human caused bare soil (%)	15	n/a	3
4.2 Bare Soil	6 4 2 0	4	Moss & Lichen cover(%)		n/a	4
			deep ravine in central portion of stand			

5. Are noxious weeds present?

Noxious Weeds						
5.1 Cover	3 2 1 0	3	Dominant Species	% Cover	Comments	Score
5.2 Density Distribution	3 2 1 0	3	none observed			6

Site Score (total score) 23

Forest Health % 55

Actual Score / 42 *100 = % Health Rating

Healthy = 75 - 100%; Health with Problems = 50 - 74%; Unhealthy < 50%

Points	6	12	18	24	30	36	42	45	48	54
%	10	20	30	40	50	60	70	75	80	90
	Unhealthy			/	Healthy with Problems	/		Healthy		

[1] Adapted From the Rangeland Health Assessment For Forest Field Workbook.

Forest Health Assessment [1]

urbfor CONSULTING

Date: 02-Apr **Crew:** AS/JS **Polygon No:** 6608

Location: Hawrelak Park

Special Observations: some snow patches; frozen soils and leaf off conditions; could not assess grass and forbs or LFH thickness did not include LFH component in the total scoring calculation below

1. What kind of plants are on the site? What is the plan community?

Dominant Species

Grass	Cover %	Forbs	Cover %	Shrubs	Cover %	Trees	Cover %
				beaked hazelnut	30	Balsam poplar	70
				red osier dogwood	10	White spruce	20
				prickly rose	5	Trembling aspen	10

Subregion/Plant Community (PC) Name (code): CLM 3. mixed shrubs

Ecological Status			Comments:		Score
1A Native Forest:	18 12 6 0				
1B Modified Forest:	9 5 0 -	0			0

2. Are the expected plant layers present?

			Comments:	Score
Community Structure:	18 12 6 0	6	not many open gaps in canopy; limited structure	6

3. Thickness of surface organic layer (LFH)?

LFH thickness	9 6 3 0	--	Comments:	Score
			could not assess; frozen soils	0

4. Is there accelerated soil erosion? Site Stability

Stable with slight valley extending east west
no erosion observed

Site Stability			Comments:			Score
4.1 Erosion	3 2 1 0	2	Human caused bare soil (%)		n/a	2
4.2 Bare Soil	6 4 2 0	4	Moss & Lichen cover(%)		n/a	4

5. Are noxious weeds present?

Noxious Weeds						
5.1 Cover	3 2 1 0	Dominant Species	% Cover	Comments	Score	
5.2 Density Distribution	3 2 1 0	many thistle plants noted on edge significant caragana established in central portions of stand			0	

Site Score (total score) 12

Forest Health % 29

Actual Score /42 *100 = % Health Rating

Healthy = 75 - 100%; Health with Problems = 50 - 74%; Unhealthy < 50%

Points	6	12	18	24	30	36	42	45	48	54
%	10	20	30	40	50	60	70	75	80	90
	Unhealthy			/	Healthy with Problems	/		Healthy		

[1] Adapted From the Rangeland Health Assessment For Forest Field Workbook.

Forest Health Assessment [1]

Date: 03-Apr **Crew:** AS/JS **Polygon No:** 6497

Location: Hawrelak Park

Special Observations: some snow patches; frozen soils and leaf off conditions; could not assess grass and forbs or LFH thickness did not include LFH component in the total scoring calculation below

1. What kind of plants are on the site? What is the plan community?

Dominant Species

Grass	Cover %		Forbs	Cover %		Shrubs	Cover %		Trees	Cover %
						beaked hazlenut	30		Balam poplar	60
						red-osier dogwood	40		Trembling aspen	30
						prickly rose	10		White spruce	1
						high bush cranberry	10		Balsam fir	1

Subregion/Plant Community (PC) Name (code): PB. 3 red-osier dogwood

Ecological Status					Comments:				Score
1A Native Forest:	18 12 6 0			18	few trails and non-native species				18
1B Modified Forest:	9 5 0 -								

2. Are the expected plant layers present?

					Comments:				Score
Community Structure:	18 12 6 0				multi layered with spruce and fir				18

3. Thickness of surface organic layer (LFH)?

LFH thickness	9 6 3 0			--	Comments:				Score
					could not assess; frozen soils				0

4. Is there accelerated soil erosion? Site Stability

no erosion observed

Site Stability					Comments:				Score
4.1 Erosion	3 2 1 0			2	Human caused bare soil (%)			n/a	2
4.2 Bare Soil	6 4 2 0			4	Moss & Lichen cover(%)			n/a	4

5. Are noxious weeds present?

Noxious Weeds									Score
5.1 Cover	3 2 1 0			2	Dominant Species	% Cover		Comments	1
5.2 Density Distribution	3 2 1 0			1	large patches of caragana on south side sloping up towards Groat Road				1

Site Score (total score) 44

Forest Health % 86

Actual Score /51 *100 = % Health Rating

Healthy = 75 - 100%; Health with Problems = 50 - 74%; Unhealthy < 50%

Points	6	12	18	24	30	36	42	45	48	54
%	10	20	30	40	50	60	70	75	80	90
	Unhealthy			/	Healthy with Problems	/		Healthy		

[1] **Adapted From the Rangeland Health Assessment For Forest Field Workbook.**

Appendix 3. Tree Impact and Protection Summary

GridID's	Treel Ds	Scientific Name	Common Name	DBH (cm)	Average Crown Width (m)	Comments	Height to Bottom of Crown (m)	Height to Top of Crown (m)	Condition Rating %	Tree Protection Radius (m)	Preservation Notes	Action	Conflicts (scope of work within TPZ)
1	528	*Salix alba*	White Willow	52.3	10.2	broken limbs on north side; dead top; lean	2.1	11.8	30	3.6	case bore new storm or follow trench box T6 design; abandon existing storm	Protect	New Storm; Remove Storm
1	902	*Picea pungens*	Blue Spruce	40.9	6.6	asymmetric crown; resinosis	1.1	16.6	50	3.0	move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design; abandon existing electrical	Protect	New Electrical Lines; New Electrical Lights; Remove Electrical Equipment; Remove Electrical Line
1	903	*Picea pungens*	Blue Spruce	45.7	5.4	forked	1.7	20.1	40	3.0	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New_SUP; Remove Electrical Line
1	905	*Picea glauca*	White Spruce	43.6	6.0	sweep	0.2	19.2	50	3.0	move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Electrical Lines; New_SUP; Remove Electrical Line
1	906	*Acer platanoides*	Norway Maple	62.1	10.5	large `10 cm deep frost crack on east side	1.7	11.8	50	4.2	top-dress existing path; no compaction or excavation of roots in TPZ; abandon existing electrical; directionally drill new electrical; cut curb and lift do not drag; prune roots > 2.5 cms; *** discuss with COE	Protect	New Cut & Fill, New Electrical, New Electrical Equipment, New_Roads_Curb, New_SUP, Remove Electrical Line, Remove ROAD-CURB
1	907	*Quercus alba*	White Oak	50.7	9.0		2.5	13.8	60	3.6	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new sanitary or follow trench box T6 design; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lines; New Sanitary; New_Water; Remove Electrical Equipment; Remove Storm; Remove Water; REMOVE_CBAS_ManHole
1	908	*Picea pungens*	Blue Spruce	55.4	10.0		0.6	18.6	60	3.6	case bore new sanitary or follow trench box T6 design; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Sanitary; New_Water; Remove Electrical Equipment; Remove Storm; Remove Water; REMOVE_CBAS_ManHole
1	910	*Picea glauca*	White Spruce	33.4	5.0	sweep	0.5	14.5	60	2.4	move new light install outside the TPZ and follow T8b design; case bore new storm or follow trench box T6 design; abandon existing storm	Protect	New Electrical Lights; New Storm; Remove Storm
1	911	*Picea pungens*	Blue Spruce	30.3	4.4		0.3	13.1	70	2.4	case bore new storm or follow trench box T6 design; abandon existing storm	Protect	New Storm; Remove Storm
1	938	*Ulmus americana*	American Elm	63.0	11.3		1.9	14.4	70	4.2	Directionally Drill New Electrical	Protect	New Electrical
1	940	*Crataegus mordenensis*	Morden Hawthorn	18.4	2.9	cavity	2.0	7.2	30	1.8	Directionally Drill New Electrical	Protect	New Electrical
1	941	*Crataegus mordenensis*	Morden Hawthorn	18.8	2.2	cavity	1.9	6.9	30	1.8	Directionally Drill New Electrical	Protect	New Electrical
1	1020	*Crataegus mordenensis*	Morden Hawthorn	21.8	4.7	lean	1.3	6.6	60	1.8	move new electrical line out of TPZ or follow T4 design for directional drilling	Protect	New Electrical Lines
1	1021	*Crataegus mordenensis*	Morden Hawthorn	17.7	3.2		1.5	6.0	50	1.8	move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design	Protect	New Electrical Lines; New Electrical Lights
1	1971	*Populus jackii*	Northwest Poplar	97.5	17.0	scar; lean; 5 percent dead crown	2.5	22.6	30	5.0	if unable to move electrical north then directional drill north of trees ; see T4 design	Protect	New Electrical
1	1972	*Populus jackii*	Northwest Poplar	78.7	18.8	exposed roots lean	2.4	23.7	40	4.8	no ground disturbance, no stock piling, and no equipment inside the TPZ	Protect	
1	1973	*Populus jackii*	Northwest Poplar	81.1	16.0	exposed roots	2.3	25.4	30	5.0	move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design	Protect	New Electrical Lines; New Electrical Lights
1	1977	*Malus x adstringens*	Spring Snow Crabapple	33.3	8.0	frost crack; forked; diameter taken at 1.0 meter	1.0	8.3	40	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
1	1978	*Malus x adstringens*	Spring Snow Crabapple	31.5	10.0	frost crack; scar lean	2.0	8.3	20	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_SUP, Remove Storm
1	1980	*Populus jackii*	Northwest Poplar	99.7	20.0	exposed roots burl cavity; dead top; decay in main trunk	2.2	24.1	20	5.0	Protect for now - April 5 walk through	Protect	New Cut & Fill, New Electrical, New Storm, New_SUP, Remove ROAD-CURB, Remove Storm
1	1994	*Ulmus americana*	American Elm	54.0	7.2	frost crack; sparse crown; lean	4.4	15.1	40	3.6	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lights; New_Roads_Curb; Remove Electrical Equipment; Remove Electrical Line; Remove ROAD-CURB
1	1995	*Ulmus americana*	American Elm	62.0	14.0	frost crack	7.2	17.0	50	4.2	keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Storm; New_Roads_Curb; New_Water; Remove Electrical Line; Remove ROAD-CURB; Remove Storm; Remove Water

1	1996	*Ulmus americana*	American Elm	48.8	14.0	exposed roots	4.5	13.2	60	3.0	directional drill for new water - see T4 design; cut and lift curb sections - see T2 design; abandon CB - see T9a; March 16 Walk through	Protect	New Cut & Fill, New_Roads_Curb, New_Water, Remove Electrical Equipment, Remove Electrical Line, Remove ROAD-CURB, Remove Storm, REMOVE_CBAS_ManHole
1	1997	*Ulmus americana*	American Elm	48.3	14.0	exposed roots	5.1	14.1	60	3.0	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lights; New_Roads_Curb; New_Water; Remove Electrical Line; Remove ROAD-CURB; Remove Storm; Remove Water
1	1998	*Ulmus americana*	American Elm	49.5	14.0	frost crack sparse crown; asymmetric crown; possible root instability with root cuts on east & west sides of tree	7.2	13.9	30	3.0	keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Storm; New_CBAS_MANHOLE; New_Roads_Curb; New_Water; Remove Electrical Line; Remove ROAD-CURB; Remove Storm; Remove Water
1	1999	*Ulmus americana*	American Elm	54.8	13.9	frost crack	5.3	13.7	50	3.6	March 16 Walk through; Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical Lights, New Storm, New_CBAS_MANHOLE, New_Roads_Curb, Remove Electrical Equipment, Remove Electrical Line, Remove ROAD-CURB
1	9031	*Acer negundo*	Manitoba maple	77.3	19.8		1.5	14.0	60	4.8	abandon existing utilities, lift curb, directionally drill new electrical; prune for clearance March 16 walk through	Protect	New Cut & Fill, New Electrical, New Sanitary, New_Roads_Curb, New_Water, Remove ROAD-CURB, Remove Storm
2	1032	*Ulmus americana*	American Elm	60.0	11.7	exposed roots	3.3	11.4	50	3.6	move new electrical out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Electrical, Remove Electrical Line
2	1936	*Quercus macrocarpa*	Bur Oak	17.5	4.0	memorial tree sapsucker damage scar	1.4	8.3	50	1.8	Commemorative Tree	Protect	Commemorative Tree
2	1939	*Prunus virginiana 'Schubert'*	Schubert Chokecherry	5.3	1.6	memorial tree	1.2	4.1	40	1.2	Commemorative Tree	Protect	Commemorative Tree
2	1940	*Quercus macrocarpa*	Bur Oak	14.1	4.6	galls on leaves	1.2	7.3	50	1.8	Commemorative Tree	Protect	Commemorative Tree
2	1941	*Betula papyrifera*	Paper Birch	32.2	7.8	dead top	1.7	10.3	40	2.4	abandon existing electrical	Protect	Remove Electrical Line
2	1942	*Salix alba*	White Willow	3.2	2.8	memorial tree	1.2	3.1	40	1.2	Commemorative Tree	Protect	Commemorative Tree
2	1944	*Betula papyrifera*	Paper Birch	24.8	3.4	dead top scar	1.9	11.7	50	1.8	abandon existing electrical	Protect	Remove Electrical Line
2	1945	*Betula papyrifera*	Paper Birch	18.3	2.9	forked dead top	1.9	6.7	30	1.8	abandon existing electrical	Protect	Remove Electrical Line
2	1946	*Betula papyrifera*	Paper Birch	24.6	4.0	stripped bark forked leaf minor	1.4	9.6	50	1.8	abandon existing electrical	Protect	Remove Electrical Line
2	1947	*Ulmus americana*	American Elm	53.3	8.4	burls	5.4	14.1	50	3.6	abandon existing electrical	Protect	Remove Electrical Line
2	1948	*Ulmus americana*	American Elm	58.4	15.0	basal scar; caged	4.9	14.7	50	3.6	abandon existing storm; abandon existing water	Protect	New_Water; Remove Storm; Remove Water
2	1949	*Ulmus americana*	American Elm	54.2	18.0	frost crack	5.4	13.9	50	3.6	abandon existing electrical	Protect	Remove Electrical Line
2	1951	*Betula papyrifera*	Paper Birch	38.4	6.2	frost crack; 10 percent dead crown	2.1	14.2	50	2.4	abandon existing electrical	Protect	Remove Electrical Line
2	1952	*Acer negundo*	Manitoba maple	54.1	13.0	frost crack	2.7	10.0	50	3.6	abandon existing electrical	Protect	Remove Electrical Line
2	2100	*Picea pungens*	Blue Spruce	44.5	5.4	Fork	0.0	16.2	50	3.0	abandon existing electrical	Protect	Remove Electrical Line
2	2102	*Picea pungens*	Blue Spruce	36.5	5.6	Corrected lean	0.0	13.4	50	2.4	abandon existing electrical	Protect	Remove Electrical Line
2	5012	*Prunus mackii*	Amur Cherry	9.2	6.2	clump of 4 stems	0.9	6.0	40	1.2	cut concrete foundation below grade; do not remove concrete form; back fill with top soil and sod for existing electrical equipment	Protect	Remove Electrical Equipment
2	10001	*Picea pungens*	Blue Spruce	31.4	3.7	lean memorial tree	0.4	13.7	50	2.4	Commemorative Tree	Protect	Commemorative Tree
3	955	*Ulmus americana*	American Elm	35.0	7.4	thin crown	3.4	9.7	50	2.4	keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design	Protect	New Cut & Fill; New Storm; New_Roads_Curb; Remove ROAD-CURB
3	956	*Ulmus americana*	American Elm	29.8	4.8	basal scar; exposed root	3.3	6.2	40	1.8	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	
3	957	*Ulmus americana*	American Elm	34.5	4.4	asy crown; exposed root	3.2	7.6	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	958	*Ulmus americana*	American Elm	35.3	4.0	exposed root; asymmetrical crown	3.5	8.3	40	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design	Protect	New Cut & Fill; New Electrical Lines; New Electrical Lights; New_Roads_Curb; Remove ROAD-CURB
3	959	*Ulmus americana*	American Elm	37.8	3.2	small elm leaf; exposed root	3.8	9.9	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	960	*Ulmus americana*	American Elm	36.2	3.4	exposed root; 5 % dead crown	4.9	10.3	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	961	*Ulmus americana*	American Elm	35.3	5.2	exposed root; 5% dead crown	4.8	9.7	50	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_Roads_Curb; Remove ROAD-CURB; Remove Storm; Remove Water
3	962	*Ulmus americana*	American Elm	38.5	6.8	exposed root; 5% dead crown	3.2	9.2	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	963	*Ulmus americana*	American Elm	38.0	9.1	sparse crown; exposed root	3.4	8.8	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB

3	964	*Ulmus americana*	American Elm	36.0	8.2	5% dead crown; sparse crown	4.6	9.5	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	965	*Ulmus americana*	American Elm	35.0	4.8	basal scar; exposed root	3.9	9.1	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	966	*Ulmus americana*	American Elm	27.8	5.8	exposed root; 5% dead crown	3.4	7.2	40	1.8	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Grading	New Cut & Fill
3	967	*Ulmus americana*	American Elm	36.0	7.0	exposed roots	3.9	10.7	50	2.4	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design	Protect	New Cut & Fill; New Electrical Lights; New_Roads_Curb; Remove ROAD-CURB
3	968	*Ulmus americana*	American Elm	33.8	9.6	exposed root; sparse crown	3.8	7.6	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	969	*Ulmus americana*	American Elm	37.2	10.5	exposed root	2.7	9.6	50	2.4	carefully hydrovac around the catch basin/man hole, then backfill and level off. Concrete catch basin/man hole can be broken up inward and chunks pulled out by hand or hydrovac and lift out; keep grading out of TPZ - see T10 design for grading	Protect	New Cut & Fill; New_Roads_Curb; Remove ROAD-CURB; REMOVE_CBAS_ManHole
3	970	*Ulmus americana*	American Elm	51.0	9.8	exposed roots	3.5	11.3	40	3.6	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	971	*Ulmus americana*	American Elm	48.7	8.4	5% dead crown; exposed root	3.8	10.7	40	3.0	carefully hydrovac around the catch basin/man hole, then backfill and level off. Concrete catch basin/man hole can be broken up inward and chunks pulled out by hand or hydrovac and lift out; keep grading out of TPZ - see T10 design for grading	Protect	New Cut & Fill; New_Roads_Curb; Remove ROAD-CURB; REMOVE_CBAS_ManHole
3	972	*Ulmus americana*	American Elm	42.1	10.4	exposed roots; 5% dead crown	4.8	9.8	50	3.0	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	973	*Ulmus americana*	American Elm	36.3	7.2	exposed root; 5% dead crown	3.6	9.4	50	2.4	carefully hydrovac around the catch basin/man hole, then backfill and level off. Concrete catch basin/man hole can be broken up inward and chunks pulled out by hand or hydrovac and lift out; keep grading out of TPZ - see T10 design for grading	Protect	New Cut & Fill; New_Roads_Curb; Remove ROAD-CURB; REMOVE_CBAS_ManHole
3	974	*Ulmus americana*	American Elm	35.4	6.8	exposed root; basal scar	3.3	7.5	50	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_Roads_Curb; Remove ROAD-CURB; Remove Storm; Remove Water
3	975	*Ulmus americana*	American Elm	34.2	6.2	10% dead crown; exposed roots	3.4	8.8	50	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_Roads_Curb; Remove ROAD-CURB; Remove Storm; Remove Water
3	976	*Ulmus americana*	American Elm	39.7	6.5	exposed root; 5% dead crown	5.0	11.9	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	977	*Ulmus americana*	American Elm	34.7	8.9	exposed root; 10% dead crown	3.3	9.4	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	978	*Ulmus americana*	American Elm	38.7	8.2	10% dead crown; exposed roots	3.4	8.0	50	2.4	carefully hydrovac around the catch basin/man hole, then backfill and level off. Concrete catch basin/man hole can be broken up inward and chunks pulled out by hand or hydrovac and lift out; keep grading out of TPZ - see T10 design for grading	Protect	New Cut & Fill; New_Roads_Curb; Remove ROAD-CURB; REMOVE_CBAS_ManHole
3	979	*Ulmus americana*	American Elm	36.3	8.8	basal scar; sparse crown	3.9	10.0	50	2.4	carefully hydrovac around the catch basin/man hole, then backfill and level off. Concrete catch basin/man hole can be broken up inward and chunks pulled out by hand or hydrovac and lift out; keep grading out of TPZ - see T10 design for grading	Protect	New Cut & Fill; New_Roads_Curb; Remove ROAD-CURB; REMOVE_CBAS_ManHole
3	980	*Ulmus americana*	American Elm	40.7	9.6	exposed roots; 10 % dead crown	4.4	11.0	50	3.0	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	981	*Ulmus americana*	American Elm	32.2	7.2	crack mid crown	5.3	9.4	50	2.4	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design	Protect	New Cut & Fill; New Electrical Lights; New_Roads_Curb; Remove ROAD-CURB
3	982	*Ulmus americana*	American Elm	38.7	8.8	15% dead crown; exposed root; basal scar	2.2	8.3	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	983	*Ulmus americana*	American Elm	39.2	7.8	10% dead crown; exposed root	4.3	10.9	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	984	*Ulmus americana*	American Elm	38.3	7.8	exposed roots; 5% dead crown; basal scar	4.3	8.5	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	985	*Ulmus americana*	American Elm	37.4	8.2	10 % dead crown; exposed roots	3.5	10.0	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB

3	986	*Ulmus americana*	American Elm	43.8	10.0	basal scar; 10 % dead crown; exposed roots	4.2	10.1	50	3.0	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lights; New_Roads_Curb; Remove ROAD-CURB; Remove Storm; Remove Water
3	987	*Ulmus americana*	American Elm	39.5	9.4	exposed root	3.9	9.0	50	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_Roads_Curb; Remove ROAD-CURB; Remove Storm; Remove Water
3	988	*Ulmus americana*	American Elm	48.5	10.8	exposed roots; thin crown	2.8	11.6	50	3.0	carefully hydrovac around the catch basin/man hole, then backfill and level off. Concrete catch basin/man hole can be broken up inward and chunks pulled out by hand or hydrovac and lift out; keep grading out of TPZ - see T10 design for grading	Protect	New Cut & Fill; New_Roads_Curb; Remove ROAD-CURB; REMOVE_CBAS_ManHole
3	989	*Ulmus americana*	American Elm	54.3	9.8	exposed root	4.8	13.1	50	3.6	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms;	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	990	*Ulmus americana*	American Elm	41.2	9.6	10 % dead crown	3.1	8.4	50	3.0	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	991	*Ulmus americana*	American Elm	41.8	9.0	15% dead crown	4.7	10.6	50	3.0	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	992	*Ulmus americana*	American Elm	42.5	9.4	exposed roots	4.2	10.7	50	3.0	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	993	*Ulmus americana*	American Elm	46.5	11.0	thin crown	4.0	11.8	50	3.0	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms;	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	994	*Ulmus americana*	American Elm	33.0	7.0	15% dead crown	3.9	8.3	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	995	*Ulmus americana*	American Elm	47.7	11.6	exposed root; 10% dead crown	3.7	10.6	50	3.0	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	996	*Ulmus americana*	American Elm	38.3	8.6	burl; exposed roots; 20 % dead crown	4.3	8.5	50	2.4	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	997	*Ulmus americana*	American Elm	49.0	9.6	20% dead crown.	3.7	9.9	50	3.0	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	998	*Ulmus americana*	American Elm	50.0	9.0		5.6	14.1	60	3.0	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	999	*Ulmus americana*	American Elm	49.5	8.6	basal scar; 5% dead crown; exposed roots	4.5	9.6	40	3.0	cut curb and lift do not drag; maintain existing grade in islands; prune roots > 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
3	1000	*Ulmus americana*	American Elm	47.0	9.8	5% dead crown	4.1	9.9	50	3.0	keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design	Protect	New Cut & Fill; New Storm; New_CBAS_MANHOLE; New_Roads_Curb; Remove ROAD-CURB
3	1035	*Fraxinus pennsylvanica*	Green Ash	40.8	8.2	aphids; mites	1.8	14.4	40	3.0	move electrical equipment out of TPZ	Protect	New Electrical Equipment
3	1037	*Pinus ponderosa*	Ponderosa Pine	43.0	5.2	forked top	1.8	16.8	50	3.0	directionally drill new electrical	Protect	New Electrical
3	1038	*Pinus contorta latifolia*	Lodgepole Pine	35.5	7.2	slight sweep	1.6	14.2	50	2.4	March 16 Walk through; Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New Storm, New_CBAS_MANHOLE, New_Roads_Curb, New_SUP, Remove Electrical Line, Remove ROAD-CURB
3	1039	*Malus x adstringens*	Spring Snow Crabapple	11.3	3.4	diameter measured at .4 meters	1.2	3.7	30	1.8	move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Electrical Lines; New_SUP; Remove Electrical Line
3	1041	*Pinus contorta latifolia*	Lodgepole Pine	29.0	6.8	dead, not measured			0	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Electrical, Remove Electrical Line
3	1043	*Pinus sylvestris*	Scotts Pine	28.5	8.0	basal scar; broken top	0.6	4.2	30	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Electrical, New_SUP, Remove Electrical Line
3	1044	*Pinus contorta latifolia*	Lodgepole Pine	24.3	4.8		0.6	10.6	40	1.8	Abandon existing Electrical, Directionally Drill New Electrical; Move SUP out of TPZ	Protect	New Cut & Fill, New Electrical, New_SUP, Remove Electrical Line
3	1045	*Pinus contorta latifolia*	Lodgepole Pine	24.0	4.4	resinosis; fork	1.9	11.9	40	1.8	directionally drill new electrical - see T4 design	Protect	New Cut & Fill, New Electrical
3	1046	*Pinus contorta latifolia*	Lodgepole Pine	30.3	4.6		0.8	12.5	40	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New_Roads_Curb; New_SUP; Remove Electrical Line; Remove ROAD-CURB
3	1100	*Ulmus americana*	American Elm	55.0	10.4	5% dead crown; basal frost cracks	4.9	12.0	40	3.6	install trench box on north side - see T6 design; March 16 Walk through	Protect	New Cut & Fill, New Electrical, New Electrical Lights, New Sanitary, New Storm, New_Roads_Curb, New_SUP, New_Water, Remove Electrical Line, Remove ROAD-CURB, Remove Sanitation, Remove Storm
3	1101	*Ulmus americana*	American Elm	44.0	7.4	2 frost cracks with ooze	3.7	12.5	40	3.0	keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_Water; Remove Electrical Line; Remove Sanitation; Remove Storm; Remove Water
3	1105	*Ulmus americana*	American Elm	41.5	11.1		3.7	11.4	50	3.0	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_Water; Remove Sanitation; Remove Storm; Remove Water

3	1955	*Malus x adstringens*	Spring Snow Crabapple	6.1	1.8	royalty varieties	1.4	3.5	40	1.2	abandon sanitation	Protect	Remove Sanitation
3	1959	*Pinus contorta latifolia*	Lodgepole Pine	20.8	3.8	scar	1.4	5.7	20	1.8	move new light install outside the TPZ and follow T8b design; abandon existing storm	Protect	New Electrical Lights; Remove Storm
3	1960	*Pinus contorta latifolia*	Lodgepole Pine	27.3	6.2	forked scar	0.5	8.9	40	1.8	abandon existing storm	Protect	Remove Storm
3	1962	*Ulmus americana*	American Elm	47.2	8.0	exposed roots; scar	3.9	12.5	40	3.0	abandon electrical	Protect	Remove Electrical Line
3	1963	*Ulmus americana*	American Elm	53.8	12.0	burl	3.7	12.4	40	3.6	abandon existing electrical; abandon existing storm; abandon existing water	Protect	New_Water; Remove Electrical Line; Remove Storm; Remove Water
3	1964	*Pinus contorta latifolia*	Lodgepole Pine	26.8	5.8	forked top; scar	1.0	8.4	30	1.8	abandon existing storm	Protect	Remove Storm
3	1965	*Pinus contorta latifolia*	Lodgepole Pine	24.8	5.4	forked; resinosis	1.1	9.6	50	1.8	abandon existing storm; abandon existing water	Protect	Remove Storm; Remove Water
3	1966	*Pinus contorta latifolia*	Lodgepole Pine	31.0	6.6	sweep	0.8	11.7	40	2.4	move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design; abandon existing electrical; follow T8a design for light removal; abandon existing storm; abandon existing water	Protect	New Electrical Lines; New Electrical Lights; New_Roads_Curb; Remove Electrical Lights; Remove Electrical Line; Remove ROAD-CURB; Remove Storm; Remove Water
3	1967	*Pinus contorta latifolia*	Lodgepole Pine	35.8	7.0	basal scar	0.6	11.4	50	2.4	abandon existing electrical; abandon existing storm; abandon existing water	Protect	Remove Electrical Line; Remove ROAD-CURB; Remove Storm; Remove Water
3	1968	*Pinus contorta latifolia*	Lodgepole Pine	27.1	6.4	crook	1.0	10.1	50	1.8	abandon existing storm; abandon existing water	Protect	Remove Storm; Remove Water
3	1969	*Pinus contorta latifolia*	Lodgepole Pine	31.6	7.4	crook; deformed top	0.6	8.8	40	2.4	move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Electrical Lines; Remove Electrical Line; Remove Storm; Remove Water
3	5004	*Acer negundo*	Manitoba maple	6.2	1.6	cluster of 3 stems, other 2 stems dead	0.8	5.5	20	1.2	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Electrical, New Storm, New_CBAS_MANHOLE, Remove Electrical Line, Remove Storm, REMOVE_CBAS_ManHole
3	5005	*Acer tataricum*	Tatarium Maple	13.3	6.2	shares stump with 5007, 5006	1.7	5.6	30	1.8	March 16 walk through; save with trench box install	Protect	New Cut & Fill, New Electrical, New Storm, New_Roads_Curb, Remove Electrical Line, Remove ROAD-CURB
3	5006	*Acer tataricum*	Tatarium Maple	13.7	5.2	shares stump with 5005, 5007	1.2	5.4	30	1.8	March 16 walk through; save with trench box install	Protect	New Cut & Fill, New Electrical, New Storm, New_Roads_Curb, Remove Electrical Line, Remove ROAD-CURB
3	5007	*Acer tataricum*	Tatarium Maple	9.9	4.8		1.1	5.7	40	1.2	March 16 walk through; save with trench box install	Protect	New Cut & Fill, New Electrical, Remove Electrical Line
3	5013	*Ulmus americana*	American Elm	38.5	6.8	exp roots; 5 percent dead crown	3.5	8.6	50	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_Roads_Curb; Remove ROAD-CURB; Remove Storm; Remove Water
4	1001	*Ulmus americana*	American Elm	54.0	7.6	exposed roots; 10 % dead crown	5.2	12.5	50	3.6	case bore new sanitary to the west of TPZ; cut and lift curb - do not drag concrete over roots; abandon existing sanitation	Protect	New Cut & Fill, New Sanitary, New_Roads_Curb, Remove ROAD-CURB, Remove Sanitation
4	1002	*Ulmus americana*	American Elm	46.2	7.8	frost crack; exposed root	3.2	12.5	50	3.0	cut and lift curb/pavement sections to the south; prune roots over 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
4	1003	*Ulmus americana*	American Elm	33.3	6.2	10% dead crown; basal scar	3.7	8.6	40	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing storm	Protect	New Cut & Fill; New_Roads_Curb; Remove ROAD-CURB; Remove Storm
4	1004	*Ulmus americana*	American Elm	54.8	9.6	exposed roots;	4.9	17.3	50	3.6	abandon storm and catch basin; cut and lift curb - do not drag concrete over roots; prune roots over 2.5 cms on north side of TPZ	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB, Remove Storm, REMOVE_CBAS_ManHole
4	1005	*Ulmus americana*	American Elm	38.0	7.6	exposed roots; 5% dead crown	3.8	10.2	40	2.4	cut and lift curb - do not drag concrete over roots; prune roots over 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
4	1006	*Ulmus americana*	American Elm	43.0	7.2	20% dead crown	3.0	9.4	40	3.0	cut and lift curb - do not drag concrete over roots; prune roots over 2.5 cms	Protect	New Cut & Fill, Remove ROAD-CURB
4	1007	*Ulmus americana*	American Elm	38.1	6.8	exposed roots; lean	3.7	10.0	40	2.4	case bore new storm; keep catch basin out of TPZ; cut and lift curb - do not drag concrete over roots; prune roots over 2.5 cms	Protect	New Cut & Fill, New Storm, New_CBAS_MANHOLE, Remove ROAD-CURB
4	1008	*Ulmus americana*	American Elm	50.0	10.4	exposed roots; basal scar; 20% dead crown	4.2	11.9	40	3.0	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; case bore new storm or follow trench box T6 design	Protect	New Cut & Fill; New Electrical Lights; New Storm; New_CBAS_MANHOLE; New_Roads_Curb; Remove ROAD-CURB
4	1009	*Ulmus americana*	American Elm	35.5	7.0	exposed roots; 10% dead crown	3.3	8.4	40	2.4	case bore for new stormwater line to the south west; follow T4 directional drill sketch and BMP specifications ; cut and lift up curb/pavement sections to the south – do not drag out curb/pavement over roots; prune roots > 2.5 cms	Protect	New Cut & Fill, New Storm, Remove ROAD-CURB
4	1010	*Ulmus americana*	American Elm	41.5	9.8	exposed roots; 15% dead crown; basal scar	5.2	11.9	40	3.0	cut and lift curb - do not drag concrete over roots; prune roots over 2.5 cms	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
4	1011	*Ulmus americana*	American Elm	57.7	11.4	15% dead crown; frost crack; exposed roots	2.9	11.3	40	3.6	case bore for new stormwater line to the south west; cut and lift up curb/pavement sections to the south – do not drag out curb/pavement over roots; prune roots > 2.5 cms	Protect	New Cut & Fill, New Storm, Remove ROAD-CURB

4	1048	*Pinus contorta latifolia*	Lodgepole Pine	24.5	6.8		0.7	9.0	50	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new sanitary or follow trench box T6 design; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New Sanitary; New_SUP; Remove Electrical Line
4	1049	*Pinus contorta latifolia*	Lodgepole Pine	30.0	6.2	resinosis	1.1	9.8	40	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New_Roads_Curb; New_SUP; Remove Electrical Line; Remove ROAD-CURB
4	1050	*Pinus contorta latifolia*	Lodgepole Pine	28.5	6.7	basal scar	1.8	9.5	40	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New_SUP; Remove Electrical Line
4	1051	*Pinus contorta latifolia*	Lodgepole Pine	28.3	4.8	basal scar	1.4	12.1	20	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New_Roads_Curb; New_SUP; Remove Electrical Line; Remove ROAD-CURB
4	1052	*Pinus contorta latifolia*	Lodgepole Pine	35.0	5.4	forked; resinosis	1.2	9.9	30	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New_SUP; Remove Electrical Line
4	1053	*Malus baccata*	Siberian Crab Apple	20.0	4.6	40% dead crown; shares stump with 1054	2.1	7.0	20	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_SUP, Remove Electrical Line
4	1054	*Malus baccata*	Siberian Crab Apple	16.5	1.0	80% dead crown; shares stump with 1053			0	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_SUP, Remove Electrical Line
4	1055	*Malus x adstringens*	Spring Snow Crabapple	19.0	4.2	20% dead crown; shares stump with 1056	2.0	8.1	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_SUP, Remove Electrical Line
4	1056	*Malus x adstringens*	Spring Snow Crabapple	26.5	6.2	shares stump with 1055; 15% dead crown	2.0	6.5	30	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_Roads_Curb, New_SUP, Remove Electrical Line, Remove ROAD-CURB
4	1058	*Malus x adstringens*	Spring Snow Crabapple	34.3	7.4		1.2	9.9	40	2.4	no ground disturbance, no stock piling, and no equipment inside the TPZ	Protect	
4	1059	*Picea glauca*	White Spruce	22.7	3.8		0.2	11.1	30	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New_SUP; Remove Electrical Line
4	1060	*Picea glauca*	White Spruce	31.8	3.8	resinosis; lean; crook	0.2	9.4	30	2.4	keep new electrical equipment out of TPZ; directional drill new electrical - see T4 design; move path south out of TPZ; abandon electrical	Protect	New Cut & Fill, New Electrical, New Electrical Equipment, New_SUP, Remove Electrical Line
4	1061	*Picea glauca*	White Spruce	16.7	2.0		0.2	8.8	50	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; move new electrical equipment and foundations outside of the TPZ; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New Electrical Equipment; New_SUP; Remove Electrical Equipment; Remove Electrical Line
4	1062	*Picea glauca*	White Spruce	30.2	4.4	resinosis; lean	1.4	12.8	20	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New_SUP; Remove Electrical Line
4	1063	*Picea glauca*	White Spruce	20.2	3.6		0.9	10.3	50	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New_SUP; Remove Electrical Line
4	1064	*Picea glauca*	White Spruce	17.2	3.0		0.2	7.8	30	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New_SUP; Remove Electrical Line
4	1505	*Pinus contorta latifolia*	Lodgepole Pine	28.0	6.2	scars	1.5	9.3	50	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
4	1506	*Pinus contorta latifolia*	Lodgepole Pine	30.6	6.2	scars; broken top	1.1	8.0	30	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; Remove Electrical Line; Remove Storm; Remove Water
4	1507	*Pinus contorta latifolia*	Lodgepole Pine	11.8	3.6	scars	0.8	7.1	40	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; Remove Storm; Remove Water
4	1508	*Pinus contorta latifolia*	Lodgepole Pine	26.7	5.4	resinosis	0.7	9.3	40	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; Remove Storm; Remove Water
4	1509	*Pinus sylvestris*	Scotts Pine	24.9	5.4		1.6	6.7	40	1.8	abandon existing storm	Protect	Remove Storm

4	1510	*Pinus sylvestris*	Scotts Pine	24.1	5.2	scars	2.0	7.8	40	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_Water; Remove Storm; Remove Water
4	1511	*Pinus banksiana*	Jack Pine	28.2	7.2	lean	2.1	9.1	40	1.8	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing storm; abandon existing water	Grading	New Cut & Fill
4	1512	*Pinus banksiana*	Jack Pine	20.1	5.4	scar	2.5	7.9	30	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_Water; Remove Storm; Remove Water
4	1513	*Pinus contorta latifolia*	Lodgepole Pine	25.9	6.0	scar	1.6	8.6	30	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
4	1514	*Pinus contorta latifolia*	Lodgepole Pine	32.2	8.4	scar	1.4	10.8	40	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_Water; Remove Storm; Remove Water
4	1515	*Pinus contorta latifolia*	Lodgepole Pine	26.5	5.5	forked	1.9	10.5	30	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling	Protect	New Cut & Fill; New Electrical Lines; New_SUP
4	1516	*Pinus contorta latifolia*	Lodgepole Pine	34.5	8.6	scars crook	2.0	9.5	30	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; Remove Electrical Equipment; Remove Electrical Line
4	1517	*Pinus contorta latifolia*	Lodgepole Pine	26.0	7.2	crook scar	2.7	10.6	40	1.8	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing storm; abandon existing water	Grading	New Cut & Fill
4	1518	*Pinus contorta latifolia*	Lodgepole Pine	28.2	7.2	resinosis; forked	2.0	10.2	30	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design	Protect	New Cut & Fill; New Electrical Lines; New Electrical Lights; New_SUP
4	1519	*Malus x adstringens*	Spring Snow Crabapple	10.2	4.0		1.7	5.8	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
4	1520	*Pinus contorta latifolia*	Lodgepole Pine	24.0	5.2	scar	3.0	11.4	30	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
4	1521	*Pinus contorta latifolia*	Lodgepole Pine	24.4	5.0	scar	2.8	9.2	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
4	1522	*Pinus contorta latifolia*	Lodgepole Pine	31.8	6.2	pruned	2.2	9.3	40	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
4	1523	*Pinus contorta latifolia*	Lodgepole Pine	23.9	5.4	resinosis	2.0	8.8	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
4	1524	*Pinus contorta latifolia*	Lodgepole Pine	22.1	4.6	resinosis	1.3	8.8	40	1.8	directionally drill new electrical - see T4 design; abandon catch basin	Protect	New Electrical, REMOVE_CBAS_ManHole
4	1525	*Pinus contorta latifolia*	Lodgepole Pine	31.4	5.4		0.8	12.3	50	2.4	move SUP north of tree 1524	Protect	New Cut & Fill, New_SUP, REMOVE_CBAS_ManHole
4	1526	*Ulmus americana*	American Elm	57.8	12.6	frost crack	4.0	13.2	50	3.6	keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm	Protect	New Cut & Fill; Remove Electrical Line; Remove Storm
4	1527	*Quercus alba*	White Oak	25.5	7.2	in flower bed; frost crack; memorial tree	1.7	5.6	50	1.8	Grading; keep grading out of TPZ; see T10 design for grading; Commemorative Tree	Grading	New Cut & Fill
4	1528	*Pinus sylvestris*	Scotts Pine	37.0	9.4	frost crack	1.8	9.1	40	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design	Protect	New Cut & Fill; New Electrical Lines; New Electrical Lights; New_SUP
4	1530	*Populus jackii*	Northwest Poplar	67.5	18.0	exposed root	2.3	17.5	40	4.2	abandon electrical and use air and hand tools on the north side of the TPZ – follow T7 design and specifications	Protect	New Cut & Fill, New_SUP, Remove Electrical Line
4	1532	*Quercus alba*	White Oak	20.8	3.8		1.6	5.5	50	1.8	move path east outside of TPZ; no excavation and compaction within TPZ;	Protect	New Cut & Fill, New_SUP
4	1533	*Picea pungens*	Blue Spruce	26.7	4.0	5 % dead crown	0.1	12.6	50	1.8	move SUP southwest	Protect	New Cut & Fill, New_SUP
4	1534	*Picea pungens*	Blue Spruce	28.3	4.6	forked 5% dead crown	0.1	11.5	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_Roads_Curb
4	1535	*Picea pungens*	Blue Spruce	34.8	4.2	crook top	0.1	13.3	30	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_Roads_Curb, New_SUP
5	1065	*Acer negundo*	Manitoba maple	49.8	12.4	burl; scar mid crown; exposed roots	2.1	10.1	40	3.0	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; move SUP out of TPZ or follow t3a or t3b designs for new path install; abandon existing electrical	Protect	New Cut & Fill, New Electrical, New_SUP, Remove Electrical Line

5	1066	*Acer negundo*	Manitoba maple	44.8	14.1		2.5	10.1	50	3.0	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; case bore new storm or follow trench box T6 design; abandon existing electrical	Protect	New Cut & Fill, New Electrical, New Storm, Remove Electrical Line
5	1067	*Picea pungens*	Blue Spruce	28.2	4.4		0.0	10.7	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; keep new electrical equipment and foundations outside of the TPZ; abandon existing electrical	Protect	New Cut & Fill, New Electrical, New Electrical Equipment, Remove Electrical Line
5	1068	*Picea pungens*	Blue Spruce	23.5	3.4	resinosis; recommend removal; by gate	0.0	6.4	20	1.8	poor form	Remove	New Electrical, New Electrical Equipment, Remove Electrical Line
5	1069	*Pinus banksiana*	Jack Pine	17.8	3.8	resinosis	1.6	7.8	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; keep new electrical equipment and foundations outside of the TPZ; abandon existing electrical	Protect	New Cut & Fill, New Electrical, New Electrical Equipment, Remove Electrical Line
5	1070	*Pinus sylvestris*	Scotts Pine	12.3	3.6		0.6	4.6	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill, New Electrical, Remove Electrical Line
5	1071	*Acer negundo*	Manitoba maple	10.2	10.2	clustered with 1072, 1073, 1074	3.7	8.9	50	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
5	1072	*Acer negundo*	Manitoba maple	6.4	10.2	clustered with 1071, 1073, 1074	3.7	8.9	50	1.2	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
5	1073	*Acer negundo*	Manitoba maple	9.5	10.2	clustered with 1071, 1072, 1074	3.7	8.9	50	1.2	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
5	1074	*Acer negundo*	Manitoba maple	12.3	10.2	clustered with 1071, 1072, 1073	3.7	8.9	50	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
5	1536	*Ulmus americana*	American Elm	70.0	17.0	exposed root; 20 % dead crown	3.5	16.0	40	4.2	Grading; keep grading out of TPZ; see T10 design for grading; prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; cut curb and lift do not drag - prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs	Protect	New Cut & Fill, New_Roads_Curb, Remove ROAD-CURB
5	1557	*Populus jackii*	Northwest Poplar	103.0	13.4	basal scar; burl; exposed root; forked above dbh	4.6	18.1	40	5.0	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow t3a or t3b designs for new path install	Protect	New Cut & Fill, New_SUP
5	1558	*Ulmus americana*	American Elm	58.3	11.6	burl	3.0	12.2	50	3.6	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ as per T8b design; move SUP out of TPZ or follow t3a or t3b designs for new path install	Protect	New Cut & Fill, New Electrical, New Electrical Lights, New_SUP
5	1666	*Picea pungens*	Blue Spruce	29.6	4.6		1.2	14.2	50	1.8	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; case bore new storm or follow trench box T6 design; move new manhole or catch basin out of TPZ	Protect	New Cut & Fill, New Electrical, New Storm, New_CBAS_MANHOLE
5	1669	*Picea pungens*	Blue Spruce	24.2	5.2		0.2	11.9	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New_SUP
5	1670	*Pinus sylvestris*	Scotts Pine	33.0	8.0	crook; fork	2.5	9.6	40	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New_SUP
6	1895	*Salix alba*	White Willow	76.4	11.4	large basal scar; frost crack; caged	1.9	19.7	30	4.8	abandon storm; abandon catch basin/ manhole to the north	Protect	Remove Storm, REMOVE_CBAS_ManHole
6	1896	*Salix alba*	White Willow	92.0	8.0	frost crack; basal scar; pruned; crown extends over lake	1.8	18.6	40	5.0	abandon storm; abandon catch basin/ manhole to the north	Protect	Remove Storm, REMOVE_CBAS_ManHole
6	1897	*Salix pentandra*	Bay Willow	15.5	5.8	memorial tree; DBH measured at 1 meter	1.2	5.5	50	1.8	abandon existing electrical; follow T8a design for light removal; Commemorative Tree	Protect	Remove Electrical Lights; Remove Electrical Line
6	1898	*Salix pentandra*	Bay Willow	10.3	4.0	memorial tree; caged; basal scar	1.1	6.3	40	1.8	abandon electrical; Commemorative Tree	Protect	Remove Electrical Line
6	1900	*Quercus macrocarpa*	Bur Oak	21.3	3.6	lean; sweep; frost crack	1.2	9.6	40	1.8	abandon electrical; Commemorative Tree	Protect	Remove Electrical Line
6	1901	*Prunus mackii*	Amur Cherry	39.5	8.6	frost crack; lean; memorial tree	1.4	7.2	40	2.4	abandon electrical; Commemorative Tree	Protect	Remove Electrical Line
6	1902	*Picea pungens*	Blue Spruce	28.0	5.8	memorial tree	0.0	11.4	50	1.8	Commemorative Tree	Protect	Commemorative Tree
6	1906	*Pinus cembra*	Swiss Stone Pine	28.0	3.8	basal scar. bird nest	0.6	9.8	60	1.8	Commemorative Tree	Protect	Commemorative Tree
6	1907	*Picea pungens*	Blue Spruce	34.1	5.4	memorial tree	0.0	14.1	50	2.4	Commemorative Tree	Protect	Commemorative Tree
6	1908	*Picea pungens*	Blue Spruce	28.5	5.2	memorial tree; resinosis	0.0	13.0	50	1.8	Commemorative Tree	Protect	Commemorative Tree
6	1909	*Picea pungens*	Blue Spruce	26.0	3.8		0.0	13.1	60	1.8	abandon electrical; Commemorative Tree	Protect	Remove Electrical Line
6	1910	*Picea pungens*	Blue Spruce	27.5	6.5	resinosis.	0.0	12.9	50	1.8	Commemorative Tree	Protect	Commemorative Tree

6	1911	*Picea pungens*	Blue Spruce	30.0	3.8	corrected lean; sweep; memorial tree	0.0	12.8	50	1.8	Commemorative Tree	Protect	Commemorative Tree
6	1915	*Picea pungens*	Blue Spruce	51.8	8.2	resinosis	0.0	21.9	60	3.6	abandon electrical	Protect	Remove Electrical Line
6	1981	*Picea glauca*	White Spruce	36.4	7.6		0.0	18.7	40	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New Electrical Lights, New Storm, New_SUP, Remove Electrical Line, Remove ROAD-CURB, Remove Storm, REMOVE_CBAS_ManHole
6	1983	*Populus jackii*	Northwest Poplar	87.3	23.0	basal scar; forked	6.6	21.6	40	5.0	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New Storm, New_SUP, Remove Electrical Equipment, Remove Electrical Line, Remove ROAD-CURB, Remove Storm
6	1984	*Populus jackii*	Northwest Poplar	85.5	14.0	exposed roots; pruned; lean	3.5	24.5	40	5.0	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_SUP, Remove Electrical Equipment, Remove Electrical Line, Remove ROAD-CURB
6	2313	*Populus tremuloides*	Trembling Aspen	10.0	2.0	Conk/Lean	1.8	4.6	20	1.2	abandon storm	Protect	Remove Storm
6	2314	*Populus balsamifera*	Balsam Poplar	17.9	8.0	Lean/Slight	1.9	14.9	50	1.8	abandon storm	Protect	Remove Storm
6	2316	*Populus tremuloides*	Trembling Aspen	7.5	3.0		1.8	6.3	30	1.2	abandon storm	Protect	Remove Storm
6	2317	*Populus tremuloides*	Trembling Aspen	6.5	3.0	Lean	1.7	7.1	30	1.2	abandon storm	Protect	Remove Storm
6	2318	*Populus tremuloides*	Trembling Aspen	18.7	4.0	Crook/Lean	3.4	8.5	40	1.8	abandon storm	Protect	Remove Storm
6	2319	*Populus balsamifera*	Balsam Poplar	37.8	10.0		6.0	22.0	50	2.4	abandon storm	Protect	Remove Storm
6	2322	*Populus balsamifera*	Balsam Poplar	68.0	10.0	Estimated DBH, Exposed roots	8.6	27.5	40	4.2	abandon storm	Protect	Remove Storm
6	2324	*Populus balsamifera*	Balsam Poplar	39.3	5.0	Lean	5.2	14.2	40	2.4	abandon storm	Protect	Remove Storm
6	2325	*Populus tremuloides*	Trembling Aspen	7.0	5.0	Broken top	1.8	7.8	20	1.2	abandon storm	Protect	Remove Storm
6	2326	*Populus balsamifera*	Balsam Poplar	8.9	2.0	Slight Lean	1.4	3.5	40	1.2	abandon storm	Protect	Remove Storm
6	2327	*Populus balsamifera*	Balsam Poplar	6.3	3.0	Lean	1.7	3.6	30	1.2	abandon storm	Protect	Remove Storm
6	2328	*Populus balsamifera*	Balsam Poplar	40.4	10.0	Lean	6.3	19.3	40	3.0	abandon storm	Protect	Remove Storm
6	2329	*Populus balsamifera*	Balsam Poplar	34.2	5.0	Lean	6.0	11.5	40	2.4	abandon storm	Protect	Remove Storm
6	2330	*Populus balsamifera*	Balsam Poplar	26.8	4.0	Lean	2.2	8.4	20	1.8	abandon storm	Protect	Remove Storm
6	2331	*Populus balsamifera*	Balsam Poplar	40.2	10.0	Lean	6.6	26.6	40	3.0	abandon storm	Protect	Remove Storm
6	2332	*Populus balsamifera*	Balsam Poplar	40.8	10.0	Lean	8.9	26.9	50	3.0	abandon storm	Protect	Remove Storm
6	2333	*Populus balsamifera*	Balsam Poplar	48.0	10.0	Lean-Forked below DBH to #2334	8.7	27.9	50	3.0	abandon storm	Protect	Remove Storm
6	2336	*Populus balsamifera*	Balsam Poplar	36.2	10.0	Slight Lean	13.3	26.4	40	2.4	abandon storm	Protect	Remove Storm
6	2339	*Populus balsamifera*	Balsam Poplar	38.0	10.0	Lean/Other Good	11.9	26.2	40	2.4	abandon storm	Protect	Remove Storm
6	2340	*Populus balsamifera*	Balsam Poplar	27.8	8.0	Dead top/lean	5.5	16.0	20	1.8	abandon storm	Protect	Remove Storm
6	2341	*Populus balsamifera*	Balsam Poplar	7.5	4.0	Lean	2.3	8.5	40	1.2	abandon storm	Protect	Remove Storm
6	2343	*Picea glauca*	White Spruce	13.2	5.0	Exposed Roots	0.1	9.5	50	1.8	abandon storm	Protect	Remove Storm
6	2345	*Populus balsamifera*	Balsam Poplar	14.0	5.0	Lean	3.8	10.7	40	1.8	abandon storm	Protect	Remove Storm
6	2346	*Acer negundo*	Manitoba maple	7.8	3.0		1.2	6.9	40	1.2	abandon storm	Protect	Remove Storm
6	2347	*Populus balsamifera*	Balsam Poplar	15.5	5.0	Lean	3.2	10.9	40	1.8	abandon storm	Protect	Remove Storm
6	2348	*Populus balsamifera*	Balsam Poplar	34.3	10.0		6.0	24.1	50	2.4	abandon storm	Protect	Remove Storm
6	2349	*Populus balsamifera*	Balsam Poplar	22.4	8.0	Dead Top	2.3	16.0	20	1.8	abandon storm	Protect	Remove Storm
6	2350	*Populus balsamifera*	Balsam Poplar	36.8	10.0	Lean	2.2	25.2	50	2.4	abandon storm	Protect	Remove Storm
6	2351	*Populus balsamifera*	Balsam Poplar	28.7	9.0	Lean/Crook	2.2	17.6	30	1.8	abandon storm	Protect	Remove Storm
6	2352	*Populus balsamifera*	Balsam Poplar	46.6	10.0	Forked with #2353, #2354, below DBH	1.8	23.9	30	3.0	abandon storm	Protect	Remove Storm
6	2353	*Populus balsamifera*	Balsam Poplar	30.6	10.0	Forked	4.6	22.9	30	2.4	abandon storm	Protect	Remove Storm
6	2354	*Populus balsamifera*	Balsam Poplar	19.8	10.0	Forked/Lean	2.3	20.1	30	1.8	abandon storm	Protect	Remove Storm
6	2355	*Populus balsamifera*	Balsam Poplar	10.5	2.0	Major Lean/Cage	1.9	5.5	20	1.8	abandon storm	Protect	Remove Storm
6	2454	*Populus tremuloides*	Trembling Aspen	11.1	5.0	Poplar Borer	1.6	10.4	20	1.8	abandon existing electrical; abandon existing water	Protect	Remove Electrical Line; Remove Water
6	2455	*Populus tremuloides*	Trembling Aspen	14.5	6.0	Poplar Borer	1.3	11.0	20	1.8	abandon existing electrical; abandon existing water	Protect	Remove Electrical Line; Remove Water
6	2512	*Populus tremuloides*	Trembling Aspen	23.5	10.0	Stem Gall/Lean	4.3	18.5	50	1.8	move new light install outside the TPZ and follow T8b design; abandon existing storm; abandon existing water	Protect	New Electrical Lights; Remove Storm; Remove Water
6	2527	*Populus tremuloides*	Trembling Aspen	7.8	3.0	Lean/Bent	2.8	6.1	30	1.2	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lines; Remove Storm; Remove Water
6	2528	*Populus tremuloides*	Trembling Aspen	16.4	8.0	Lean/Bent	4.8	15.4	40	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lines; Remove Storm; Remove Water
6	2529	*Populus tremuloides*	Trembling Aspen	16.4	5.0	Lean/Crook	2.7	9.5	30	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lines; Remove Storm; Remove Water

6	2530	*Populus tremuloides*	Trembling Aspen	8.7	3.0	Lean	2.3	6.5	30	1.2	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lines; Remove Storm; Remove Water
6	9032	*Populus tremuloides*	Trembling Aspen	6.7	2.1		2.0	8.0	40	1.2	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
6	12000	*Picea glauca*	White Spruce	40.0	9.0	lean	0.1	16.3	50	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_Roads_Curb, New_SUP, Remove Electrical Line, REMOVE_CBAS_ManHole
6	14001	*Picea pungens*	Blue Spruce	7.0	1.7		0.2	3.2	70	1.2	abandon existing electrical; Commemorative Tree	Protect	Remove Electrical Line
7	1203	*Ulmus americana*	American Elm	40.0	8.0	exposed roots; sparse crown; cavity	3.7	10.1	50	2.4	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; move SUP out of TPZ or follow T3a or T3b designs for new path install	Protect	New Cut & Fill, New Electrical, New_SUP
7	1211	*Ulmus americana*	American Elm	52.8	14.1	exposed root	3.8	11.2	50	3.6	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
7	1213	*Pinus contorta latifolia*	Lodgepole Pine	37.2	7.6	lean	2.5	11.9	20	2.4	move electrical out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ as per T8b design; move SUP out of TPZ or follow T3a or T3b designs for new path install	Protect	New Electrical, New Electrical Lights, New_SUP
7	1215	*Pinus mugo*	Mugo Pine	24.0	5.6	spines on cones; resinosis	0.0	4.9	40	1.8	abandon existing electrical; abandon existing storm; abandon existing water April 5 walk through	Protect	Remove Electrical Line, Remove Storm, Remove Water
8	1102	*Ulmus americana*	American Elm	34.0	9.6	mid crown split	3.6	10.6	40	2.4	abandon electrical	Protect	Remove Electrical Line
8	1103	*Ulmus americana*	American Elm	50.5	9.8	5% dead crown	6.1	13.0	60	3.6	move new electrical equipment and foundations outside of the TPZ; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Electrical Equipment; New_Water; Remove Electrical Line; Remove Sanitation; Remove Storm; Remove Water
8	1104	*Ulmus americana*	American Elm	45.5	7.2	10 % dead crown; basal scar	4.6	12.5	40	3.0	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
8	1107	*Pinus contorta latifolia*	Lodgepole Pine	32.3	4.2	lean; basal scar	0.4	10.0	40	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
8	1108	*Pinus contorta latifolia*	Lodgepole Pine	28.4	4.9	resinosis	1.9	15.6	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
8	1116	*Populus jackii*	Northwest Poplar	46.3	8.8	basal scar	5.5	19.2	40	3.0	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
8	1117	*Populus jackii*	Northwest Poplar	59.0	7.8	basal scar; lean; one sided crown	2.9	14.6	40	3.6	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
8	1118	*Populus jackii*	Northwest Poplar	56.0	14.0	exposed root; basal scar	2.8	15.8	50	3.6	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
8	1119	*Populus jackii*	Northwest Poplar	51.0	12.0	slight crook	4.5	18.2	40	3.6	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
8	1125	*Pinus contorta latifolia*	Lodgepole Pine	46.3	9.6	multiple forks	0.9	14.6	40	3.0	abandon sanitary	Protect	New Cut & Fill, Remove Sanitation
8	1126	*Pinus contorta latifolia*	Lodgepole Pine	24.5	5.4		1.9	11.8	40	1.8	abandon sanitary	Protect	Remove Sanitation
8	1127	*Pinus contorta latifolia*	Lodgepole Pine	33.7	6.8	forked top; exposed root	1.8	12.8	40	2.4	abandon electrical	Protect	New Cut & Fill, Remove Electrical Line
8	1128	*Pinus contorta latifolia*	Lodgepole Pine	29.0	6.8	forked top	1.3	13.8	50	1.8	abandon sanitary	Protect	Remove Sanitation
8	1129	*Pinus contorta latifolia*	Lodgepole Pine	29.6	4.8	forked top; bird nest	0.5	11.7	50	1.8	abandon sanitary	Protect	Remove Sanitation
8	1130	*Pinus contorta latifolia*	Lodgepole Pine	22.7	4.8	crook	5.5	12.0	40	1.8	abandon sanitary	Protect	Remove Sanitation
8	1132	*Pinus contorta latifolia*	Lodgepole Pine	20.0	4.2		1.9	12.5	50	1.8	abandon sanitary	Protect	Remove Sanitation
8	1138	*Pinus contorta latifolia*	Lodgepole Pine	25.0	4.8	major crook	3.2	13.9	40	1.8	abandon sanitary	Protect	Remove Sanitation
8	1139	*Pinus contorta latifolia*	Lodgepole Pine	39.0	8.0	forked top; basal scar	2.0	12.3	40	2.4	abandon sanitary	Protect	Remove Sanitation
8	1150	*Pinus contorta latifolia*	Lodgepole Pine	36.7	8.6	multiple forks	0.2	12.2	40	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
8	1151	*Pinus contorta latifolia*	Lodgepole Pine	30.8	8.8	corrected lean; exposed roots; forked top	1.6	13.7	50	2.4	abandon electrical	Protect	New Cut & Fill, Remove Electrical Line
8	1152	*Pinus contorta latifolia*	Lodgepole Pine	30.4	9.6	resinosis; basal scars	1.9	14.1	40	2.4	abandon electrical	Protect	New Cut & Fill, Remove Electrical Line
8	1154	*Pinus contorta latifolia*	Lodgepole Pine	47.4	8.8	basal scar; exposed root; forked top	1.1	13.8	50	3.0	case bore new storm, abandon existing electrical; March 16 Walk through	Protect	New Cut & Fill, New Storm, Remove Electrical Line
8	1155	*Populus jackii*	Northwest Poplar	45.9	12.8	lean; poplar gall mites; exposed root	3.7	16.2	50	3.0	move SUP out of TPZ, case bore new storm; follow T4 design and boring specifications as per BMP	Protect	New Cut & Fill, New Storm, New_SUP
8	1156	*Populus jackii*	Northwest Poplar	41.0	12.4	basal scar	4.2	16.9	40	3.0	directional drill new electrical; case bore new storm east of tree; no excavation or compaction of roots within TPZ; prune roots >2.5 cms on east side of TPZ	Protect	New Cut & Fill, New Electrical, New Storm, Remove Electrical Line
8	1157	*Populus jackii*	Northwest Poplar	66.5	14.0	frost crack; exposed roots	6.1	20.2	50	4.2	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
8	1158	*Populus jackii*	Northwest Poplar	94.0	16.0	basal scar	3.6	26.2	40	5.0	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; Remove Storm; Remove Water
8	1159	*Populus jackii*	Northwest Poplar	65.4	11.8	basal rot	2.9	18.8	40	4.2	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; Remove Sanitation; Remove Storm; Remove Water

8	1160	*Pinus contorta latifolia*	Lodgepole Pine	21.0	5.4		0.6	8.9	50	1.8	March 23 Walk through	Protect	New Cut & Fill, Remove Sanitation, Remove Storm
8	1161	*Pinus contorta latifolia*	Lodgepole Pine	18.2	4.4		0.4	7.3	40	1.8	directional drill new electrical; case bore new sanitary; abandon existing sanitary; follow T7 for SUP removal	Protect	New Cut & Fill, New Electrical, New Sanitary, Remove Sanitation, Remove Storm
8	1162	*Pinus contorta latifolia*	Lodgepole Pine	19.0	3.8		0.2	8.3	50	1.8	March 23 Walk through	Protect	New Cut & Fill, Remove Sanitation
8	1163	*Pinus contorta latifolia*	Lodgepole Pine	18.5	4.8		0.1	8.8	50	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; Remove Sanitation; Remove Storm; Remove Water
8	1164	*Pinus contorta latifolia*	Lodgepole Pine	19.5	4.0	forked top	0.2	5.7	40	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water; abandon existing sanitation	Protect	New Cut & Fill; Remove Sanitation; Remove Storm; Remove Water
8	1165	*Populus jackii*	Northwest Poplar	44.3	9.6	slight lean	2.9	18.8	60	3.0	keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water; abandon existing sanitation	Protect	New Cut & Fill; Remove Electrical Line; Remove Sanitation; Remove Storm; Remove Water
8	1166	*Populus jackii*	Northwest Poplar	49.8	11.2	basal crack	2.9	20.6	50	3.0	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; Remove Sanitation; Remove Storm; Remove Water
8	1167	*Populus jackii*	Northwest Poplar	57.7	14.4	exposed root	2.5	18.8	60	3.6	March 23 Walk through	Protect	New Cut & Fill, New Electrical, New Sanitary, Remove Electrical Line, Remove Sanitation, Remove Storm
8	1168	*Pinus contorta latifolia*	Lodgepole Pine	6.5	1.0	standing dead; recommend removal			0	1.2	standing dead	Remove	New Electrical, New Sanitary, Remove Electrical Line, Remove Sanitation
8	1169	*Populus jackii*	Northwest Poplar	49.0	12.8		2.5	16.3	50	3.0	April 6 Walk through; Prune - 6m over road	Protect	New Cut & Fill, New Electrical Equipment, New Sanitary, New_SUP, Remove Electrical Equipment, Remove Electrical Line, Remove Sanitation
8	1170	*Populus jackii*	Northwest Poplar	47.5	12.0	sweep; exposed roots	2.3	17.2	40	3.0	abandon existing electrical; directional drill new electrical	Protect	New Cut & Fill, New Electrical, Remove Electrical Line
8	1171	*Populus jackii*	Northwest Poplar	42.5	9.4	significant lean	2.2	15.4	30	3.0	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New Storm, Remove Electrical Line
8	1173	*Populus jackii*	Northwest Poplar	34.5	9.0	scar lower stem	3.4	17.4	60	2.4	abandon existing electrical; directional drill new electrical	Protect	New Electrical, Remove Electrical Line
8	1175	*Populus jackii*	Northwest Poplar	31.5	11.0	frost crack	3.0	16.0	60	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling	Protect	New Cut & Fill; New Electrical Lines; New_SUP
8	1176	*Populus jackii*	Northwest Poplar	46.0	14.0	exposed root; crook.	2.5	16.2	50	3.0	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new storm or follow trench box T6 design; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New Storm; New_SUP; Remove Electrical Line
8	1177	*Populus jackii*	Northwest Poplar	55.3	14.3	frost crack; exposed roots.	2.3	18.1	50	3.6	case bore new storm; no excavation or compaction of roots within TPZ; prune roots > 2.5 cms on west side of TPZ - see T3 design	Protect	New Cut & Fill, New Storm
8	1178	*Pinus banksiana*	Jack Pine	19.9	4.2	crook; broken top;	1.2	13.0	30	1.8	abandon existing storm; abandon existing water and abandon existing sanitation	Protect	Remove Sanitation; Remove Storm; Remove Water
8	1179	*Pinus banksiana*	Jack Pine	27.6	5.6	exposed root; lean	1.7	15.0	40	1.8	abandon existing electrical	Protect	Remove Electrical Line; Remove Sanitation
8	1180	*Pinus banksiana*	Jack Pine	22.8	7.6	basal scar	2.3	8.9	40	1.8	abandon sanitation	Protect	Remove Sanitation
8	1181	*Pinus banksiana*	Jack Pine	17.1	4.8		1.4	10.5	40	1.8	abandon sanitation	Protect	Remove Sanitation
8	1182	*Populus jackii*	Northwest Poplar	73.0	14.0	exposed roots; forked - 2 stems	3.1	20.2	50	4.8	abandon existing electrical	Protect	Remove Electrical Line; Remove Sanitation
8	1184	*Populus jackii*	Northwest Poplar	48.0	10.0	exposed roots	3.6	16.2	40	3.0	keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Storm; Remove Storm; Remove Water
8	1185	*Populus jackii*	Northwest Poplar	42.0	6.4	exposed root; lean	3.6	16.2	40	3.0	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new storm or follow trench box T6 design; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New Storm; Remove Electrical Equipment; Remove Electrical Line
8	1189	*Populus jackii*	Northwest Poplar	36.3	6.6	scars	3.6	16.7	20	2.4	abandon existing storm; abandon existing water	Protect	New_Water; Remove Storm; Remove Water
8	1190	*Populus jackii*	Northwest Poplar	45.5	11.0	exposed roots	3.6	15.5	30	3.0	directional drill for installation of new water; follow T4 design and boring specifications as per BMP; March 16 Walk through	Protect	New_Water, Remove Sanitation, Remove Storm
8	1192	*Pinus contorta latifolia*	Lodgepole Pine	23.5	4.0	2 needle; forked top	1.6	10.8	30	1.8	March 16 Walk through; Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Sanitary, Remove Sanitation, Remove Storm
8	1193	*Pinus contorta latifolia*	Lodgepole Pine	26.2	5.2	sweep; basal scar	1.6	12.4	40	1.8	March 16 Walk through; Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Sanitary, New Storm, Remove Sanitation, Remove Storm

8	1194	*Pinus contorta latifolia*	Lodgepole Pine	21.0	3.8	scar	1.6	9.6	40	1.8	case bore new storm; abandon existing sanitary; follow T4 design and boring specifications as per BMP; use T7 sketch for installation of SUP	Protect	New Cut & Fill, New Storm, Remove Sanitation
8	1195	*Pinus contorta latifolia*	Lodgepole Pine	21.5	2.4	basal scar	1.4	9.0	30	1.8	abandon existing storm; abandon existing water	Protect	Remove Sanitation; Remove Storm; Remove Water
8	1196	*Populus jackii*	Northwest Poplar	47.5	10.8	exposed root	2.8	14.9	40	3.0	Hyrdrovac curb removal as per March 23 walk through with city foresters	Protect	New Cut & Fill, New Electrical, New Storm, New_Roads_Curb, Remove Electrical Line, Remove ROAD-CURB, Remove Sanitation, Remove Storm
8	1197	*Picea pungens*	Blue Spruce	24.0	4.2	lean	0.2	10.0	40	1.8	no ground disturbance, no stock piling, and no equipment inside the TPZ	Protect	Remove Storm
8	1199	*Picea glauca*	White Spruce	14.7	2.8	broken top; standing dead			0	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	Remove Sanitation
8	1200	*Picea pungens*	Blue Spruce	21.8	4.4		0.0	9.8	50	1.8	abandon existing water	Protect	Remove Water
8	1201	*Pinus contorta latifolia*	Lodgepole Pine	31.7	4.8	forked top	1.8	9.7	50	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing storm; abandon existing water; March 23 Walk through	Protect	New Cut & Fill; New Electrical Lines; New_SUP; New_Water; Remove Storm; Remove Water
8	1202	*Populus jackii*	Northwest Poplar	43.3	8.4	poplar gall; forked above dbh	2.6	11.4	40	3.0	no ground disturbance, no stock piling, and no equipment inside the TPZ	Protect	
8	1236	*Ulmus americana 'Brandon'*	Brandon Elm	33.0	7.6	smaller leaves than American elm	3.7	11.1	70	2.4	abandon existing water; directional drill deep under trunk of tree for install of new water; follow T4 design and boring specifications as per BMP; March 16 Walk through	Protect	New Cut & Fill, New_Water, Remove Storm
8	1238	*Pinus contorta latifolia*	Lodgepole Pine	17.5	4.0	in shrub polygon	0.0	6.1	70	1.8	Grading; keep grading out of TPZ; see T10 design for grading; March 16 Walk through	Grading	New Cut & Fill
9	1106	*Ulmus americana*	American Elm	63.0	9.2	included bark	3.8	13.3	40	4.2	keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_Water; Remove Electrical Equipment; Remove Sanitation; Remove Storm; Remove Water
9	1482	*Populus jackii*	Northwest Poplar	62.8	12.0	scar exposed root	2.9	13.9	20	4.2	abandon sanitary	Protect	New Cut & Fill, Remove Sanitation
9	1484	*Populus jackii*	Northwest Poplar	39.0	5.0	scar exposed root roots	2.2	10.6	20	2.4	abandon sanitary	Protect	New Cut & Fill, Remove Sanitation
9	1485	*Populus jackii*	Northwest Poplar	67.5	15.0	exposed root roots burl	2.5	15.4	40	4.2	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1486	*Populus jackii*	Northwest Poplar	49.5	10.6	exposed root roots lean	2.2	15.3	30	3.0	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1487	*Pinus banksiana*	Jack Pine	18.2	3.5	poor vigor	2.9	7.0	20	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1488	*Pinus banksiana*	Jack Pine	17.0	4.6	scar	2.4	6.4	30	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1489	*Pinus banksiana*	Jack Pine	25.7	8.4	lean	4.3	10.6	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1490	*Pinus banksiana*	Jack Pine	26.0	5.6	mid crown scar	2.8	10.4	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1491	*Pinus banksiana*	Jack Pine	24.7	5.0	scar lean	2.4	10.5	50	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1492	*Pinus banksiana*	Jack Pine	19.4	4.6	lean scar	2.2	6.2	30	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_Water; Remove Storm; Remove Water
9	1493	*Fraxinus pennsylvanica*	Green Ash	41.7	12.8	scars	3.4	15.2	40	3.0	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1494	*Fraxinus pennsylvanica*	Green Ash	30.4	8.0	15% dead crown	2.2	12.1	50	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1495	*Fraxinus pennsylvanica*	Green Ash	38.2	8.0	frost crack	3.4	9.3	40	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1496	*Fraxinus pennsylvanica*	Green Ash	33.5	9.0	frost crack	2.4	10.3	40	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1497	*Fraxinus pennsylvanica*	Green Ash	36.2	10.0	frost crack	2.7	12.5	40	2.4	do not excavate within TPZ for removal of catch basin	Protect	New Cut & Fill, REMOVE_CBAS_ManHole
9	1498	*Fraxinus pennsylvanica*	Green Ash	36.2	7.0	frost crack	2.3	12.2	40	2.4	move electrical equipment out of TPZ	Protect	New Cut & Fill, New Electrical Equipment
9	1499	*Fraxinus pennsylvanica*	Green Ash	37.3	14.0	frost crack	2.8	13.7	50	2.4	abandon storm and electrical; directionally drill new water; follow T4 design and BMP specifications; follow T7 design; air and hand tools for path construction to the east	Protect	New Cut & Fill, New_SUP, New_Water, Remove Electrical Line, Remove Storm
9	1500	*Fraxinus pennsylvanica*	Green Ash	39.5	8.5	frost crack	3.2	14.8	50	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1501	*Fraxinus pennsylvanica*	Green Ash	42.4	14.0	frost crack	2.2	9.8	30	3.0	keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm	Protect	New Cut & Fill; Remove Electrical Line; Remove Storm

9	1502	*Pinus contorta latifolia*	Lodgepole Pine	20.4	5.0	frost crack scar	0.9	8.8	30	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm	Protect	New Cut & Fill; Remove Storm
9	1503	*Pinus contorta latifolia*	Lodgepole Pine	19.6	4.4	scars	2.5	8.5	40	1.8	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing storm; abandon existing water	Grading	New Cut & Fill
9	1504	*Pinus contorta latifolia*	Lodgepole Pine	23.6	5.8	scar	1.8	9.1	50	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm	Protect	New Cut & Fill; Remove Storm
9	1537	*Fraxinus pennsylvanica*	Green Ash	38.5	9.0	basal scar	1.2	9.5	40	2.4	move new road out of TPZ; see T1 design and follow BMP	Protect	New Cut & Fill, New_Roads_Curb
9	1538	*Fraxinus pennsylvanica*	Green Ash	37.5	9.8	basal scar frost crack	2.6	10.6	40	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New_Roads_Curb
9	1539	*Fraxinus pennsylvanica*	Green Ash	33.1	6.8	frost crack burl	2.4	9.2	50	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1540	*Malus baccata*	Siberian Crab Apple	7.2	2.2	20 % dead crown basal scar	1.2	3.6	40	1.2	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New_Roads_Curb
9	1552	*Fraxinus pennsylvanica*	Green Ash	35.9	9.2	frost crack	1.8	8.9	40	2.4	abandon electrical; cut and lift curb sections west of tree; prune roots > 2.5 cms	Protect	Remove Electrical Line
9	1553	*Acer platanoides*	Norway Maple	10.5	3.6	basal scar	0.9	5.3	40	1.8	abandon electrical	Protect	Remove Electrical Line
9	1554	*Fraxinus pennsylvanica*	Green Ash	36.5	7.8	10 % dead crown	2.7	15.7	50	2.4	abandon electrical; cut and lift curb sections west of tree; prune roots > 2.5 cms	Protect	Remove Electrical Line, Remove ROAD-CURB
9	1565	*Ulmus americana*	American Elm	54.0	14.0	exposed root	3.6	11.3	60	3.6	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; prune roots > 2.5 cms; move SUP out of TPZ or follow T3a or T3b designs for new path install; abandon existing electrical; cut curb and lift do not drag -prune roots > 2.5 cms - follow T1 or T2 designs for existing road and curbs	Protect	New Cut & Fill, New Electrical, New_Roads_Curb, New_SUP, Remove Electrical Line, Remove ROAD-CURB
9	1567	*Fraxinus pennsylvanica*	Green Ash	37.7	11.2	frost crack; decay	3.0	12.1	50	2.4	move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new storm or follow trench box T6 design; abandon existing electrical; follow T8a design for light removal	Protect	New Electrical Lines; New Storm; Remove Electrical Lights; Remove Electrical Line
9	1568	*Fraxinus pennsylvanica*	Green Ash	36.8	9.6	frost crack	1.7	10.2	40	2.4	case bore new storm, move new path out of TPZ, See T7 design for path removal and BMP	Protect	New Cut & Fill, New Storm, New_SUP
9	1569	*Fraxinus pennsylvanica*	Green Ash	38.0	11.4	frost crack; 5% dead crown; basal scar	2.1	11.7	40	2.4	expose roots to the west & prune roots > 2.5 cms for new path; no excavation or compaction of roots within TPZ	Protect	New_SUP
9	1572	*Fraxinus pennsylvanica*	Green Ash	51.5	12.8	frost crack	3.6	14.1	30	3.6	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; Remove Storm; Remove Water
9	1573	*Fraxinus pennsylvanica*	Green Ash	45.8	12.4	frost crack	2.2	14.5	40	3.0	abandon existing electrical	Protect	Remove Electrical Equipment; Remove Electrical Line
9	1575	*Fraxinus pennsylvanica*	Green Ash	58.4	9.8	long frost crack	1.5	12.2	40	3.6	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
9	1576	*Picea glauca*	White Spruce	41.6	7.2		0.1	14.8	50	3.0	DD Electrical, Move new SUP out of TPZ, follow T4 sketch and BMP specifications	Protect	New Cut & Fill, New Electrical, New_SUP
9	1578	*Picea glauca*	White Spruce	28.3	5.4		0.0	13.8	50	1.8	abandon existing electrical	Protect	Remove Electrical Equipment; Remove Electrical Line
10	1559	*Picea glauca*	White Spruce	36.0	5.0	nest; sweep; 15 % dead crown	0.2	11.6	60	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
10	1560	*Populus jackii*	Northwest Poplar	62.0	12.0		0.9	16.6	40	4.2	Tree retention not viable due to severity and quantity of construction conflicts; March 23 Walk through	Remove	New Cut & Fill; New_Water; Remove Storm; Remove Water
10	1561	*Populus jackii*	Northwest Poplar	31.3	8.8	exposed root lean	0.2	10.2	20	2.4	March 16 Walk through; Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill; New_Water; Remove Storm; Remove Water
10	1562	*Populus jackii*	Northwest Poplar	61.0	12.4	in storage area	3.9	18.2	50	4.2	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	1563	*Populus jackii*	Northwest Poplar	47.7	9.6	frost crack; 15% dead crown in storage area	4.0	10.5	50	3.0	Tree retention not viable due to severity and quantity of construction conflicts	Remove	
10	1564	*Fraxinus pennsylvanica*	Green Ash	42.0	8.0		3.4	13.1	50	3.0	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	1581	*Picea glauca*	White Spruce	38.5	4.8		0.0	15.0	50	2.4	abandon electrical	Protect	Remove Electrical Line
10	1648	*Pinus sylvestris*	Scotts Pine	25.5	5.4	ants; lean	1.5	10.4	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	1649	*Pinus contorta latifolia*	Lodgepole Pine	23.0	4.2		1.4	9.5	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	1650	*Pinus sylvestris*	Scotts Pine	23.0	4.4		0.4	9.8	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	1651	*Pinus sylvestris*	Scotts Pine	27.3	7.0	sapsucker; fork top	0.1	9.8	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill

10	1653	*Pinus sylvestris*	Scotts Pine	31.3	3.8	crook	1.5	8.7	60	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	1654	*Pinus sylvestris*	Scotts Pine	26.6	5.2	basal scar	0.4	10.5	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Storm, Remove Storm, REMOVE_CBAS_ManHole
10	1655	*Pinus sylvestris*	Scotts Pine	16.6	3.8	crook; forked	0.3	8.5	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Storm, Remove Storm, REMOVE_CBAS_ManHole
10	1658	*Pinus sylvestris*	Scotts Pine	19.0	3.8	lean	2.1	9.4	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, Remove Storm
10	1659	*Ulmus americana*	American Elm	9.0	2.2	bird nest	3.0	9.0	50	1.2	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	1660	*Pinus sylvestris*	Scotts Pine	26.5	5.2	lean	0.2	6.7	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	1661	*Ulmus americana*	American Elm	10.3	2.6	lean	2.8	8.6	60	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	1662	*Ulmus americana*	American Elm	6.5	2.2		1.2	6.2	50	1.2	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	1663	*Fraxinus pennsylvanica*	Green Ash	15.5	4.0		2.1	5.7	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	1664	*Pinus contorta latifolia*	Lodgepole Pine	18.8	4.2		0.5	5.1	30	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	1665	*Pinus contorta latifolia*	Lodgepole Pine	10.2	2.8	lean	2.7	7.9	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, Remove Sanitation
10	3000	*Fraxinus pennsylvanica*	Green Ash	47.3	12.2	in compound. lean. pruned. upper crown scar	3.4	11.4	40	3.0	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	5001	*Fraxinus pennsylvanica*	Green Ash	41.5	8.6	lean	2.0	14.1	60	3.0	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	5002	*Fraxinus pennsylvanica*	Green Ash	11.0	4.4		1.8	7.9	60	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
10	9084	*Pinus sylvestris*	Scotts Pine	20.5	4.3	dead top	3.0	9.0	20	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
11	601	*Salix alba*	White Willow	75.4	9.5	scar, basal cavity, hornets nest	1.7	17.9	40	2.4	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; move SUP out of TPZ or follow t3a or t3b designs for new path install; abandon existing electrical	Protect	New Cut & Fill, New Electrical, New_SUP, Remove Electrical Line
11	602	*Salix alba*	White Willow	48.0	9.6		2.1	15.1	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow t3a or t3b designs for new path install	Protect	New Cut & Fill, New_SUP
11	604	*Picea glauca*	White Spruce	54.8	6.4		1.6	20.0	40	3.6	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill, New Electrical, Remove Electrical Line
11	605	*Populus balsamifera*	Balsam Poplar	6.8	3.0		0.8	5.6	40	1.2	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
11	606	*Prunus pensylvanica*	Pin cherry	6.7	3.6		1.9	3.1	40	1.2	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
11	607	*Prunus pensylvanica*	Pin cherry	6.4	2.9		1.5	7.3	50	1.2	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
11	608	*Prunus pensylvanica*	Pin cherry	7.0	5.0		2.1	5.0	20	1.2	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
11	609	*Populus balsamifera*	Balsam Poplar	21.0	6.4	lean	2.8	13.1	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
11	610	*Populus balsamifera*	Balsam Poplar	59.2	11.3	dominant dead top	4.6	17.9	50	3.6	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; abandon existing electrical; cut curb and lift do not drag -prune roots > 2.5 cms - follow T1 or T2 designs for road and curbs	Protect	New Cut & Fill, New Electrical, New_Roads_Curb, Remove Electrical Line, Remove ROAD-CURB
11	611	*Populus balsamifera*	Balsam Poplar	16.7	5.4	lean	3.2	6.6	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
11	612	*Populus balsamifera*	Balsam Poplar	29.5	7.8		4.4	15.4	30	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_Roads_Curb, Remove Electrical Line, Remove ROAD-CURB
11	613	*Picea glauca*	White Spruce	6.2	3.1	suppressed	1.0	3.1	40	1.2	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_Roads_Curb, Remove Electrical Line, Remove ROAD-CURB
11	614	*Populus balsamifera*	Balsam Poplar	27.2	7.2		5.1	13.6	50	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill

11	615	*Picea pungens*	Blue Spruce	31.0	5.4		1.6	19.4	50	2.4	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill, New Electrical, Remove Electrical Line
11	617	*Picea pungens*	Blue Spruce	38.8	5.3		2.4	20.3	40	2.4	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; abandon existing electrical; cut curb and lift do not drag -prune roots > 2.5 cms - follow T1 or T2 designs for road and curbs	Protect	New Cut & Fill, New Electrical, New_Roads_Curb, Remove Electrical Line, Remove ROAD-CURB
11	843	*Picea pungens*	Blue Spruce	32.2	3.4	basal scar	0.9	18.6	40	2.4	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; abandon existing electrical; cut curb and lift do not drag -prune roots > 2.5 cms - follow T1 or T2 designs for road and curbs	Protect	New Cut & Fill, New Electrical, New_Roads_Curb, Remove Electrical Line, Remove ROAD-CURB
11	1985	*Pinus contorta latifolia*	Lodgepole Pine	22.0	4.4	resinosis	1.4	9.1	50	1.8	abandon electrical	Protect	Remove Electrical Line
11	1986	*Picea glauca*	White Spruce	55.1	7.2	lean; 15 percent dead crown scar	3.0	23.5	40	3.6	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow t3a or t3b designs for new path install; abandon existing electrical; cut curb and lift do not drag - prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; abandon existing storm; abandon existing water	Protect	New Cut & Fill, New_SUP, Remove Electrical Line, Remove ROAD-CURB, Remove Storm, Remove Water
11	1987	*Picea glauca*	White Spruce	58.7	6.4	burl; dead top; scar; resinosis; lean	1.8	21.7	40	3.6	abandon existing water; abandon existing storm	Protect	Remove Storm; Remove Water
11	1988	*Picea glauca*	White Spruce	56.1	5.4	frost crack; scar; 60 percent dead crown	2.3	22.9	30	3.6	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow t3a or t3b designs for new path install; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill, New_SUP, Remove Electrical Line, Remove Storm, Remove Water
11	1989	*Picea glauca*	White Spruce	39.9	5.0	scar; forked top	1.0	18.6	30	2.4	Grading; keep grading out of TPZ; see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill, Remove Storm, Remove Water
11	1991	*Populus balsamifera*	Balsam Poplar	51.3	6.6	burl; exposed roots; cavity; lean	4.0	19.3	30	3.6	Tree retention not viable due to severity and quantity of construction conflicts; April 5 walk through	Remove	New Cut & Fill, New Electrical, New Electrical Lights, New_Roads_Curb, New_SUP, Remove Electrical Equipment, Remove Electrical Line, Remove ROAD-CURB, Remove Storm, Remove Water
11	1992	*Populus balsamifera*	Balsam Poplar	53.7	4.0	dead tree lean	6.0	19.1	30	3.6	Tree retention not viable due to severity and quantity of construction conflicts; April 5 walk through	Remove	New Cut & Fill, New Electrical, New_Roads_Curb, New_SUP, Remove Electrical Line, Remove ROAD-CURB, Remove Storm, Remove Water
11	1993	*Populus balsamifera*	Balsam Poplar	55.5	4.6	dead top; scar	9.4	19.1	30	3.6	Tree retention not viable due to severity and quantity of construction conflicts; April 5 walk through	Remove	New Cut & Fill, New Electrical, New_Roads_Curb, New_SUP, Remove Electrical Line, Remove ROAD-CURB, Remove Storm, Remove Water
11	2131	*Populus balsamifera*	Balsam Poplar	18.0	7.5	Branch Galls/Forked	3.5	7.4	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill, Remove Electrical Line, Remove Storm, Remove Water
11	2132	*Populus balsamifera*	Balsam Poplar	46.8	11.8	Lean	9.0	21.4	40	3.0	Grading; keep grading out of TPZ; see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill, Remove Electrical Line, Remove Storm, Remove Water
11	2152	*Populus balsamifera*	Balsam Poplar	8.3	1.6	Lean/Dead Top	1.4	3.4	20	1.2	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow t3a or t3b designs for new path install; abandon existing storm; abandon existing water	Protect	New Cut & Fill, New_SUP, Remove Storm, Remove Water
11	2153	*Populus balsamifera*	Balsam Poplar	13.2	4.7	Lean/Stem Gall	2.2	6.2	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow t3a or t3b designs for new path install; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill, New_SUP, Remove Electrical Line, Remove Storm, Remove Water
11	2154	*Populus balsamifera*	Balsam Poplar	55.0	10.4	Cage/Lean	8.9	21.7	30	3.6	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow t3a or t3b designs for new path install; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill, New_SUP, Remove Electrical Line, Remove Storm, Remove Water

11	2208	*Populus balsamifera*	Balsam Poplar	52.9	7.3	Lean/Cage	6.3	23.0	20	3.6	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow t3a or t3b designs for new path install; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill, New_SUP, Remove Electrical Line, Remove Storm, Remove Water
11	2210	*Populus balsamifera*	Balsam Poplar	10.0	4.8	Lean	4.4	8.1	20	1.2	Grading; keep grading out of TPZ; see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill, Remove Electrical Line, Remove Storm, Remove Water
11	2211	*Populus balsamifera*	Balsam Poplar	8.3	5.1	Lean	2.7	8.4	30	1.2	Grading; keep grading out of TPZ; see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill, Remove Electrical Line, Remove Storm, Remove Water
11	2212	*Populus balsamifera*	Balsam Poplar	12.3	6.0	Lean	2.2	6.6	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 5 Walk through	Remove	New Cut & Fill, New_SUP, Remove Electrical Line, Remove Storm, Remove Water
11	2213	*Populus balsamifera*	Balsam Poplar	56.0	10.8	Lean/10% Crown Mortality	4.4	23.1	40	3.6	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow t3a or t3b designs for new path install; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill, New_SUP, Remove Electrical Line, Remove Storm, Remove Water
11	11026	*Picea glauca*	White Spruce	66.2	7.8	frost crack	2.8	18.3	40	4.2	Grading; keep grading out of TPZ; see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill, Remove Electrical Line, Remove Storm, Remove Water
12	1204	*Ulmus americana*	American Elm	42.2	12.8		3.1	10.6	50	3.0	Grading; keep grading out of TPZ; see T10 design for grading; move new light install outside the TPZ as per T8b design; follow T8a design for light removal; abandon existing electrical	Protect	New Cut & Fill, New Electrical Lights, Remove Electrical Lights, Remove Electrical Line
12	1205	*Ulmus americana*	American Elm	38.2	8.0	15% dead crown.	4.1	11.4	50	2.4	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow T3a or T3b designs for new path install; abandon existing electrical	Protect	New Cut & Fill, New_SUP, Remove Electrical Line
12	1209	*Pinus contorta latifolia*	Lodgepole Pine	39.7	6.6		2.0	9.3	40	2.4	move electrical out of TPZ or follow T4 design for directional drilling	Protect	New Electrical
12	1216	*Ulmus americana*	American Elm	54.5	12.0	non-uniform crown	4.7	14.0	50	3.6	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow T3a or T3b designs for new path install	Protect	New Cut & Fill, New_SUP
12	1217	*Ulmus americana*	American Elm	49.4	14.0	bird nest	6.0	13.7	50	3.0	Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; keep new light install outside the TPZ as per T8b design	Protect	New Cut & Fill, New Electrical, New Electrical Lights
12	1219	*Ulmus americana*	American Elm	51.3	11.5		4.8	13.6	50	3.6	move electrical out of TPZ or follow T4 design for directional drilling	Protect	New Electrical
12	1220	*Ulmus americana*	American Elm	44.9	7.4	exposed root collar	5.6	13.4	50	3.0	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
12	1221	*Ulmus americana*	American Elm	49.4	9.2		4.2	11.9	50	3.0	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
12	1222	*Ulmus americana*	American Elm	56.7	16.0	exposed root collar	4.4	12.5	50	3.6	Grading; keep grading out of TPZ; see T10 design for grading; keep new electrical equipment and foundations outside of the TPZ	Protect	New Cut & Fill, New Electrical Equipment
12	1839	*Picea pungens*	Blue Spruce	63.5	10.2		0.0	18.1	60	4.2	abandon existing electrical; abandon existing storm	Protect	Remove Electrical Line, Remove Storm
12	1840	*Salix alba*	White Willow	76.0	10.6	three stems; 25% dead crown	3.3	16.6	50	4.8	abandon existing electrical; abandon existing storm	Protect	Remove Electrical Line, Remove Storm
12	1841	*Salix alba*	White Willow	72.0	8.5	20% dead crown; frost crack; x3 stems from 1 stump	3.3	16.6	50	4.8	abandon existing electrical; abandon existing storm	Protect	Remove Electrical Line, Remove Storm
12	1842	*Salix alba*	White Willow	45.0	16.0	sparse crown; crown extends over lake; frost crack	3.3	16.6	50	3.0	abandon existing electrical; abandon existing storm	Protect	Remove Electrical Line, Remove Storm
12	1843	*Picea pungens*	Blue Spruce	33.2	4.2	lean; crook	1.8	16.1	40	2.4	abandon existing storm	Protect	Remove Storm
12	1845	*Picea pungens*	Blue Spruce	37.5	5.6	lean	0.2	17.6	50	2.4	abandon existing electrical	Protect	Remove Electrical Line
12	1846	*Salix alba*	White Willow	92.7	13.8	basal scar; frost crack; exp roots	3.2	15.7	50	5.0	abandon existing electrical	Protect	Remove Electrical Line
12	1847	*Picea pungens*	Blue Spruce	47.5	6.2	lean	0.5	17.0	50	3.0	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow T3a or T3b designs for new path install; cut curb and lift do not drag - prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; abandon existing storm; abandon existing water	Protect	New Cut & Fill, New_SUP, Remove Electrical Line, Remove ROAD-CURB, Remove Storm, Remove Water

12	1848	*Picea pungens*	Blue Spruce	47.0	9.2	lean; crook; fork	0.6	17.4	40	3.0	Grading - keep grading out of TPZ - see T10 design for grading; prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; cut concrete foundation below grade - do not remove concrete form - back fill with top soil and sod; cut curb and lift do not drag - prune roots > 2.5 cms - follow T1 or T2 designs for road and curbs removal; abandon existing storm; abandon existing water	Protect	New Cut & Fill, New Electrical, Remove Electrical Equipment, Remove ROAD-CURB, Remove Storm, Remove Water
12	1849	*Picea pungens*	Blue Spruce	41.0	10.4	sweep	1.4	19.6	50	3.0	Grading - keep grading out of TPZ - see T10 design for grading; prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; cut concrete foundation below grade - do not remove concrete form - back fill with top soil and sod; cut curb and lift do not drag - prune roots > 2.5 cms - follow T1 or T2 designs for road and curbs; abandon existing storm; abandon existing water	Protect	New Cut & Fill, New_Roads_Curb, Remove Electrical Equipment, Remove ROAD-CURB, Remove Storm, Remove Water
12	1850	*Picea pungens*	Blue Spruce	50.7	10.6	broken top; resinosis	0.8	14.0	50	3.6	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow T3a or T3b designs for new path install; cut curb and lift do not drag - prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; abandon existing storm; abandon existing water	Protect	New Cut & Fill, New_SUP, Remove Electrical Line, Remove ROAD-CURB, Remove Storm, Remove Water
12	1851	*Picea pungens*	Blue Spruce	29.7	4.8	basal scar; forked top	1.5	14.3	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading; abandon existing electrical	Protect	New Cut & Fill, Remove Electrical Line
12	1852	*Picea pungens*	Blue Spruce	41.4	6.0	lean; exposed root	1.2	20.4	50	3.0	Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow T3a or T3b designs for new path install; cut curb and lift do not drag - prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; abandon existing storm; abandon existing water	Protect	New Cut & Fill, New_SUP, Remove Electrical Line, Remove ROAD-CURB, Remove Storm, Remove Water
12	1853	*Picea pungens*	Blue Spruce	37.0	3.2	lean; one-sided crown	1.2	20.5	50	2.4	abandon existing electrical	Protect	Remove Electrical Line
12	1854	*Picea pungens*	Blue Spruce	34.0	2.8	resinosis; basal scar	1.2	20.4	40	2.4	abandon existing electrical	Protect	Remove Electrical Line
12	1866	*Prunus mackii*	Amur Cherry	23.3	5.6	basal scar; lean; memorial tree	1.2	5.5	40	1.8	Commemorative Tree	Protect	Commemorative Tree
12	1870	*Picea pungens*	Blue Spruce	12.7	2.6	memorial tree	0.0	6.3	50	1.8	abandon existing electrical; Commemorative Tree	Protect	Remove Electrical Line
12	1871	*Prunus mackii*	Amur Cherry	17.2	5.6	memorial tree; 20% dead crown	0.6	5.7	50	1.8	abandon existing electrical; Commemorative Tree	Protect	Remove Electrical Line
12	1872	*Picea pungens*	Blue Spruce	27.5	6.0	memorial tree; resinosis.; tagged on branch	0.0	10.8	50	1.8	abandon existing electrical; Commemorative Tree	Protect	Remove Electrical Line
12	1873	*Pinus cembra*	Swiss Stone Pine	20.1	3.2		0.3	8.0	50	1.8	Commemorative Tree	Protect	Commemorative Tree
12	1877	*Picea glauca*	White Spruce	43.0	6.2	pruned	0.0	16.6	50	3.0	abandon existing electrical	Protect	Remove Electrical Line
12	3001	*Populus jackii*	Northwest Poplar	38.4	4.8	manually girdled. standing dead; removed previously				2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, Remove Electrical Line
12	3002	*Picea pungens*	Blue Spruce	40.4	5.8	resinosis. corrected lean	0.4	15.3	40	3.0	Grading; keep grading out of TPZ; see T10 design for grading; move new light install outside the TPZ as per T8b design	Protect	New Cut & Fill, New Electrical Lights
12	3003	*Picea pungens*	Blue Spruce	54.5	8.0	fork. resinosis. lean	0.0	15.2	50	3.6	move electrical out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ as per T8b design; abandon existing irrigation	Protect	New Electrical, New Electrical Lights, Remove Irrigation
13	1223	*Populus jackii*	Northwest Poplar	44.0	14.8	frost crack; exposed roots; poplar gall	5.0	14.3	40	3.0	keep grading out of TPZ - see T10 design for grading	Grading	New Cut & Fill; New Electrical
13	1224	*Populus jackii*	Northwest Poplar	29.3	6.0	30% dead crown; lean	2.3	13.1	30	1.8	directional drill new electrical on north side of TPZ;	Protect	New Electrical
13	1225	*Populus jackii*	Northwest Poplar	60.5	16.0	lean	3.7	19.0	50	4.2	realign utility down sidewalk as per Apr 13 walk through with city foresters	Protect	New Sanitary
13	1227	*Populus jackii*	Northwest Poplar	46.4	13.2		2.1	20.0	50	3.0	realign utility down sidewalk as per Apr 13 walk through with city foresters	Protect	New Sanitary
13	1228	*Populus jackii*	Northwest Poplar	51.2	10.6	frost crack; poplar gall; crook; 20 % dead crown	2.5	21.2	40	3.6	move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing irrigation	Protect	New Electrical Lines; Remove Irrigation
13	1230	*Populus jackii*	Northwest Poplar	33.2	10.2	poplar gall	1.8	14.1	50	2.4	directional drill new electrical - see T4 design	Protect	New Cut & Fill, New Electrical
13	1231	*Populus jackii*	Northwest Poplar	42.8	10.8	exposed root	2.4	17.8	50	3.0	Grading; keep grading out of TPZ; see T10 design for grading; April 5 Walk through	Grading	New Cut & Fill
13	1232	*Populus jackii*	Northwest Poplar	33.5	8.4	one sided crown	3.0	17.6	60	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
13	1233	*Populus jackii*	Northwest Poplar	38.0	11.0	exposed root	4.3	16.7	50	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
13	1234	*Populus jackii*	Northwest Poplar	30.5	12.0	15% dead crown	3.4	14.3	40	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill

13	1235	*Populus jackii*	Northwest Poplar	39.0	12.4	sweep; exposed root; 15% dead crown; decay at root collar	2.3	17.0	30	2.4	abandon existing sanitation; abandon existing catch basin – see T9a design	Protect	New Cut & Fill, Remove Sanitation
13	1237	*Ulmus americana 'Brandon'*	Brandon Elm	33.8	8.4		3.8	11.8	60	2.4	case bore new sanitary - see T4 design; move electrical south outside of TPZ; March 16 Walk through	Protect	New Cut & Fill, New Electrical, New Sanitary
13	1239	*Populus jackii*	Northwest Poplar	43.5	9.6		3.5	16.4	50	3.0	Grading; keep grading out of TPZ; see T10 design for grading; April 5 Walk through	Grading	New Cut & Fill
13	1241	*Populus jackii*	Northwest Poplar	34.8	8.4	one sided crown	2.3	14.2	40	2.4	stay out of TPZ to the northeast with new sanitary	Protect	New Sanitary
13	1242	*Pinus strobus*	Eastern White Pine	31.6	5.8	5 needle pine; scar and resinosis	1.5	16.2	40	2.4	abandon existing storm; abandon existing water; April 5 walk through	Protect	New_Water; Remove Sanitation; Remove Storm; Remove Water
13	1243	*Populus jackii*	Northwest Poplar	45.1	13.0		2.6	10.9	30	1.8	move new light install outside the TPZ and follow T8b design	Protect	New Electrical Lights
13	1244	*Populus jackii*	Northwest Poplar	63.7	16.0	root collar decay; 15% dead crown	3.8	19.0	50	4.2	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New_SUP, Remove Storm
13	1245	*Pinus contorta latifolia*	Lodgepole Pine	17.4	3.2	lean; crook	1.9	9.4	40	1.8	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing storm; abandon existing water	Grading	New Cut & Fill
13	1247	*Pinus contorta latifolia*	Lodgepole Pine	16.4	2.8	forked	0.4	6.8	40	1.8	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing storm; abandon existing water	Grading	New Cut & Fill
13	1248	*Populus jackii*	Northwest Poplar	76.7	20.0	frost crack; exposed roots	2.6	21.5	30	4.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
13	1261	*Quercus alba*	White Oak	48.8	14.0	frost crack	2.0	15.4	60	3.0	abandon sanitation and CB - see T9a design; March 16 Walk through	Protect	Remove Sanitation, REMOVE_CBAS_ManHole
13	1304	*Picea pungens*	Blue Spruce	28.0	4.8		0.6	11.3	40	1.8	no ground disturbance, no stock piling, and no equipment inside the TPZ; March 16 Walk through	Protect	
13	1306	*Pinus contorta latifolia*	Lodgepole Pine	39.1	8.8	crack; resinosis	0.2	13.9	50	2.4	no ground disturbance, no stock piling, and no equipment inside the TPZ; March 16 Walk through	Protect	
13	1307	*Pinus contorta latifolia*	Lodgepole Pine	37.1	7.6	fork	0.1	12.4	50	2.4	no ground disturbance, no stock piling, and no equipment inside the TPZ; March 16 Walk through	Protect	
13	1309	*Pinus contorta latifolia*	Lodgepole Pine	39.4	9.2	forks	0.3	13.2	50	2.4	Grading; keep grading out of TPZ; see T10 design for grading; March 16 Walk through	Grading	New Cut & Fill
13	1310	*Pinus contorta latifolia*	Lodgepole Pine	36.2	8.8	scar; fork	0.2	15.3	50	2.4	Grading; keep grading out of TPZ; see T10 design for grading; March 16 Walk through	Grading	New Cut & Fill
13	1311	*Pinus contorta latifolia*	Lodgepole Pine	42.6	7.8	scar	0.2	9.9	50	3.0	Grading; keep grading out of TPZ; see T10 design for grading; March 16 Walk through	Grading	New Cut & Fill
13	2000	*Populus jackii*	Northwest Poplar	47.0	14.0	basal scar	3.6	20.7	40	3.0	Prune lowest branches on northwest side of crowns as per Apr 13 walk through with city foresters	Protect	New Cut & Fill, New Electrical, New Sanitary, New_Water, Remove Electrical Line, Remove Storm
13	2001	*Populus jackii*	Northwest Poplar	39.2	16.0	exposed roots	3.2	16.9	50	2.4	Prune lowest branches on northwest side of crowns as per Apr 13 walk through with city foresters	Protect	New Cut & Fill, New Electrical, New_Water, Remove Electrical Line, Remove Storm
13	2002	*Populus jackii*	Northwest Poplar	38.5	11.2	exposed roots; poplar gall	6.0	20.0	50	2.4	April 5 Walk through	Protect	New Cut & Fill, New Electrical, Remove Electrical Line
13	2003	*Pinus sylvestris*	Scotts Pine	19.8	7.2	crook	3.6	14.4	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
13	2004	*Pinus sylvestris*	Scotts Pine	27.5	7.4	sweep	4.5	15.5	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical
13	2005	*Pinus sylvestris*	Scotts Pine	21.0	5.2	crook	5.1	14.2	50	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
13	2006	*Pinus sylvestris*	Scotts Pine	29.0	8.0	exp roots	1.8	13.6	50	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
13	2007	*Pinus cembra*	Swiss Stone Pine	20.2	4.8	basal scar	2.0	11.0	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Cut & Fill, New Sanitary
13	2008	*Pinus cembra*	Swiss Stone Pine	17.5	5.0	scar; 10 % dead crown	2.1	11.3	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Cut & Fill
13	2009	*Pinus sylvestris*	Scotts Pine	27.1	4.8		2.3	14.9	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Cut & Fill
13	2010	*Populus jackii*	Northwest Poplar	43.3	15.0	exposed roots	3.5	16.9	50	3.0	directional drill new electrical on west side of tree- see T4 design	Protect	New Cut & Fill, New Electrical
13	2011	*Populus jackii*	Northwest Poplar	41.0	14.8	lean gall	3.4	20.2	50	3.0	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Cut & Fill, New Electrical, New Electrical Equipment
13	2012	*Populus jackii*	Northwest Poplar	27.2	10.0	lean	1.5	16.9	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Cut & Fill, New Electrical, New Electrical Equipment
13	2013	*Populus jackii*	Northwest Poplar	31.3	12.0	lean	4.1	19.9	50	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New Electrical Equipment
13	2014	*Populus jackii*	Northwest Poplar	30.0	12.0	lean	5.0	17.7	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Cut & Fill

13	2015	*Populus jackii*	Northwest Poplar	41.3	14.0	lean	3.3	18.8	50	3.0	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Cut & Fill, New Electrical
13	2016	*Pinus sylvestris*	Scotts Pine	24.0	7.6	sweep	2.4	12.7	20	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
13	2017	*Pinus sylvestris*	Scotts Pine	28.3	6.4	crook	2.4	13.5	50	1.8	directional drill new electrical - see T4 design	Protect	New Cut & Fill, New Electrical
13	2018	*Populus jackii*	Northwest Poplar	42.2	16.0	lean gall	2.5	18.0	50	3.0	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical
13	2019	*Populus jackii*	Northwest Poplar	24.0	8.6	lean poplar gall	2.6	14.4	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical
13	2020	*Populus jackii*	Northwest Poplar	40.8	16.4	exposed roots	1.3	16.8	40	3.0	keep grading out of TPZ - see T10 design for grading	Grading	New Cut & Fill
13	2022	*Pinus sylvestris*	Scotts Pine	32.2	11.0	resinosis basal scar	2.3	16.2	50	2.4	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Cut & Fill
13	2023	*Pinus cembra*	Swiss Stone Pine	22.2	5.2	crook	2.2	14.7	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Cut & Fill
13	2024	*Pinus cembra*	Swiss Stone Pine	15.4	4.6	basal scar; crook	1.8	12.3	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Cut & Fill
13	2025	*Pinus cembra*	Swiss Stone Pine	19.3	5.4	crook; burl	3.3	13.9	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 5 walk through	Remove	New Cut & Fill
13	2026	*Pinus cembra*	Swiss Stone Pine	17.4	5.2		2.1	14.8	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Cut & Fill
13	2027	*Pinus sylvestris*	Scotts Pine	29.5	10.0	lean crook	2.2	13.0	30	1.8	realign utility down sidewalk as per Apr 13 walk through with city foresters	Remove	New Cut & Fill, New Electrical
13	2028	*Pinus sylvestris*	Scotts Pine	23.9	8.0		2.5	13.5	40	1.8	abandon sanitation and CB - see T9a design	Protect	New Cut & Fill, Remove Sanitation, REMOVE_CBAS_ManHole
13	2029	*Pinus sylvestris*	Scotts Pine	34.3	8.2	exposed roots	5.9	13.9	50	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Sanitary, Remove Sanitation, Remove Wall, REMOVE_CBAS_ManHole
13	2030	*Populus jackii*	Northwest Poplar	39.7	14.0	exposed roots	2.6	17.7	40	2.4	Grading; keep grading out of TPZ; see T10 design for grading; April 5 Walk through	Grading	New Cut & Fill
13	2031	*Populus jackii*	Northwest Poplar	55.5	16.6	lean	5.3	21.2	50	3.6	April 5 Walk through	Protect	New Cut & Fill, Remove Electrical Line
13	2032	*Populus jackii*	Northwest Poplar	56.5	14.4	exposed roots; lean	5.5	23.9	50	3.6	April 5 Walk through	Protect	New Cut & Fill, Remove Electrical Line
13	2033	*Populus jackii*	Northwest Poplar	47.0	17.8	lean	2.6	20.1	50	3.0	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical; April 5 walk through	Protect	New Cut & Fill; New Electrical Lines; Remove Electrical Line
13	2034	*Pinus cembra*	Swiss Stone Pine	16.8	3.8	crook				1.8	washroom installation April 5 walk through	Remove	
13	2035	*Pinus cembra*	Swiss Stone Pine	20.2	6.6	basal scar	1.9	12.2	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 5 Walk through	Remove	New Cut & Fill
13	2036	*Pinus cembra*	Swiss Stone Pine	23.3	4.4	basal scar; crook	2.3	14.0	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 5 Walk through	Remove	New Cut & Fill
13	2037	*Pinus cembra*	Swiss Stone Pine	19.0	7.8	resinosis	2.1	14.6	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 5 Walk through	Remove	New Cut & Fill, Remove Electrical Line
13	2038	*Pinus sylvestris*	Scotts Pine	33.5	7.8	crook; lean; sapsucker damage	2.5	11.7	50	2.4	Tree retention not viable due to severity and quantity of construction conflicts; April 5 Walk through	Remove	New Cut & Fill, Remove Electrical Line
13	2039	*Pinus contorta latifolia*	Lodgepole Pine	22.8	5.9	1 sided crown	3.4	14.8	40	3.0	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Electrical, New_SUP, Remove Electrical Equipment, Remove Electrical Lights, Remove Electrical Line, Remove Storm
13	2040	*Pinus sylvestris*	Scotts Pine	38.3	11.2	crook	4.3	18.1	50	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Electrical, Remove Electrical Line, Remove Storm
13	2041	*Pinus sylvestris*	Scotts Pine	36.2	10.4	sapsucker damage	2.1	17.1	50	2.4	abandon existing storm; abandon existing water	Protect	Remove Storm; Remove Water
13	2042	*Pinus sylvestris*	Scotts Pine	20.0	4.9	sweep	3.6	16.4	50	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	Remove Storm
13	2043	*Pinus sylvestris*	Scotts Pine	34.5	9.4	lean	3.1	16.2	40	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lines; Remove Electrical Equipment; Remove Electrical Line; Remove Storm; Remove Water
13	2044	*Pinus contorta latifolia*	Lodgepole Pine	23.8	4.8	nest basal scar	3.0	10.6	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts; April 5 Walk through	Remove	New Cut & Fill, Remove Electrical Equipment, Remove Electrical Lights, Remove Electrical Line, Remove Storm
13	2045	*Populus jackii*	Northwest Poplar	35.3	10.7	lean	4.6	19.5	40	2.4	Tree retention not viable due to severity and quantity of construction conflicts; April 5 Walk through	Remove	New Cut & Fill
13	2046	*Populus jackii*	Northwest Poplar	51.0	18.0		5.4	20.3	50	3.6	abandon electrical; move new electrical east outside of TPZ	Protect	New Cut & Fill, New Electrical, Remove Electrical Line
13	2047	*Populus jackii*	Northwest Poplar	28.8	10.2	lean	2.4	12.0	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
13	2049	*Populus jackii*	Northwest Poplar	55.8	16.0		6.9	20.9	50	3.6	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill

13	2050	*Populus jackii*	Northwest Poplar	50.2	15.0		5.2	22.1	50	3.6	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
13	2051	*Pinus sylvestris*	Scotts Pine	33.3	8.2	crook	2.4	12.7	50	2.4	Prune lowest branches on west side of crowns as per Apr 13 walk through with city foresters	Protect	New Cut & Fill
13	2052	*Pinus sylvestris*	Scotts Pine	31.8	8.7	sapsucker damage	2.1	11.5	40	2.4	Prune lowest branches on west side of crowns as per Apr 13 walk through with city foresters	Protect	New Cut & Fill, Remove Electrical Line
13	2053	*Pinus cembra*	Swiss Stone Pine	28.0	4.4	resinosis scar	2.3	14.5	30	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	Remove Electrical Lights
13	2054	*Populus jackii*	Northwest Poplar	54.3	16.4	exposed roots	2.6	19.0	50	3.6	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill
13	2055	*Populus jackii*	Northwest Poplar	41.3	14.4	exposed roots	4.7	18.2	50	3.0	April 5 Walk through	Protect	New Cut & Fill
13	2056	*Populus jackii*	Northwest Poplar	52.4	6.8	exposed roots	2.5	21.7	50	3.6	Grading; keep grading out of TPZ; see T10 design for grading; April 5 Walk through	Grading	New Cut & Fill
13	2057	*Populus jackii*	Northwest Poplar	47.0	14.4		4.1	22.8	50	3.0	Grading; keep grading out of TPZ; see T10 design for grading; April 13 Walk through	Grading	New Cut & Fill
13	2058	*Populus jackii*	Northwest Poplar	52.5	16.4		3.4	22.3	50	3.6	Tree retention not viable due to severity and quantity of construction conflicts; April 13 walk through	Remove	New Cut & Fill
13	2059	*Picea pungens*	Blue Spruce	38.3	7.2		2.9	18.0	60	2.4	Tree retention not viable due to severity and quantity of construction conflicts; April 5 Walk through	Remove	
13	2060	*Picea pungens*	Blue Spruce	52.8	9.2	resinosis	3.5	18.9	60	3.6	April 5 Walk through	Protect	
13	3007	*Pinus cembra*	Swiss Stone Pine	29.0	8.4	frost crack. 3006 leaning on crown.	4.0	12.6	40	1.8	abandon electrical	Protect	Remove Electrical Line
13	3021	*Picea pungens*	Blue Spruce	39.2	8.9	70% dead crown from base	8.9	18.0	40	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	
13	3038	*Pinus strobus*	Eastern White Pine	26.0	4.8	5 needles. forked top	2.2	15.8	40	1.8	move new light install outside the TPZ and follow T8b design	Protect	New Electrical Lights
13	3040	*Pinus strobus*	Eastern White Pine	22.0	7.6		2.0	12.8	40	1.8	abandon existing electrical; follow T8a design for light removal	Protect	Remove Electrical Lights; Remove Electrical Line
13	3063	*Populus jackii*	Northwest Poplar	59.0	14.4	lean	4.1	20.8	50	3.6	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
13	10012	*Populus jackii*	Northwest Poplar	41.8	13.1	dead top	4.1	19.9	30	3.0	April 5 Walk through	Protect	New Cut & Fill, New Electrical
13	14003	*Acer saccharinum*	Silver Maple	36.9	8.8	memorial tree	2.1	10.1	50	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing storm; abandon existing water; Commemorative Tree	Protect	New Cut & Fill; New Electrical Lines; Remove Storm; Remove Water
14	1308	*Pinus contorta latifolia*	Lodgepole Pine	36.8	7.0	fork	0.0	10.2	50	2.4	no ground disturbance, no stock piling, and no equipment inside the TPZ; March 16 Walk through	Protect	
14	1312	*Pinus contorta latifolia*	Lodgepole Pine	40.8	7.8	fork	0.4	10.2	50	3.0	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
14	1318	*Pinus contorta latifolia*	Lodgepole Pine	33.7	6.2		0.4	9.9	50	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
14	1319	*Pinus contorta latifolia*	Lodgepole Pine	30.3	5.0	forked with1320	0.5	13.2	40	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
14	1320	*Pinus contorta latifolia*	Lodgepole Pine	13.5	2.6	forked with 1319	0.5	13.2	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
14	1321	*Pinus contorta latifolia*	Lodgepole Pine	30.0	7.0	forked with 1320	0.5	13.2	40	1.8	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
14	1322	*Pinus contorta latifolia*	Lodgepole Pine	45.5	10.0	resinosis; forked	0.5	12.9	40	3.0	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
14	1323	*Pinus contorta latifolia*	Lodgepole Pine	38.5	8.4	forked; resinosis	0.1	11.4	30	2.4	Grading; keep grading out of TPZ; see T10 design for grading	Grading	New Cut & Fill
14	1324	*Populus jackii*	Northwest Poplar	92.2	10.0	scar possible basal decay	2.4	14.0	30	5.0	Move New Electrical Equipment out of TPZ, Directionally Drill New Electrical	Protect	New Cut & Fill, New Electrical, New Electrical Equipment
14	1326	*Populus jackii*	Northwest Poplar	50.8	7.0	exposed root roots	2.3	14.5	50	3.6	Abandon Electrical	Protect	Remove Electrical Line
14	1327	*Populus jackii*	Northwest Poplar	55.0	12.0	exposed root roots; 20 % dead crown	2.0	14.8	50	3.6	move new electrical north or directionally Drill New Electrical - see T4 design; Abandon Electrical	Protect	New Electrical, Remove Electrical Line
14	1328	*Populus jackii*	Northwest Poplar	50.0	8.0	lean; exposed root roots	2.4	15.4	50	3.0	Abandon Electrical to the south west	Protect	Remove Electrical Line
14	1329	*Populus jackii*	Northwest Poplar	33.4	4.0	lean; exposed root roots	1.5	9.6	50	2.4	Abandon Electrical to the east and north	Protect	Remove Electrical Line
14	1330	*Populus jackii*	Northwest Poplar	36.5	4.0	lean; joined with 1329	1.5	9.1	40	2.4	Abandon Electrical to the east	Protect	Remove Electrical Line
14	1331	*Populus jackii*	Northwest Poplar	33.0	4.2	lean; joined 1329	1.5	9.4	50	2.4	Abandon Electrical to the east	Protect	Remove Electrical Line
14	1337	*Ulmus americana*	American Elm	61.1	13.0	frost crack	3.9	10.7	60	4.2	abandon existing electrical	Protect	Remove Electrical Equipment
14	1338	*Ulmus americana*	American Elm	45.3	13.0	exposed root roots	7.0	17.7	60	3.0	Abandon Electrical to the west	Protect	Remove Electrical Line
14	1340	*Ulmus americana*	American Elm	37.7	10.4	frost crack; burl	4.0	9.9	50	2.4	abandon existing sanitation	Protect	Remove Sanitation
14	1341	*Fraxinus nigra*	Black Ash	47.3	12.0	frost crack scar 40 % dead crown	2.9	11.1	40	3.0	abandon existing sanitation; recheck crown condition and die back; option to remove with significant die back; March 16 Walk through and prune elms before March 31	Protect	New Sanitary, Remove Sanitation
14	1342	*Ulmus americana*	American Elm	57.3	14.5	exposed root; 5% dead crown	3.0	13.5	60	3.6	Abandon Storm; March 16 Walk through and prune elms before March 31	Protect	New Sanitary, Remove Storm

14	1343	*Ulmus americana*	American Elm	41.0	7.5	frost crack	4.2	16.6	50	3.0	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1344	*Ulmus americana*	American Elm	42.1	10.2		5.6	14.8	50	3.0	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1348	*Pinus contorta latifolia*	Lodgepole Pine	18.2	4.0		2.1	9.4	50	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1349	*Pinus contorta latifolia*	Lodgepole Pine	20.0	5.6	sparse crown; scar	2.5	9.9	40	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1350	*Pinus sylvestris*	Scotts Pine	23.7	4.2	possible woodpecker damage	2.5	7.0	50	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1356	*Pinus contorta latifolia*	Lodgepole Pine	16.1	3.6	scar	2.5	7.8	40	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1357	*Pinus contorta latifolia*	Lodgepole Pine	17.3	4.2	forked	2.1	8.1	40	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1358	*Pinus sylvestris*	Scotts Pine	23.8	5.8	bird damage; forked	2.0	7.8	40	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1359	*Picea pungens*	Blue Spruce	23.6	4.6	nest	2.3	10.4	50	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1361	*Picea glauca*	White Spruce	20.1	3.4	lean	2.8	10.9	40	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1362	*Picea glauca*	White Spruce	18.7	2.6	resinosis	2.3	11.5	40	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1366	*Picea glauca*	White Spruce	17.3	4.4		0.3	9.9	50	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1368	*Picea glauca*	White Spruce	27.0	2.2		1.7	13.3	50	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1369	*Picea glauca*	White Spruce	31.8	2.7		0.2	13.9	40	2.4	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1370	*Pinus contorta latifolia*	Lodgepole Pine	20.9	6.0		1.0	10.5	50	2.4	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1372	*Picea pungens*	Blue Spruce	31.2	5.8		0.2	15.5	40	2.4	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1384	*Ulmus americana*	American Elm	35.0	5.0		4.9	17.0	50	2.4	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1386	*Ulmus americana*	American Elm	36.6	6.0		4.1	12.6	50	2.4	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1388	*Picea glauca*	White Spruce	37.5	5.8	exposed root	0.2	10.7	50	2.4	case bore new sanitary or follow trench box T6 design	Protect	New Sanitary
14	1398	*Acer platanoides*	Norway Maple	14.2	3.8	scars	1.9	7.1	50	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1438	*Picea glauca*	White Spruce	39.0	6.6	basal scar	0.2	16.6	60	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_SUP; New_Water; Remove Storm; Remove Water
14	1441	*Picea glauca*	White Spruce	36.5	6.4	lean	0.0	17.4	50	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_SUP; New_Water; Remove Storm; Remove Water
14	1442	*Picea glauca*	White Spruce	37.8	6.4	lean; forked top	0.0	17.3	50	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_SUP; New_Water; Remove Storm; Remove Water
14	1445	*Picea glauca*	White Spruce	40.0	7.2	in wooden planter	1.7	12.8	50	2.4	protect tree that is in planter; use hand tools to remove wooden planter	Protect	New SUP
14	1446	*Picea pungens*	Blue Spruce	39.6	9.6	in wooden planter	0.5	12.7	60	2.4	protect tree that is in planter; use hand tools to remove wooden planter	Protect	Remove Storm
14	1447	*Pinus contorta latifolia*	Lodgepole Pine	26.0	8.4	resinosis	0.2	10.0	50	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1449	*Pinus contorta latifolia*	Lodgepole Pine	32.3	7.2	slight lean	1.3	10.3	50	2.4	Directionally Drill New Electrical - see T4 design	Protect	New Electrical
14	1450	*Ulmus americana*	American Elm	43.5	11.2	sparse crown	3.2	14.5	60	3.0	move new light install outside the TPZ and follow T8b design	Protect	New Electrical Lights; New_SUP
14	1451	*Ulmus americana*	American Elm	53.5	24.0	exposed roots; lean; mid crown scar	5.0	13.1	50	3.6	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1452	*Pinus contorta latifolia*	Lodgepole Pine	25.8	6.4	60% dead crown; bird nest; resinosis	0.4	12.7	50	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1453	*Pinus contorta latifolia*	Lodgepole Pine	20.2	6.4	forked top	1.5	7.4	40	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1455	*Pinus contorta latifolia*	Lodgepole Pine	29.0	7.8	resinosis; basal scar	0.5	10.6	50	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_SUP; New_Water; Remove Storm; Remove Water
14	1456	*Pinus contorta latifolia*	Lodgepole Pine	34.8	7.2		0.4	10.8	60	2.4	abandon existing storm; abandon existing water	Protect	New_SUP; New_Water; Remove Storm; Remove Water
14	1460	*Pinus contorta latifolia*	Lodgepole Pine	40.0	8.4	forked above dbh	1.4	12.4	40	2.4	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1462	*Pinus contorta latifolia*	Lodgepole Pine	24.4	6.8		0.4	9.4	50	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1463	*Ulmus americana*	American Elm	47.0	12.6	5% dead crown; frost crack	4.4	12.1	50	3.0	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1464	*Quercus alba*	White Oak	31.0	10.4		2.2	11.7	60	2.4	Abandon Storm to the north west	Protect	New Electrical, Remove Storm
14	1465	*Quercus alba*	White Oak	28.6	13.6	20% dead crown	2.0	13.0	50	1.8	Abandon Storm; Directionally Drill New Electrical, Move Light out of TPZ to the north	Protect	New Electrical, New Electrical Lights, Remove Storm
14	1466	*Quercus alba*	White Oak	34.0	14.0		1.3	13.3	50	2.4	Abandon Storm; Directionally Drill New Electrical, Move Light out of TPZ to the west	Protect	New Electrical, New Electrical Lights, Remove Storm
14	1467	*Ulmus americana*	American Elm	42.4	7.2	exposed root; frost crack; one sided crown	3.3	13.8	60	3.0	Abandon Storm	Protect	New_SUP, Remove Storm
14	1468	*Ulmus americana*	American Elm	50.7	18.8	exposed roots; frost crack	3.5	14.4	60	3.6	keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design; abandon existing storm	Protect	New Cut & Fill; New Storm; New_SUP; Remove Storm; REMOVE_CBAS_ManHole
14	1469	*Ulmus americana*	American Elm	38.0	12.0	minor crook	5.8	12.4	50	2.4	keep SUP out of TPZ; use T7 design	Protect	New SUP
14	1470	*Ulmus americana*	American Elm	60.7	10.0		6.2	17.8	60	4.2	leave concrete planter walls up	Protect	New Electrical Lines; New_SUP; Remove Storm
14	1471	*Ulmus americana*	American Elm	44.5	10.0	frost crack	4.3	15.8	50	3.0	leave concrete planter walls up	Protect	New Electrical Lines; New Electrical Lights; New_SUP; Remove Storm
14	1472	*Ulmus americana*	American Elm	47.1	18.0	cavity	4.6	13.1	30	3.0	leave concrete planter walls up	Protect	New SUP
14	1473	*Ulmus americana*	American Elm	42.9	12.0	frost crack	3.5	15.6	50	3.0	leave concrete planter walls up	Protect	New SUP

14	1474	*Ulmus americana*	American Elm	37.3	10.0	frost crack	5.0	15.2	50	2.4	leave concrete planter walls up	Protect	New SUP
14	1475	*Ulmus americana*	American Elm	49.6	12.0	frost crack	5.1	13.9	50	3.0	leave concrete planter walls up	Protect	New SUP
14	1476	*Ulmus americana*	American Elm	45.9	12.0	frost crack	4.3	15.3	50	3.0	leave concrete planter walls up	Protect	New SUP
14	1477	*Pinus contorta latifolia*	Lodgepole Pine	27.5	7.8	exposed root	2.5	12.6	50	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_SUP; New_Water; Remove Storm; Remove Water
14	1478	*Pinus contorta latifolia*	Lodgepole Pine	33.1	6.6	joined with next 3 trees; forked	1.0	12.8	40	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_SUP; New_Water; Remove Storm; Remove Water
14	1479	*Pinus contorta latifolia*	Lodgepole Pine	18.5	5.0	forked	1.0	9.0	40	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_SUP; New_Water; Remove Storm; Remove Water
14	1480	*Pinus contorta latifolia*	Lodgepole Pine	12.3	2.0	forked	1.0	5.3	40	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_SUP; New_Water; Remove Storm; Remove Water
14	1481	*Pinus contorta latifolia*	Lodgepole Pine	20.4	4.0	forked	1.0	7.5	40	1.8	abandon existing storm; abandon existing water	Protect	New_Water; Remove Storm; Remove Water
14	1483	*Populus jackii*	Northwest Poplar	57.8	12.0	frost crack exposed root roots	2.0	18.1	5	3.6	abandon sanitary	Protect	New Cut & Fill, Remove Sanitation
14	1631	*Picea glauca*	White Spruce	43.6	6.4		0.2	14.5	40	3.0	Abandon Electrical to the west	Protect	Remove Electrical Line
14	1632	*Picea glauca*	White Spruce	43.3	8.2		0.2	17.4	50	3.0	move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Electrical Lines; Remove Electrical Line; Remove ROAD-CURB
14	1633	*Picea glauca*	White Spruce	44.1	6.5		0.2	17.2	50	3.0	move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design; abandon existing electrical; follow T8a design for light removal	Protect	New Electrical Lines; New Electrical Lights; Remove Electrical Lights; Remove Electrical Line
14	1635	*Picea glauca*	White Spruce	51.5	8.4		0.2	14.5	60	3.6	no ground disturbance, no stock piling, and no equipment inside the TPZ	Protect	
14	1636	*Picea glauca*	White Spruce	46.4	5.4	lean	0.3	17.7	50	3.0	keep grading out of TPZ - see T10 design for grading; abandon existing water	Protect	New Cut & Fill; New_SUP; Remove Water
14	1637	*Fraxinus pennsylvanica*	Green Ash	39.2	13.4	frost cracks; 30% dead crown	2.9	13.5	50	2.4	directional drill new electrical - see T4 design; abandon existing electrical; cut and lift curb sections - do no drag concrete over roots	Protect	New Electrical, Remove Electrical Line, Remove ROAD-CURB
14	1640	*Fraxinus pennsylvanica*	Green Ash	49.0	14.2	frost cracks; 15% dead crown; scar	2.1	15.1	40	3.0	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design; case bore new storm or follow trench box T6 design; abandon existing electrical; follow T8a design for light removal	Protect	New Cut & Fill; New Electrical Lines; New Electrical Lights; New Storm; New_CBAS_MANHOLE; New_Roads_Curb; Remove Electrical Lights; Remove Electrical Line; Remove ROAD-CURB; REMOVE_CBAS_ManHole
14	10005	*Picea glauca*	White Spruce	20.4	1.7		2.3	11.5	40	1.8	keep SUP out of TPZ; use T7 design	Protect	New SUP
15	169	*Populus balsamifera*	Balsam Poplar	6.8	3.2	severe lean; galls	1.9	3.5	20	1.2	abandon storm	Protect	Remove Storm
15	170	*Populus balsamifera*	Balsam Poplar	13.3	4.6	lean; galls	1.9	11.2	30	1.8	abandon storm	Protect	Remove Storm
15	171	*Populus balsamifera*	Balsam Poplar	12.8	4.4	lean; galls	0.8	8.2	30	1.8	abandon storm	Protect	Remove Storm
15	335	*Picea pungens*	Blue Spruce	11.8	0.0	deformed crown; wounds at base;	0.0	4.3	20	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	Remove Storm
15	336	*Populus balsamifera*	Balsam Poplar	30.7	5.2	lean; galls; asymmetric crown	1.8	12.2	50	2.4	no ground disturbance, no stock piling, and no equipment inside the TPZ	Protect	
15	1828	*Betula pendula*	European White Birch	35.1	6.0	frost crack	1.6	13.7	60	2.4	abandon electrical	Protect	Remove Electrical Line
15	1830	*Picea pungens*	Blue Spruce	44.0	6.2	exp roots; resinosis	2.7	15.7	50	3.0	abandon electrical	Protect	Remove Electrical Line
15	1831	*Picea pungens*	Blue Spruce	16.3	3.0	memorial tree	0.9	6.8	50	1.8	Commemorative Tree	Protect	Commemorative Tree
15	1834	*Pinus contorta latifolia*	Lodgepole Pine	37.3	8.0	fork	0.2	12.7	50	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New_SUP; Remove Electrical Line
15	1835	*Picea pungens*	Blue Spruce	46.5	7.4	resinosis; exp roots	0.0	16.7	50	3.0	abandon existing electrical; follow T8a design for light removal	Protect	Remove Electrical Lights; Remove Electrical Line
15	1836	*Ulmus americana*	American Elm	52.3	4.7	exposed roots; basal swelling; burl	4.3	12.3	50	3.6	keep grading out of TPZ - see T10 design for grading; abandon existing electrical	Protect	New Cut & Fill; New_SUP; Remove Electrical Line
15	1837	*Aesculus glabra*	Ohio Buckeye	7.8	2.2	memorial tree	1.3	3.3	50	1.2	Commemorative Tree	Protect	Commemorative Tree
15	1916	*Picea pungens*	Blue Spruce	42.3	6.4	exposed roots; lean	0.1	16.5	50	3.0	abandon electrical	Protect	Remove Electrical Line
15	1917	*Picea pungens*	Blue Spruce	37.2	6.8	exposed roots; lean	0.0	15.2	50	2.4	abandon electrical	Protect	Remove Electrical Line
15	1918	*Picea pungens*	Blue Spruce	42.5	6.0	lean; fork	0.0	15.8	40	3.0	abandon electrical	Protect	Remove Electrical Line
15	9021	*Populus balsamifera*	Balsam Poplar	16.2	4.8	lean towards gully	0.3	11.7	40	1.8	abandon storm	Protect	Remove Storm
15	9051	*Salix alba*	White Willow	52.0	12.2	forked with 9052 9053 basal cavity; lean	1.2	11.0	20	3.6	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_Roads_Curb, Remove Electrical Line
15	9052	*Salix alba*	White Willow	47.0	12.2	forked with 9051 9053; lean; large defect & cavity	1.9	10.6	30	3.0	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, Remove Electrical Line

15	9053	*Salix alba*	White Willow	34.4	12.2	forked with 9052 and 9051	1.9	10.3	30	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Electrical, Remove Electrical Line
15	9054	*Salix alba*	White Willow	34.0	12.2	forked with 9052; severe lean	1.8	9.5	30	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Electrical, Remove Electrical Line
15	12002	*Picea pungens*	Blue Spruce	31.8	8.0	Need to double check; forked twice; resinosis	1.4	14.7	40	2.4	abandon existing storm; case bore new storm	Protect	New Storm, Remove Storm
15	12006	*Salix alba*	White Willow	45.0	2.9		3.8	13.4	50	3.0	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lines; New_Roads_Curb; Remove Electrical Line; Remove ROAD-CURB; Remove Storm; Remove Water
15	12007	*Salix alba*	White Willow	36.8	2.9		3.8	13.4	50	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lines; New_Roads_Curb; Remove Electrical Line; Remove Storm; Remove Water
15	12008	*Salix alba*	White Willow	32.3	2.9		3.8	13.4	50	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lines; New_Roads_Curb; Remove Electrical Line; Remove ROAD-CURB; Remove Storm; Remove Water
15	13002	*Salix alba*	White Willow	86.0	10.2	15 dead crown , frost crack	2.6	13.1	50	5.0	Grading; keep grading out of TPZ; see T10 design for grading; March 23 Walk through	Grading	New Cut & Fill; New Electrical Lines; Remove Electrical Line; Remove Storm; Remove Water
16	1713	*Aesculus glabra*	Ohio Buckeye	9.3	3.0	memorial tree scar	1.5	4.0	40	1.2	Commemorative Tree	Protect	Commemorative Tree
16	1720	*Pinus ponderosa*	Ponderosa Pine	37.9	9.4	fork scar	2.2	16.4	60	2.4	abandon existing sanitary	Protect	Remove Sanitation
16	1752	*Larix sibirica*	Siberian Larch	42.8	10.0	scar ants cavity	2.1	15.0	40	3.0	Tree retention not viable due to severity and quantity of construction conflicts	Remove	Remove Sanitation
16	1753	*Larix sibirica*	Siberian Larch	24.5	4.8	crook	0.2	9.4	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	Remove Sanitation
16	1756	*Larix sibirica*	Siberian Larch	32.2	6.8	crook	0.4	14.6	50	2.4	abandon existing sanitary	Protect	Remove Sanitation
16	1757	*Larix sibirica*	Siberian Larch	54.9	8.6	forked	0.2	15.9	50	3.6	abandon existing sanitary	Protect	Remove Sanitation
16	1781	*Prunus mackii*	Amur Cherry	12.2	5.8	memorial tree basal scar	1.3	8.9	50	1.8	Commemorative Tree	Protect	Commemorative Tree
16	1791	*Acer platanoides*	Norway Maple	44.3	8.6	cavity deformed top	2.1	8.0	30	3.0	move new SUP outside of TPZ	Protect	New Cut & Fill, New_SUP
16	1802	*Populus jackii*	Northwest Poplar	73.0	10.0	exp roots scar frost crack	1.9	12.5	40	4.8	move new electrical equipment and foundations outside of the TPZ; abandon existing storm; abandon existing water	Protect	New Electrical Equipment; New_Water; Remove Storm; Remove Water
16	1804	*Populus jackii*	Northwest Poplar	21.0	6.0	scar	2.8	10.7	50	1.8	no ground disturbance, no stock piling, and no equipment inside the TPZ	Protect	
16	1805	*Picea pungens*	Blue Spruce	33.3	6.0		0.0	12.5	60	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_Water, Remove Storm
16	1823	*Picea pungens*	Blue Spruce	20.3	3.0	memorial tree	0.3	9.4	50	1.8	Commemorative Tree	Protect	Commemorative Tree
16	1824	*Pinus banksiana*	Jack Pine	17.4	4.8	memorial tree fork	0.3	6.9	50	1.8	Commemorative Tree	Protect	Commemorative Tree
16	1825	*Picea pungens*	Blue Spruce	14.3	2.6	memorial tree crook	0.2	6.4	50	1.8	Commemorative Tree	Protect	Commemorative Tree
16	1826	*Quercus alba*	White Oak	4.9	1.8	memorial tree	1.2	3.5	40	1.2	Commemorative Tree	Protect	Commemorative Tree
16	1827	*Picea pungens*	Blue Spruce	25.7	4.8	memorial tree	0.1	10.0	50	1.8	Commemorative Tree	Protect	Commemorative Tree
17	1436	*Populus jackii*	Northwest Poplar	80.2	22.0	open wound	2.4	19.0	40	5.0	April 5 Walk through; Prune - 6m over road and balance after	Protect	New Cut & Fill, New Electrical Lights, New Storm, New_CBAS_MANHOLE, New_Roads_Curb, New_SUP, New_Water, Remove ROAD-CURB, Remove Storm
17	1437	*Picea glauca*	White Spruce	26.8	5.2		0.0	16.7	50	1.8	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; case bore new storm or follow trench box T6 design; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lights; New Storm; New_CBAS_MANHOLE; New_SUP; New_Water; Remove Storm; Remove Water
17	1603	*Ulmus americana*	American Elm	30.2	7.6	crook	5.7	8.4	50	2.4	abandon electrical; move light outside TPZ - see T8b design; March 16 Walk through	Protect	New Cut & Fill, New Electrical, New_Roads_Curb, Remove Electrical Line, Remove ROAD-CURB
17	1605	*Ulmus americana*	American Elm	28.5	7.2	sweep	5.3	13.2	50	1.8	case bore new sanitary; directionally drill new electrical; March 16 Walk through	Protect	New Cut & Fill, New Electrical, New Sanitary
17	1606	*Ulmus americana*	American Elm	32.2	5.6	fork	4.4	10.2	50	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing electrical	Protect	New Cut & Fill; New_Roads_Curb; Remove Electrical Line; Remove ROAD-CURB
17	1607	*Ulmus americana*	American Elm	22.9	5.4	sparse crown; 5% dead crown	4.1	9.2	40	1.8	keep grading out of TPZ - see T10 design for grading	Protect	New Cut & Fill; New Electrical
17	1608	*Ulmus americana*	American Elm	24.7	5.2	basal swelling; 5-10% dead crown	4.4	8.4	50	1.8	abandon electrical	Protect	New Cut & Fill, Remove Electrical Line
17	1609	*Ulmus americana*	American Elm	25.2	5.4	basal scar; 5% dead crown	3.4	9.5	50	1.8	directionally drill new electrical	Protect	New Cut & Fill, New Electrical

17	1610	*Ulmus americana*	American Elm	31.4	5.2	5% dead crown	6.3	11.3	60	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical Lights, New_Roads_Curb, Remove Electrical Lights, Remove Electrical Line, Remove ROAD-CURB, Remove Storm, REMOVE_CBAS_ManHole
17	1611	*Ulmus americana*	American Elm	31.0	7.0	5% dead crown	5.4	9.5	50	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new storm or follow trench box T6 design; abandon existing storm	Protect	New Cut & Fill; New Electrical Lines; New Storm; Remove ROAD-CURB; Remove Storm
17	1612	*Ulmus americana*	American Elm	27.9	8.0	10% dead crown	3.0	8.4	50	1.8	March 16 Walk through; Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Storm, New_CBAS_MANHOLE, New_Roads_Curb, Remove Electrical Line
17	1613	*Ulmus americana*	American Elm	28.0	6.8	basal scar	4.4	8.4	40	1.8	directionally drill new electrical	Protect	New Cut & Fill, New Electrical
17	1614	*Ulmus americana*	American Elm	32.3	9.6	sweep; lean; non-uniform crown	4.5	10.2	40	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing electrical	Protect	New Cut & Fill; New_Roads_Curb; Remove Electrical Line; Remove ROAD-CURB
17	1615	*Ulmus americana*	American Elm	32.3	8.8	basal swelling; lean	6.3	11.3	40	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Cut & Fill; New Electrical Lines; New_Roads_Curb; Remove Electrical Line; Remove ROAD-CURB
17	1616	*Ulmus americana*	American Elm	35.0	9.2	frost crack; 10% dead crown	4.0	9.7	40	2.4	keep grading out of TPZ - see T10 design for grading; abandon existing electrical	Protect	New Cut & Fill; New_Roads_Curb; Remove Electrical Line
17	1617	*Ulmus americana*	American Elm	30.5	7.4	5% dead crown	5.1	11.6	50	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling	Protect	New Cut & Fill; New Electrical Lines; Remove ROAD-CURB
17	1618	*Ulmus americana*	American Elm	32.7	8.2	exposed roots; burl	4.8	10.2	50	2.4	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; follow T8a design for light removal	Protect	New Cut & Fill; New Electrical Lights; New_Roads_Curb; Remove Electrical Lights; Remove Electrical Line; Remove ROAD-CURB
17	1619	*Ulmus americana*	American Elm	35.8	8.6	frost crack	7.2	12.8	50	2.4	move light out of TPZ; cut and lift curb sections; follow T2 design; abandon electrical; prune as required for light removal	Protect	New Cut & Fill, New Electrical, New Electrical Lights, Remove Electrical Line, Remove ROAD-CURB
17	1620	*Ulmus americana*	American Elm	42.2	5.3	5% dead crown	4.2	13.5	50	3.0	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling	Protect	New Cut & Fill; New Electrical Lines; New_Roads_Curb; Remove ROAD-CURB
17	1623	*Acer negundo*	Manitoba maple	7.8	5.8		0.2	6.2	40	1.2	move new light install outside the TPZ and follow T8b design; abandon existing electrical; follow T8a design for light removal	Protect	New Electrical Lights; Remove Electrical Lights; Remove Electrical Line
17	1624	*Picea glauca*	White Spruce	35.3	6.8		0.3	16.4	50	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical Lights, New Storm, New_CBAS_MANHOLE, New_Roads_Curb, Remove Electrical Lights, Remove Electrical Line, Remove ROAD-CURB
17	1625	*Picea pungens*	Blue Spruce	27.7	5.4		1.6	14.1	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Electrical Lights, New Storm, New_CBAS_MANHOLE, Remove Electrical Lights, Remove Electrical Line
17	1626	*Picea pungens*	Blue Spruce	32.8	5.6	crook	1.0	14.8	50	2.4	keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design; abandon existing electrical	Protect	New Cut & Fill; New Storm; New_Roads_Curb; Remove Electrical Line; Remove ROAD-CURB
17	1627	*Picea pungens*	Blue Spruce	34.4	6.3	30% dead crown	1.4	12.0	30	2.4	move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical	Protect	New Electrical Lines; Remove Electrical Line; Remove ROAD-CURB
17	1628	*Picea glauca*	White Spruce	35.0	7.0	sweep and lean	0.0	15.3	40	2.4	directionally drill new electrical	Protect	New Electrical
17	1629	*Prunus mackii*	Amur Cherry	10.2	4.0	memorial tree	1.4	5.9	50	1.8	Commemorative Tree	Protect	Commemorative Tree
17	1630	*Acer negundo*	Manitoba maple	51.0	12.6	cut basal roots; pruned; mid-basal scar	2.1	9.9	50	3.6	abandon electrical	Protect	Remove Electrical Line
17	9063	*Acer negundo*	Manitoba maple	60.5	16.5	10% dead crown	2.1	10.6	40	4.2	directionally drill new water; move sup outside TPZ; abandon existing water; no surface disturbance inside TPZ	Protect	New Cut & Fill, New_SUP
18	237	*Populus tremuloides*	Trembling Aspen	24.8	3.8	bridge corner; crook	3.3	14.4	50	1.8	move new electrical line out of TPZ or follow T4 design for directional drilling; keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical	Protect	New Cut & Fill, New Electrical
18	1600	*Ulmus americana*	American Elm	32.2	6.2	burls; sparse crown	5.1	11.7	50	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new storm or follow trench box T6 design; abandon existing electrical; abandon existing storm	Protect	New Cut & Fill; New Electrical Lines; New Storm; New_Roads_Curb; Remove Electrical Line; Remove Storm; REMOVE_CBAS_ManHole

18	1601	*Ulmus americana*	American Elm	31.2	7.6	codon	6.6	11.7	50	2.4	keep grading out of TPZ - see T10 design for grading; move new electrical equipment and foundations outside of the TPZ; abandon existing electrical	Protect	New Cut & Fill; New Electrical Equipment; New_Roads_Curb; Remove Electrical Line; Remove ROAD-CURB
18	1671	*Acer platanoides*	Norway Maple	35.2	7.2	multiple basal scar.	1.7	9.4	40	2.4	keep grading out of TPZ - see T10 design for grading	Protect	New Cut & Fill; New_SUP
18	1672	*Acer platanoides*	Norway Maple	55.2	14.2	scar; 10% dead crown; mid crown scar; burl; exposed roots	3.7	16.6	40	3.6	abandon sanitary	Protect	Remove Sanitation
18	1673	*Picea pungens*	Blue Spruce	24.4	3.6	forked; asymmetric	0.3	12.2	50	1.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling	Protect	New Cut & Fill; New Electrical Lines; New_SUP
18	1674	*Picea pungens*	Blue Spruce	26.0	4.2		0.3	13.3	50	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; Remove Electrical Line; Remove Storm; Remove Water
18	1675	*Picea pungens*	Blue Spruce	27.8	3.8	basal scar	0.3	13.8	50	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New_SUP; Remove Electrical Line; Remove Storm; Remove Water
18	3088	*Populus tremuloides*	Trembling Aspen	17.3	4.0	crook. leaf roller	1.0	9.6	50	1.8	abandon existing water	Protect	Remove Water
18	3090	*Thuja occidentalis*	Eastern White Cedar	17.2	2.8	thuja occidentalis (upright); lean; fork	0.8	10.1	40	1.8	keep grading out of TPZ - see T10 design for grading	Grading	New Cut & Fill
18	3091	*Thuja occidentalis*	Eastern White Cedar	16.2	2.0	sweep	0.6	10.8	50	1.8	follow T7 Air and Hand Tools for path reconstruction; prune roots > 2.5 cms	Protect	New Cut & Fill, New_SUP
18	3092	*Populus tremuloides*	Trembling Aspen	21.3	7.6	lean; crook.	3.1	10.2	40	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New_SUP
18	3093	*Populus tremuloides*	Trembling Aspen	13.8	5.4	40% mortality; lean;	3.7	8.5	30	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New_SUP
18	3094	*Populus tremuloides*	Trembling Aspen	9.7	4.0	suppressed	1.6	4.0	30	1.2	Tree retention not viable due to severity and quantity of construction conflicts	Remove	
18	3096	*Picea pungens*	Blue Spruce	31.1	7.8	lean; nest; basal scar;	0.5	13.8	40	2.4	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_SUP, Remove Electrical Line, Remove Storm
18	3099	*Populus tremuloides*	Trembling Aspen	18.8	4.6	lean; crook.; frost crack	2.3	6.9	30	1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Electrical, New_SUP
18	14005	*Acer saccharinum*	Silver Maple	5.3	1.6	memorial tree	1.4	3.7	40	1.2	Commemorative Tree	Protect	Commemorative Tree
19	240	*Ulmus americana*	American Elm	76.7	14.0		6.0	16.3	60	4.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lines; New_SUP; Remove Storm; Remove Water
19	1602	*Ulmus americana*	American Elm	29.3	6.8	5% dead crown	7.2	9.1	40	1.8	keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; follow T8a design for light removal	Protect	New Cut & Fill; New Electrical Lights; Remove Electrical Lights; Remove Electrical Line
19	1604	*Ulmus americana*	American Elm	23.9	4.0	scar at dbh	1.8	6.8	40	1.8	March 16 Walk through; Tree retention not viable due to severity and quantity of construction conflicts	Remove	New Cut & Fill, New Sanitary, New_Water, Remove Electrical Line, Remove Storm
19	1676	*Picea pungens*	Blue Spruce	32.8	5.6	exposed root	0.5	13.7	60	2.4	abandon existing electrical; abandon existing storm; abandon existing water	Protect	Remove Electrical Line; Remove Storm; Remove Water
19	1677	*Acer platanoides*	Norway Maple	32.3	6.2		1.8	7.5	50	2.4	abandon electrical; abandon water	Protect	Remove Storm
19	1678	*Picea pungens*	Blue Spruce	41.7	7.2	basal scar; exposed roots	0.9	16.8	60	3.0	abandon existing storm; abandon existing water	Protect	New_Water; Remove Storm; Remove Water
19	1679	*Picea glauca*	White Spruce	45.3	8.2	lean; in shrub bed; basal scar	0.4	17.4	50	3.0	abandon water; March 16 Walk through	Protect	New_Water, Remove Storm
19	1680	*Ulmus americana*	American Elm	71.2	14.2	sparse crown; basal scar; lean	4.9	15.4	60	4.8	keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical; abandon existing storm; abandon existing water	Protect	New Cut & Fill; New Electrical Lines; New_SUP; Remove Electrical Line; Remove Storm; Remove Water
19	1681	*Picea pungens*	Blue Spruce	47.5	8.0	lean; exposed roots	0.2	13.5	60	3.0	move new electrical line out of TPZ or follow T4 design for directional drilling	Protect	New Electrical Lines
19	3069	*Populus tremuloides*	Trembling Aspen	8.3	2.2		1.2	5.5	40	1.2	keep grading out of TPZ - see T10 design for grading; abandon existing water	Protect	New Cut & Fill; New_SUP; Remove Water
19	3070	*Populus tremuloides*	Trembling Aspen	9.8	1.8	lean	1.9	6.5	40	1.2	keep grading out of TPZ - see T10 design for grading; abandon existing water	Protect	New Cut & Fill; New_SUP; Remove Water
19	3071	*Populus tremuloides*	Trembling Aspen	7.1	0.9		1.7	7.8	40	1.2	keep grading out of TPZ - see T10 design for grading; abandon existing water	Protect	New Cut & Fill; New_SUP; Remove Water
19	3072	*Populus tremuloides*	Trembling Aspen	9.2	1.0		3.7	8.3	40	1.2	keep grading out of TPZ - see T10 design for grading; abandon existing water	Protect	New Cut & Fill; New_SUP; Remove Water
19	3073	*Populus tremuloides*	Trembling Aspen	11.2	1.3		2.4	7.6	40	1.8	keep grading out of TPZ - see T10 design for grading; abandon existing water	Protect	New Cut & Fill; New_SUP; Remove Water
19	3074	*Acer negundo*	Manitoba maple	8.2	2.5		2.0	4.9	50	1.2	keep grading out of TPZ - see T10 design for grading; abandon existing water	Protect	New Cut & Fill; New_SUP; Remove Water

19	3077	*Abies balsamea*	Balsam Fir	38.5	6.2	forked top. frost crack	0.4	16.2	40	2.4	Abandon Water; Directionally drill New Electrical - see T4 design	Protect	New Electrical
19	3078	*Abies balsamea*	Balsam Fir	30.2	3.6	frost crack. basal scar	2.4	15.8	40	2.4	abandon existing storm	Protect	Remove Storm
19	3079	*Abies balsamea*	Balsam Fir	32.8	4.0		0.0	16.0	30	2.4	abandon storm	Protect	Remove Storm
19	3080	*Abies balsamea*	Balsam Fir	30.0	4.8	resinosis. basal scar; frost crack; 30% dead crown	1.7	11.4	40	1.8	abandon existing electrical; abandon existing storm	Protect	Remove Electrical Line; Remove Storm
19	3081	*Abies balsamea*	Balsam Fir	30.0	6.0	basal scar;	1.6	11.6	50	1.8	abandon existing storm	Protect	Remove Storm
19	3082	*Abies balsamea*	Balsam Fir	27.2	3.4	resinosis; lean; 5 percent dead crown; basal scar; standing Dead*2023				1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	Remove Storm
19	3084	*Abies balsamea*	Balsam Fir	39.0	6.4	exp roots; lean;	2.2	16.1	50	2.4	abandon existing electrical; abandon existing storm	Protect	Remove Electrical Line; Remove Storm
19	3085	*Abies balsamea*	Balsam Fir	29.8	5.6	scar; resinosis	1.6	15.4	50	1.8	abandon electrical	Protect	Remove Electrical Line
19	3086	*Picea pungens*	Blue Spruce	51.7	9.0	canker and scar.	1.9	15.6	60	3.6	abandon existing storm	Protect	Remove Storm
19	3087	*Ulmus americana*	American Elm	63.5	16.4	exp root;	5.3	12.8	50	4.2	abandon storm	Protect	New Electrical
14E	1641	*Picea glauca*	White Spruce	16.6	0.0	standing dead				1.8	Tree retention not viable due to severity and quantity of construction conflicts	Remove	
14E	1642	*Picea glauca*	White Spruce	37.3	7.0		0.0	15.1	50	2.4	abandon existing water	Protect	Remove Water

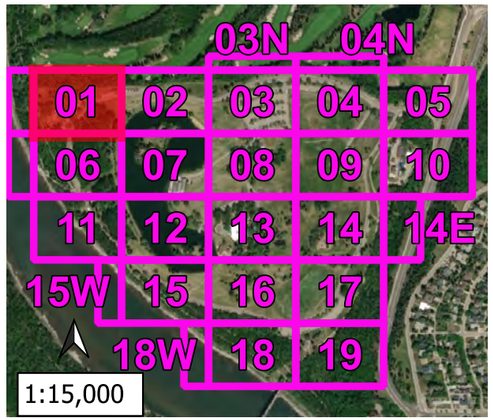
Table 1: Meaning (description) of final tree condition

Percent	Description
100%	Perfect tree or specimen quality
90%	Excellent tree
80%	Very Good tree
70%	Above Average tree
60%	Good or Average tree
50%	Below Average tree
40%	Fair tree
30%	Poor tree
20%	Very poor tree

Appendix 4. Overview Maps

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 1

(WILLIAM HAWRELAK PARK REHABILITATION)



- ☆ Commemorative Trees
- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- Natural Area Impacted
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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Tree 1994 - keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing electrical

Trees 1995 & 1998 - keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design; abandon existing electrical; abandon existing storm; abandon existing water

Tree 1996 - directional drill for new water - see T4 design; cut and lift curb sections - see T2 design; abandon CB - see T9a

Tree 1997 – keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing storm; abandon existing water

Tree 907 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new sanitary or follow trench box T6 design; abandon existing electrical; abandon existing storm; abandon existing water

Tree 908 - case bore new sanitary or follow trench box T6 design; abandon existing electrical; abandon existing storm; abandon existing water

Trees 938, 940 & 941 - directionally drill new electrical

Tree 9031 - abandon existing utilities, lift curb, directionally drill new electrical; prune for clearence

Install TPZ fencing tight to curb interface

Tree 1020 - move new electrical line out of TPZ or follow T4 design for directional drilling

Tree 1021 - move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design

Tree 902 - move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design; abandon existing electrical

Tree 903 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Tree 905 - move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Tree 910 - move new light install outside the TPZ and follow T8b design; case bore new storm or follow trench box T6 design; abandon existing storm

Tree 911 - case bore new storm or follow trench box T6 design; abandon existing storm

Tree 528 - case bore new storm or follow trench box T6 design; abandon existing storm

Tree 906 - *** DISCUSS WITH COE*** topdress existing path; no compaction or excavation of roots in TPZ; abandon existing electrical; directionally drill new electrical; cut curb and lift do not drag; prune roots > 2.5 cms;

Trees 1971 & 1973 - if unable to move electrical north then directional drill north of trees ; see T4 design

Tree 1973 - move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design

Tree 1972 - no ground disturbance, no stock piling, and no equipment inside the TPZ

Tree 1977 - keep grading out of TPZ; see T10 design for grading

Tree 1980 - follow city of Edmonton's instructions as per walk through

44.82 (m2)

282.09 (m2)

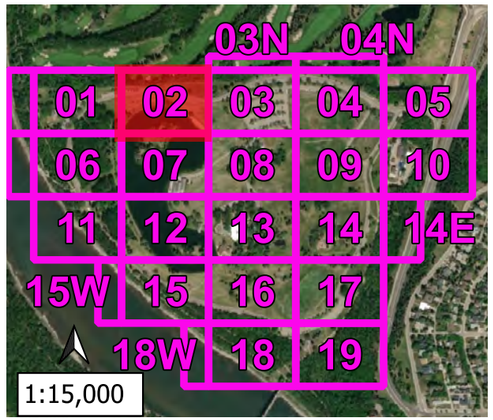
01W 01 02 06W 07

*DISCLAIMER: The analysis of above and below ground disturbances to open space trees and natural areas was conducted using various cad (.dxf) files for both shallow and deep utilities. These files were provided to UrbFor Consulting Ltd. by Chandos Construction Ltd. from January through to March 2023. Any recent changes to the designs of these utilities may not be reflected in this map and will be captured through regularly scheduled field walk throughs with the City of Edmonton Urban Foresters.

Version: 202304181950

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 2

(WILLIAM HAWRELAK PARK REHABILITATION)



- Commemorative Trees
- Trees to be Protected
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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Tree 1032 - move new electrical out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Tree 5012 - cut concrete foundation below grade; do not remove concrete form; back fill with top soil and sod for existing electrical equipment

Trees 1936, 1939, 1940, 1942 & 10001 - commemorative trees

Tree 1948 - abandon existing water; abandon existing storm

Trees 1941, 1944, 1945, 1946, 1947, 1949, 1951, 1952, 2100 & 2102 - abandon existing electrical

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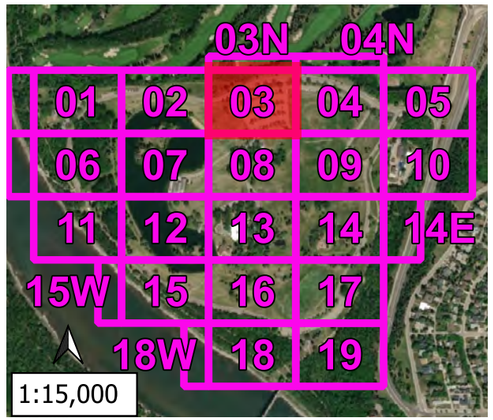
Version: 202304181952

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 3

(WILLIAM HAWRELAK PARK REHABILITATION)



- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- Natural Area Impacted
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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Tree 1035 - move electrical equipment out of TPZ

Tree 1037 - directionally drill new electrical

Trees 1039 - move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Trees 5005, 5006 & 5007 - save with trench box install

Tree 1044 - abandon electrical; directionally drill new electrical; move SUP out of TPZ

Tree 1045 - directionally drill new electrical; see T4 design

Tree 1046 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

All Islands - cut curb and lift don't drag over roots; maintain existing grade in islands; prune roots > 2.5 cms

Tree 1000 - keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design

Trees 978 & 979
---
carefully hydrovac around the catch basin/man hole, then backfill and level off. Concrete catch basin/man hole can be broken up inward and chunks pulled out by hand or hydrovac and lift out

Tree 1967 - abandon existing electrical; abandon existing storm; abandon existing water

Tree 1964 - abandon existing storm

Tree 1966 - move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design; abandon existing electrical; follow T8a design for light removal; abandon existing storm; abandon existing water

Trees 1965 & 1968 - abandon existing storm; abandon existing water

Tree 1960 - abandon existing storm

Tree 1969 - move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical; abandon existing storm; abandon existing water

Tree 1955 - abandon sanitation

Tree 1959 - move new light install outside the TPZ and follow T8b design; abandon existing storm

Tree 1962 - abandon electrical

Tree 1963 - abandon existing electrical; abandon existing storm; abandon existing water

Trees 969, 971, 973 & 988 carefully hydrovac around the catch basin/man hole, then backfill and level off. Concrete catch basin/man hole can be broken up inward and chunks pulled out by hand or hydrovac and lift out; keep grading out of TPZ - see T10 design for grading

Tree 986 - keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing storm; abandon existing water

Tree 987 - keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water

Trees 958 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design

Tree 955 - keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design

Trees 961 & 5013 - keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water

Tree 1100 - install trench box on north side - see T6 design

Tree 1101 - keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water

Tree 1105 - keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water

114.56 (m2)

43.22 (m2)

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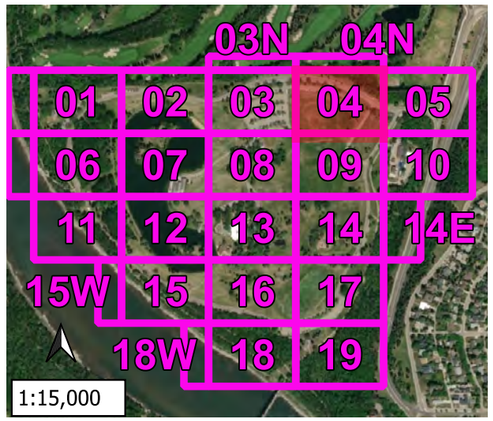
Version: 202304181953

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 4

(WILLIAM HAWRELAK PARK REHABILITATION)



- ☆ Commemorative Trees
- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- Natural Area Impacted
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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Tree 1048 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling case bore new sanitary or follow trench box T6 design; abandon existing electrical

Trees 1049, 1050, 1951 & 1952 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Tree 1058 - no ground disturbance, no stock piling, and no equipment inside the TPZ

Tree 1059 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Tree 1060 - keep new electrical equipment out of TPZ; directional drill new electrical - see T4 design; move path south out of TPZ; abandon electrical

Tree 1061 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; move new electrical equipment and foundations outside of the TPZ; abandon existing electrical

Trees - 1062, 1063 & 1064 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Island Trees

Tree 1001 - case bore new sanitary to the west of TPZ; cut and lift curb - do not drag concrete over roots; abandon existing sanitation

Trees 1002, 1005, 1006 & 1010 - cut and lift curb/pavement sections to the south; prune roots over 2.5 cms

Tree 1003 - keep grading out of TPZ - see T10 design for grading; abandon existing storm

Tree 1004 - abandon storm and catch basin; cut and lift curb - do not drag concrete over roots; prune roots over 2.5 cms on north side of TPZ

Tree 1007 - case bore new storm; keep catch basin out of TPZ; cut and lift curb - do not drag concrete over roots; prune roots over 2.5 cms

Tree 1008 - keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; case bore new storm or follow trench box T6 design

Tree 1009 - case bore for new stormwater line to the south west; follow T4 directional drill sketch and BMP specifications ; cut and lift up curb/pavement sections to the south – do not drag out curb/pavement over roots; prune roots > 2.5 cms

Tree 1011 - case bore for new stormwater line to the south west; cut and lift up curb/pavement sections to the south – do not drag out curb/pavement over roots; prune roots > 2.5 cms

Tree 1515 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling

Tree 1516 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Tree 1517 - keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing storm; abandon existing water

Tree 1518 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design

Trees 1519,1520, 1521, 1522, 1523 & 1527 - keep grading out of TPZ; see T10 design for grading

Tree 1513 - keep grading out of TPZ; see T10 design for grading

Trees 1510, 1512 & 1514 - keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water

Tree 1511 - keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing storm; abandon existing water

Tree 1506 - keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water

Trees 1507 & 1508 - keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water

Tree 1509 - abandon existing storm

Tree 1505 - keep grading out of TPZ; see T10 design for grading

Tree 1527 - Grading; keep grading out of TPZ; see T10 design for grading; Commemorative Tree

Tree 1525 - move SUP north of tree 1524

Tree 1533 - move SUP southwest

Tree 1524 - directionally drill new electrical - see T4 design; abandon catch basin

Tree 1526 - keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm

Tree 1528 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design

Tree 1530 - abandon electrical and use air and hand tools on the north side of the TPZ – follow T7 design and specifications

Tree 1532 - move path east outside of TPZ; no excavation and compaction within TPZ

92.7 (m2)

185.43 (m2)

45.91 (m2)

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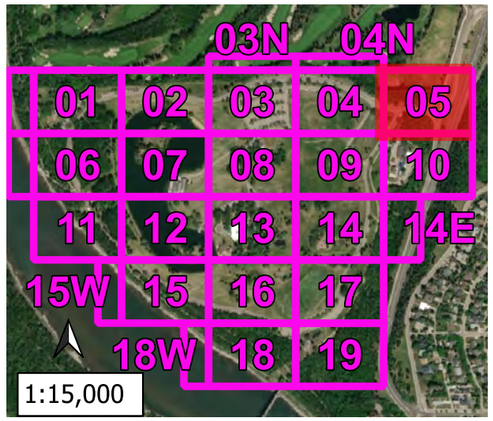
Version: 202304181954

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 05

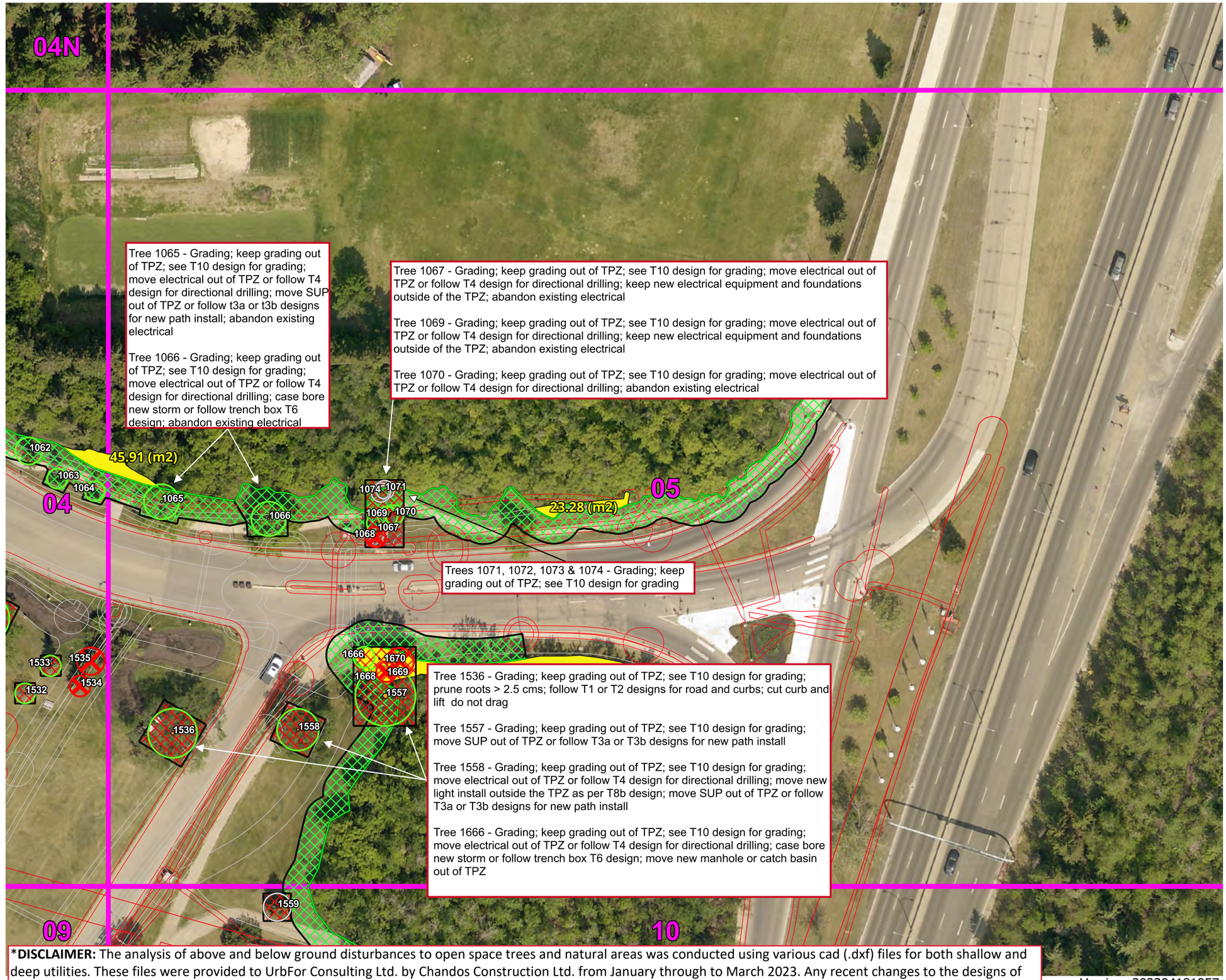
(WILLIAM HAWRELAK PARK REHABILITATION)



- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- GRID

Tree Conflicts

- New Install
- Remove Existing



0 25 50 m

1:750

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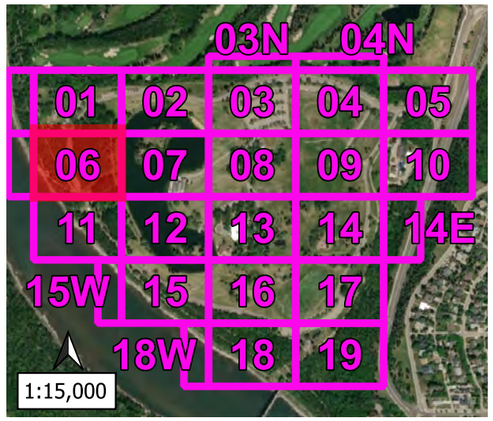
Andre Savaria
ISA Certified Arborist PR-4880A

*__DISCLAIMER:__ The analysis of above and below ground disturbances to open space trees and natural areas was conducted using various cad (.dxf) files for both shallow and deep utilities. These files were provided to UrbFor Consulting Ltd. by Chandos Construction Ltd. from January through to March 2023. Any recent changes to the designs of these utilities may not be reflected in this map and will be captured through regularly scheduled field walk throughs with the City of Edmonton Urban Foresters.

Version: 202304181957

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 06

(WILLIAM HAWRELAK PARK REHABILITATION)



- ☆ Commemorative Trees
- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- Natural Area Impacted
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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case bore new storm water line to preserve natural area

282.09 (m2)

44.82 (m2)

Tree 2512 - move new light install outside the TPZ and follow T8b design; abandon existing storm; abandon existing water

Trees 2527, 2528, 2529 & 2530 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing storm; abandon existing water

Tree 9032 - keep grading out of TPZ; see T10 design for grading

36.61 (m2)

Trees 1897, 1898, 1900, 1901, 1902, 1906, 1907, 1908, 1909, 1910 & 1911- commemorative trees

Trees 1897, 1898, 1900, 1901, 1909& 1915 - abandon electrical

Trees 1895 & 1896 - abandon storm; abandon catch basin/ manhole to the north

abandon storm water line to preserve natural area and individual trees

Trees 2454 & 2455 - abandon existing electrical; abandon existing water

80.8 (m2)

01 02 06 06W 07 11 12

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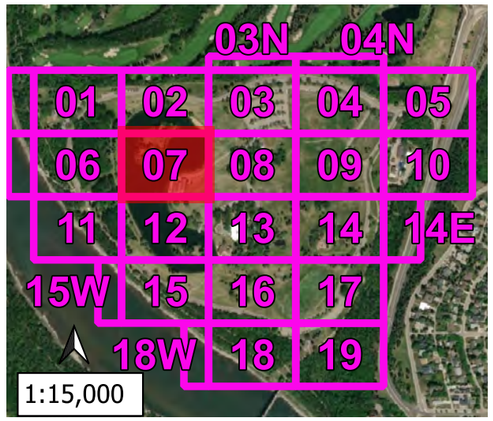
Version: 202304181958

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 07

(WILLIAM HAWRELAK PARK REHABILITATION)



- Trees to be Protected
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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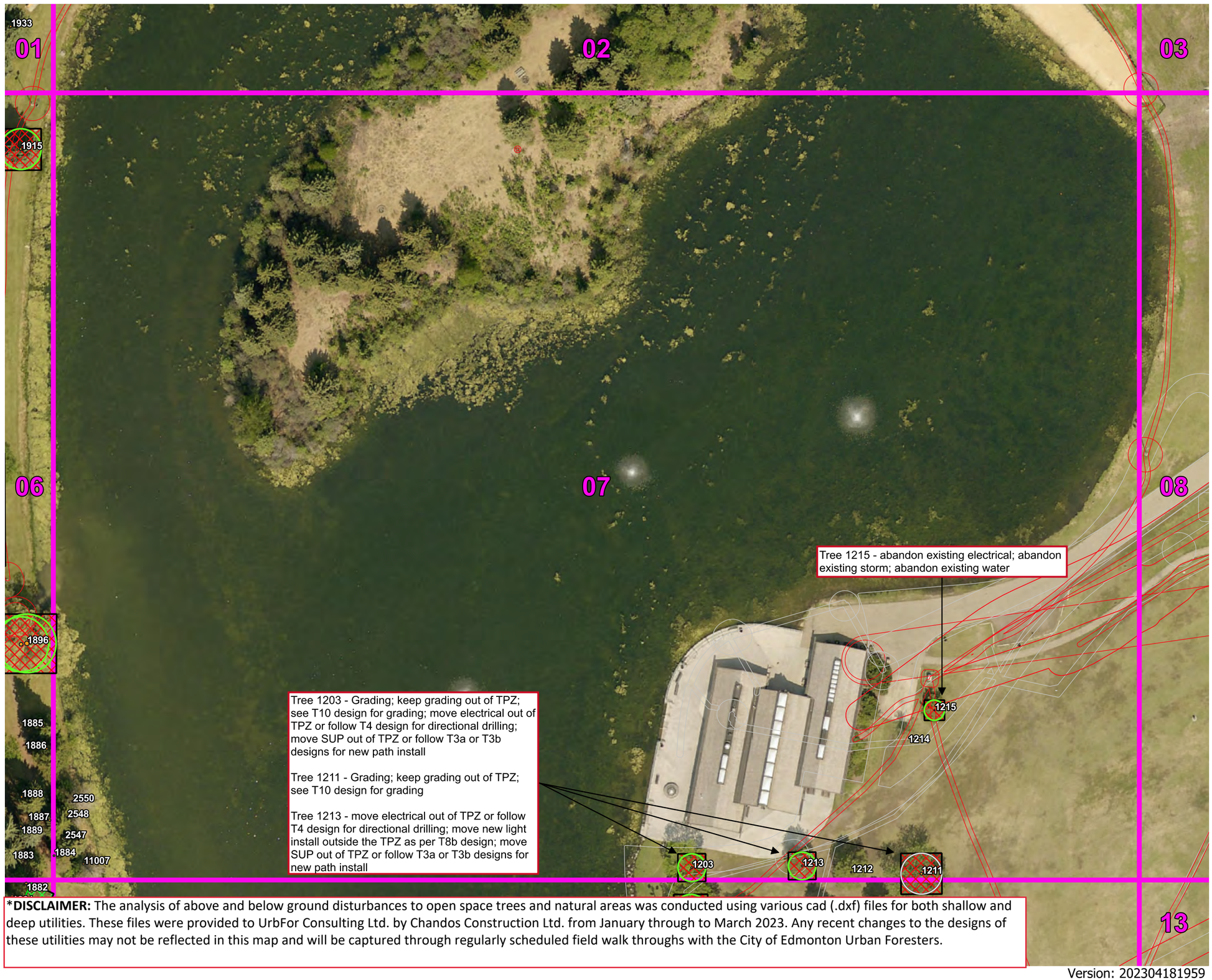

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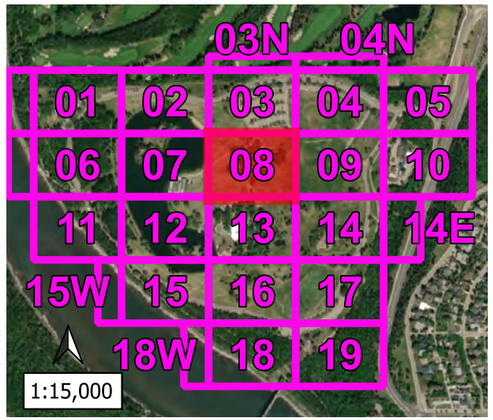
Version: 202304181959

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 8

(WILLIAM HAWRELAK PARK REHABILITATION)



- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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Trees 1201 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing storm; abandon existing water; March 23 Walk through

Tree 1202 - no ground disturbance, no stock piling, and no equipment inside the TPZ

Tree 1200 - abandon existing water

Tree 1189 - abandon existing storm; abandon existing water

Tree1190 - directional drill for installation of new water; follow T4 design and boring specifications as per BMP

Tree 1194 - case bore new storm; abandon existing sanitary; follow T4 design and boring specifications as per BMP; use T7 sketch for installation of SUP

Tree 1195 - abandon existing storm; abandon existing water

Tree 1196 - hydrovac - curb removal as per March 23 walk through with city foresters

Tree 1197 - abandon existing storm

Trees 1170 & 1173 - abandon existing electrical; directional drill new electrical

Tree 1185 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new storm or follow trench box T6 design; abandon existing electrical

Tree 1175 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling

Tree 1102 - abandon electrical

Tree 1103 - move new electrical equipment out of TPZ,directional drill for new water install; abandon electrical, sanitation and water

Trees 1104, 1107 & 1108 - keep grading out of TPZ; see T10 design for grading

Tree 1169 - prune 6m over road as per April 6 walk through with city foresters

Tree 1157 - keep grading out of TPZ; see T10 design for grading

Trees 1158 & 1159 - keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water

Trees 1160, 1162 & 1167 - protect as per March 23, walk through with city foresters

Tree 1161 - directional drill new electrical; case bore new sanitary; abandon existing sanitary, follow T7 for SUP removal

Trees 1163 & 1166 - keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water

Tree 1164 - keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water

Tree 1165 - keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water; abandon existing sanitation

Tree 1184 - keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design; abandon existing storm; abandon existing water

Trees 1116, 1117, 1118 & 1119 - keep grading out of TPZ; see T10 design for grading

Trees - 1125, 1126, 1128, 1129, 1130, 1132, 1138 & 1139 - abandon sanitary

Tree 1127 - abandon electrical

Tree 1177 - case bore new storm; no excavation or compaction of roots within TPZ; prune roots > 2.5 cms on west side of TPZ - see T3 design

Tree 1178 - abandon existing storm; abandon existing water and abandon existing sanitation

Trees 1179 & 1182 - abandon electrical

Trees 1180, 1181 - abandon sanitation

Tree 1155 - move SUP out of TPZ; case bore new storm; follow T4 design and boring specifications as per BMP

Tree 1156 - directional drill new electrical; case bore new storm east of tree; no excavation or compaction of roots within TPZ; prune roots >2.5 cms on east side of TPZ

Tree 1176 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new storm or follow trench box T6 design; abandon existing electrical

Tree 1150 - keep grading out of TPZ; see T10 design for grading

Trees 1151 & 1152 - abandon electrical

Tree 1154 - case bore new storm; abandon existing electrical

Tree 1236 - abandon existing water; directional drill deep under trunk of tree for install of new water; follow T4 design and boring specifications as per BMP

Tree 1238 - Grading; keep grading out of TPZ; see T10 design for grading

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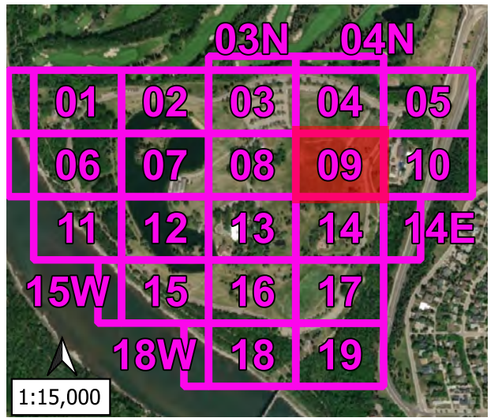
Version: 202304182012

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 9

(WILLIAM HAWRELAK PARK REHABILITATION)



- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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Tree 1106 - keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water

Trees 1502 & 1504 - keep grading out of TPZ - see T10 design for grading; abandon existing storm

Tree 1503 - keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing storm; abandon existing water

Tree 1537 - move new road out of TPZ; see T1 design and follow BMP

Tree 1539 - keep grading out of TPZ; see T10 design for grading

Tree 1567 - move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new storm or follow trench box T6 design; abandon existing electrical; follow T8a design for light removal

Tree 1568 - case bore new storm, move new path out of TPZ; See T7 design for path removal and BMP

Tree 1569 - expose roots to the west & prune roots > 2.5 cms for new path; no excavation or compaction of roots within TPZ

Trees 1552 & 1554 - abandon electrical; cut and lift curb sections west of tree; prune roots > 2.5 cms

Tree 1553 - abandon electrical

Tree 1565 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; prune roots > 2.5 cms; move SUP out of TPZ or follow T3a or T3b designs for new path install; abandon existing electrical; cut curb and lift do not drag -prune roots > 2.5 cms - follow T1 or T2 designs for existing road and curbs

Tree 1500 - keep grading out of TPZ; see T10 design for grading

Tree 1501 - keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm

Trees 1493, 1494, 1495 & 1496 - keep grading out of TPZ; see T10 design for grading

Tree 1497 - do not excavate within TPZ for removal of catch basin

Tree 1498 - move electrical equipment out of TPZ

Tree 1499 - abandon storm and electrical; directionally drill new water; follow T4 design and BMP specifications; follow T7 design; air and hand tools for path construction to the east

Tree 1572 - keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water

Tree 1573 - abandon existing electrical

Tree 1575 - keep grading out of TPZ; see T10 design for grading

Trees 1482, 1483 & 1484 - abandon sanitary

Trees 1485, 1486, 1487, 1488, 1489, 1490 & 1491 - keep grading out of TPZ; see T10 design for grading

Tree 1492 - keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water

Tree 1576 - directionally drill new electrical, move new SUP out of TPZ, follow T4 design and BMP specifications

Trees 1578 - abandon existing electrical

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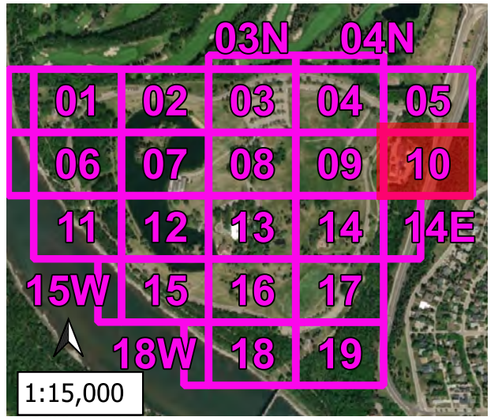
Version: 202304182014

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 10

(WILLIAM HAWRELAK PARK REHABILITATION)



- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- Natural Area Impacted
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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Trees 1559 - keep grading out of TPZ; see T10 design for grading

Tree 1581 - abandon electrical

91.65 (m2)

65.71 (m2)

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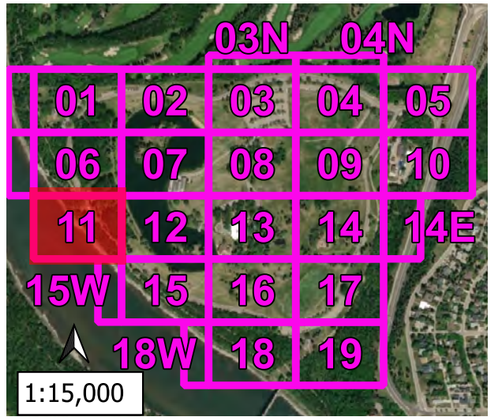
Version: 202304182015

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 11

(WILLIAM HAWRELAK PARK REHABILITATION)



- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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Tree 1985 -abandon electrical

Tree 1986 - Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow t3a or t3b designs for new path install; abandon existing electrical; cut curb and lift do not drag - prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; abandon existing storm; abandon existing water

Tree 601 - Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; move SUP out of TPZ or follow t3a or t3b designs for new path install; abandon existing electrical

Tree 602 - Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow t3a or t3b designs for new path install

Trees 1988, 2153, 2154, 2208 & 2213 - Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow T3a or T3b designs for new path install; abandon existing electrical; abandon existing storm; abandon existing water

Tree 2152 - Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow T3a or T3b designs for new path install; abandon existing storm; abandon existing water

Tree 1989 - Grading; keep grading out of TPZ; see T10 design for grading; abandon existing storm; abandon existing water

Tree 604 - Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Trees 605, 606, 607, 608 & 609 - Grading; keep grading out of TPZ; see T10 design for grading

Trees 2131, 2132, 2210, 2211 & 11026 - Grading; keep grading out of TPZ; see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water

Tree 610 - Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; abandon existing electrical; cut curb and lift do not drag -prune roots > 2.5 cms - follow T1 or T2 designs for road and curbs

Trees 611 & 614 - Grading; keep grading out of TPZ; see T10 design for grading

Tree 615 - Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; abandon existing electrical

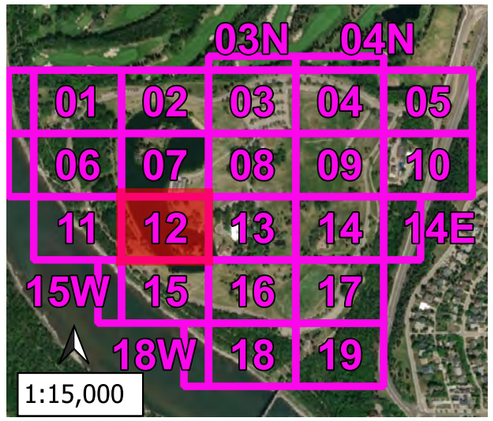
Trees 617 & 843 - Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; abandon existing electrical; cut curb and lift do not drag -prune roots > 2.5 cms - follow T1 or T2 designs for road and curbs

*DISCLAIMER: The analysis of above and below ground disturbances to open space trees and natural areas was conducted using various cad (.dxf) files for both shallow and deep utilities. These files were provided to UrbFor Consulting Ltd. by Chandos Construction Ltd. from January through to March 2023. Any recent changes to the designs of these utilities may not be reflected in this map and will be captured through regularly scheduled field walk throughs with the City of Edmonton Urban Foresters.

Version: 202304182017

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 12

(WILLIAM HAWRELAK PARK REHABILITATION)



- ☆ Commemorative Trees
- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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***DISCLAIMER:** The analysis of above and below ground disturbances to open space trees and natural areas was conducted using various cad (.dxf) files for both shallow and deep utilities. These files were provided to UrbFor Consulting Ltd. by Chandos Construction Ltd. from January through to March 2023. Any recent changes to the designs of these utilities may not be reflected in this map and will be captured through regularly scheduled field walk throughs with the City of Edmonton Urban Foresters.

Tree 1204 - Grading; keep grading out of TPZ; see T10 design for grading; move new light install outside the TPZ as per T8b design; follow T8a design for light removal; abandon existing electrical

Tree 1205 - Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow T3a or T3b designs for new path install; abandon existing electrical

Trees 1209 & 1219 - move electrical out of TPZ or follow T4 design for directional drilling

Tree 1222 - Grading; keep grading out of TPZ; see T10 design for grading; keep new electrical equipment and foundations outside of the TPZ

Trees 1220 & 1221 - Grading; keep grading out of TPZ; see T10 design for grading

Trees 1866, 1870, 1871, 1872 & 1877 - commemorative trees

Trees 1845, 1846, 1853, 1854, 1870, 1871, 1872 & 1877 - abandon existing electrical

Tree 1216 - Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow T3a or T3b designs for new path install

Tree 1217 - Grading; keep grading out of TPZ; see T10 design for grading; move electrical out of TPZ or follow T4 design for directional drilling; keep new light install outside the TPZ as per T8b design

Trees 1843 - abandon existing storm

Tree 1851 - Grading; keep grading out of TPZ; see T10 design for grading; abandon existing electrical

Trees 1839, 1840, 1841 & 1842 - abandon existing electrical; abandon existing storm

Tree 3002 - Grading; keep grading out of TPZ; see T10 design for grading; move new light install outside the TPZ as per T8b design

Tree 3003 - move electrical out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ as per T8b design; abandon existing irrigation

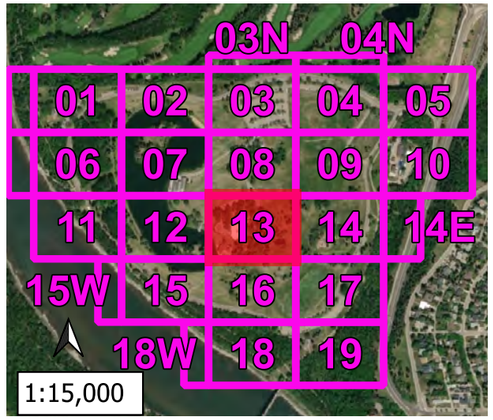
Trees 1848 & 1849 - Grading - keep grading out of TPZ - see T10 design for grading; prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; cut concrete foundation below grade - do not remove concrete form - back fill with top soil and sod; cut curb and lift do not drag - prune roots > 2.5 cms - follow T1 or T2 designs for road and curbs; abandon existing storm; abandon existing water

Trees 1847 & 1850 & 1852- Grading; keep grading out of TPZ; see T10 design for grading; move SUP out of TPZ or follow t3a or t3b designs for new path install; abandon existing electrical; cut curb and lift do not drag - prune roots > 2.5 cms; follow T1 or T2 designs for road and curbs; abandon existing storm; abandon existing water

Version: 202304182021

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 13

(WILLIAM HAWRELAK PARK REHABILITATION)



- ☆ Commemorative Trees
- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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Tree 1237 - abandon existing electrical

Trees 1235 & 2028 - abandon sanitation and catch basin - see T9a design

Tree 2025 - Grading; keep grading out of TPZ; see T10 design for grading

Trees 1230, 2010 & 2017 - directional drill new electrical - see T4 design

Trees 1231, 1232, 1233, 1234, 2016 & 2020 - Grading; keep grading out of TPZ; see T10 design for grading

Tree 1223, 2005 & 2006 - keep grading out of TPZ - see T10 design for grading

Tree 1224 - directional drill new electrical on north side of TPZ

Trees 1225 & 1227 - realign utility down sidewalk as per Apr 13 walk through with city foresters

Tree 1228 - move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing irrigation

Tree 1239 - Grading; keep grading out of TPZ; see T10 design for grading; April 5 Walk through

Tree 1241 - stay out of TPZ to the northeast with new sanitary

Tree 1242 - abandon existing storm; abandon existing water

Tree 1243 - move new light install outside the TPZ and follow T8b design

Tree 1261 - abandon sanitation and CB - see T9a design

Trees 1304, 1306 & 1307 - no ground disturbance, no stock piling, and no equipment inside the TPZ

Trees 1309, 1310 & 1311 - Grading; keep grading out of TPZ; see T10 design for grading

Tree 2027 -

Tree 14003 - commemorative tree

Trees 1245 & 1247 - keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; abandon existing storm; abandon existing water

Tree 1248, 2047, 2049, 2050 & 3063 - Grading; keep grading out of TPZ; see T10 design for grading

Tree 2041 - abandon existing storm; abandon existing water

Tree 2043 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical; abandon existing storm; abandon existing water

Tree 2046 - abandon electrical; move new electrical east outside of TPZ

Trees 2051 & 2052 - Prune lowest branches on west side of crowns as per Apr 13 walk through with city foresters

Tree 14003 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing storm; abandon existing water

Tree 2030 - Grading; keep grading out of TPZ; see T10 design for grading

Trees 2031, 2032 & 10012 - protect as per April 5 walk through with city foresters

Tree 2033 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Tree 3007 - abandon existing electrical

Trees 2000 & 2001 - Prune lowest branches on northwest side of crowns as per Apr 13 walk through with city foresters

Tree 2002 - protect as per April 5 walk through with city foresters

Trees 2055 & 2060 - protect as per April 5 walk through with city foresters

Trees 2056 & 2057 - Grading; keep grading out of TPZ; see T10 design for grading; April 5 Walk through

Tree 3038 - move new light install outside the TPZ and follow T8b design

Tree 3040 - abandon existing electrical; follow T8a design for light removal

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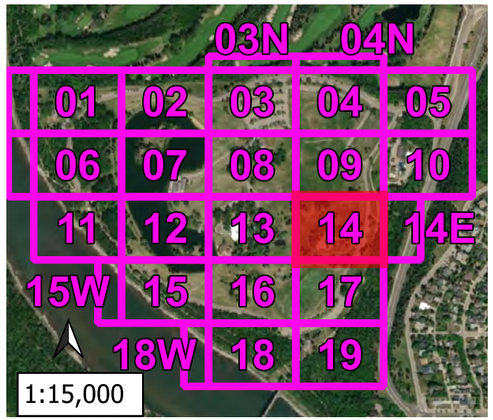
Version: 202304182028

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 14

(WILLIAM HAWRELAK PARK REHABILITATION)



- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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ISA Certified Arborist PR-4880A

Trees 1312, 1318, 1319, 1320, 1321, 1322 & 1323 - Grading; keep grading out of TPZ; see T10 design for grading

Tree 1308 - no ground disturbance, no stock piling, and no equipment inside the TPZ

Tree 1324 - move new electrical equipment out of TPZ, directionally drill new electrical

Trees 1326, 1328, 1329, 1330, 1331, 1337 & 1338 - abandon existing electrical

Tree 1327 - move new electrical north or directionally drill new electrical - see T4 design; abandon electrical

Trees 1340 & 1341 - abandon existing sanitation; prune elms before March 31

Tree 1342 - abandon existing storm; prune elms before March 31

Trees 1343, 1344, 1348, 1349, 1350, 1356, 1357, 1358, 1359, 1361, 1362, 1366, 1368, 1369, 1370, 1372, 1384, 1386, 1398, 1447, 1451, 1452, 1453, 1460, 1462, 1463 & 10005 - keep SUP out of TPZ; use T7 design

Tree 1449 - directionally Drill New Electrical - see T4 design

Tree 1450 - move new light install outside the TPZ and follow T8b design

Tree 1388 - case bore new sanitary or follow trench box T6 design

Trees 1445 & 1446 - protect tree that is in planter; use hand tools to remove wooden planter

Trees 1438, 1441 & 1442 - keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water

Trees 1470, 1471, 1472, 1473, 1474, 1475 & 1476 - leave concrete planter walls up

Trees 1464 & 1467 - abandon existing storm

Trees 1465 & 1466 - abandon existing storm; directionally drill new electrical, move light out of TPZ

Tree 1468 - keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design; abandon existing storm

Tree 1483 - abandon existing sanitary

Trees 1477, 1478, 1479 & 1480 - keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water

Tree 1481 - abandon existing storm; abandon existing water

Tree 1455 - keep grading out of TPZ - see T10 design for grading; abandon existing storm; abandon existing water

Tree 1456 - abandon existing storm; abandon existing water

Tree 1642 - abandon existing water

Tree 1637 - directional drill new electrical - see T4 design; abandon existing electrical; cut and lift curb sections - do no drag concrete over roots

Tree 1640 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design; case bore new storm or follow trench box T6 design; abandon existing electrical; follow T8a design for light removal

Tree 1631 - abandon existing electrical

Tree 1632 - move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Tree 1633 - move new electrical line out of TPZ or follow T4 design for directional drilling; move new light install outside the TPZ and follow T8b design; abandon existing electrical; follow T8a design for light removal

Tree 1635 - no ground disturbance, no stock piling, and no equipment inside the TPZ

Tree 1636 - keep grading out of TPZ - see T10 design for grading; abandon existing water

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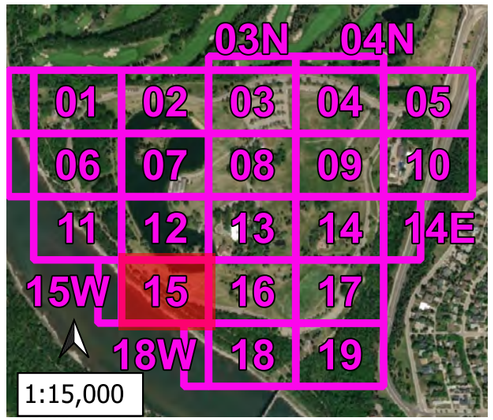
Version: 202304182034

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 15

(WILLIAM HAWRELAK PARK REHABILITATION)



- ☆ Commemorative Trees
- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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Trees 169, 170, 171 & 9021 - abandon storm

Tree 336 - no ground disturbance, no stock piling, and no equipment inside the TPZ

Tree 1836 - keep grading out of TPZ - see T10 design for grading; abandon existing electrical

Tree 1837 - commemorative tree

Tree 1835 – abandon existing electrical; follow T8a design for light removal

Trees 1828 , 1830, 1916, 1917 & 1918 – abandon electrical

Tree 1834 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Tree 1831 - commemorative tree

Trees 12006,12007 & 12008 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical; abandon existing storm; abandon existing water

Tree 13002 - keep grading out of TPZ; see T10 design for grading

Tree 12002 – abandon existing storm; case bore new storm

for outfall areas

(see Chandos files 3590 Hawrelak Park Foliage Removal 230112 NW & South) for survey notes on clearing.

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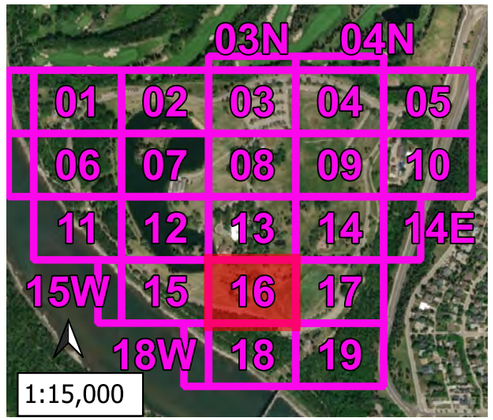
Version: 202304182036

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 16

(WILLIAM HAWRELAK PARK REHABILITATION)



- Commemorative Trees
- Trees to be Protected
- Trees to Be Removed
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- Natural Area Impacted
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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Tree 1791 - move new SUP outside of TPZ

Trees 1781, 1823, 1824, 1825, 1826 & 1827 - commemorative trees

Trees 1720, 1756 & 1757 - abandon existing sanitary

Tree 1802 - move new electrical equipment and foundations outside of the TPZ; abandon existing storm; abandon existing water

Tree 1804 - no ground disturbance, no stock piling, and no equipment inside the TPZ

70.84 (m2)

20.02 (m2)

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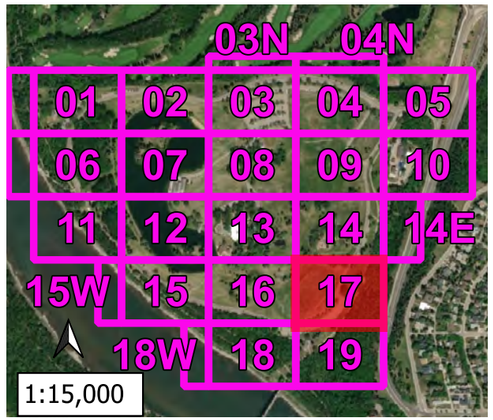
Version: 202304182038

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 17

(WILLIAM HAWRELAK PARK REHABILITATION)



- Commemorative Trees
- Trees to be Protected
- Trees to Be Removed
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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ISLAND TREES

Tree 1603 - abandon electrical; move light outside TPZ - see T8b design

Tree 1605 - case bore new sanitary; directionally drill new electrical

Trees 1606, 1614 & 1616 - keep grading out of TPZ - see T10 design for grading; abandon existing electrical

Tree 1607 - keep grading out of TPZ - see T10 design for grading

Tree 1608 - abandon electrical

Trees 1609 & 1613 - directionally drill new electrical

Tree 1611 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new storm or follow trench box T6 design; abandon existing storm

Tree 1615 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Trees 1617 & 1620 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling

Tree 1618 - keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; follow T8a design for light removal

Tree 1619 - move light out of TPZ; cut and lift curb sections; follow T2 design; abandon electrical; prune as required for light removal

Tree 1436 - prune - 6m over road and balance after as per April 5 walk through with city foresters

Tree 1437 - keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; case bore new storm or follow trench box T6 design; abandon existing storm; abandon existing water

Tree 1623 - move new light install outside the TPZ and follow T8b design; abandon existing electrical; follow T8a design for light removal

Tree 1626 - keep grading out of TPZ - see T10 design for grading; case bore new storm or follow trench box T6 design; abandon existing electrical

Tree 1627 - move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical

Tree 1628 - directionally drill new electrical

Tree 1630 - abandon electrical

Tree 1629 - commemorative tree

Tree 9063 - directionally drill new water; move sup outside TPZ; abandon existing water; no surface disturbance inside TPZ

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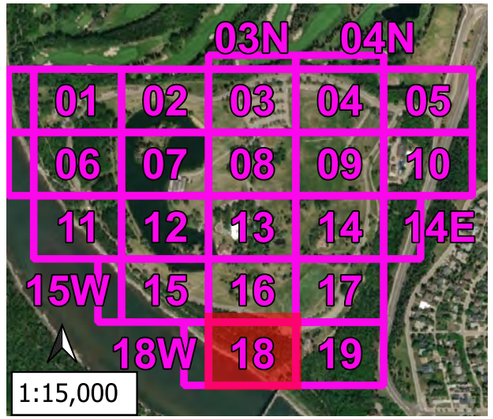
Version: 202304182043

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 18

(WILLIAM HAWRELAK PARK REHABILITATION)



- ☆ Commemorative Trees
- Trees to be Protected
- Trees to Be Removed
- Trees affected by grading
- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- Natural Area Impacted
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

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Tree 1600 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; case bore new storm or follow trench box T6 design; abandon existing electrical; abandon existing storm

Tree 1601 - keep grading out of TPZ - see T10 design for grading; move new electrical equipment and foundations outside of the TPZ; abandon existing electrical

Tree 1671 - keep grading out of TPZ - see T10 design for grading

Tree 1672- abandon sanitation

Tree 1673 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling

Trees 1674 & 1675 - keep grading out of TPZ - see T10 design for grading; abandon existing electrical; abandon existing storm; abandon existing water

Trees 3090 & 3091 - follow T7 design; air and hand tools for path reconstruction; prune roots > 2.5 cms

Tree 14005 - commemorative tree

Tree 3088 - abandon existing water

Tree 237 - move new electrical line out of TPZ or follow T4 design for directional drilling; keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical

directional drill for new electrical installation on southeast side of path

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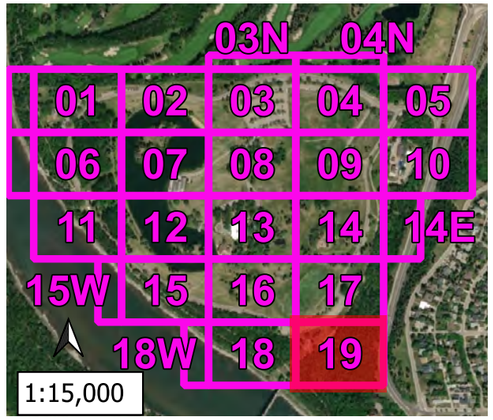
Version: 202304182042

Tree Protection Plan - ECN 6.1.2023
Site Overview - Area 19

(WILLIAM HAWRELAK PARK REHABILITATION)



- Diameter at Breast Height
- Tree Protection Zones
- Natural Area's Edge
- Natural Area's Protection Zones
- GRID

Tree Conflicts

- New Install
- Remove Existing

0 25 50 m

1:750

Tree 1602 - keep grading out of TPZ - see T10 design for grading; move new light install outside the TPZ and follow T8b design; abandon existing electrical; follow T8a design for light removal

Tree 1681 - move new electrical line out of TPZ or follow T4 design for directional drilling

Tree 3087 - abandon existing storm

Trees 3069, 3070, 3071, 3072, 3073 & 3074 - keep grading out of TPZ - see T10 design for grading; abandon existing water

Tree 1676 - abandon existing electrical; abandon existing storm; abandon existing water

Tree 1677 - abandon electrical; abandon water

Tree 1678 - abandon existing storm; abandon existing water

Tree 1679 - abandon water

Tree 1680 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing electrical; abandon existing storm; abandon existing water

Tree 240 - keep grading out of TPZ - see T10 design for grading; move new electrical line out of TPZ or follow T4 design for directional drilling; abandon existing storm; abandon existing water

Tree 3077 - abandon water; directionally drill new electrical; see T4 design

Trees 3078, 3079, 3081 & 3086 - abandon existing storm

Trees 3080 & 3084 - abandon existing electrical; abandon existing storm

Tree 3085 - abandon electrical

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Version: 202304182040

Appendix 5. Cut and Fill Plan

Appendix 5. Cut and Fill Plan

(WILLIAM HAWRELAK PARK REHABILITATION)

ELEVATIONS			
NUMBER	MINIMUM	MAXIMUM	COLOUR
1	-2.000	-1.750	
2	-1.750	-1.500	
3	-1.500	-1.250	
4	-1.250	-1.000	
5	-1.000	-0.750	
6	-0.750	-0.500	
7	-0.500	-0.250	
8	-0.250	-0.075	
9	-0.075	0.075	
10	0.075	0.250	
11	0.250	0.500	
12	0.500	0.750	
13	0.750	1.000	
14	1.000	1.500	
15	1.500	1.750	
16	0.339	1.345	

Tree Protection Status

Tree To be Protected

Tree To Be Removed

0 25 50 75 100 m

1:1,200

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Andre Savaria

ISA Certified Arborist PR-4880A

Version: 202303152001

Appendix 6. Erosion and Sediment Control Matrix

Appendix 6. Erosion and Sediment Control Matrix

Activity Type	Description	Drainage Site / polygon specific	Erosion Control	Sediment Control	Soil Compaction	Revegetation	Other Risks / considerations
Deep Trench	3 to 4 meters deep 1:4 trench cut slope 8 meter wide footprint Storm and sanitary systems	Ponding and pooling of water in excavated areas and compacted soils Runoff on exposed sloped ground	Stabilize all cut and fill slopes temporarily by establishing cover. Vegetation is preferred, but short terms measures such as mulch, geotextile fabrics or jute type mats/erosion control blankets have been shown effective. Steeper cuts (> 3:1) should be hydroseeded. Terrace or bench slopes to slow and dissipate or re-direct water into pre-determined catch basins/sediment traps. Dust control might be needed in high traffic areas. Regular watering during dry conditions or more longer term soil binders can be used.	Install silt fences perpendicular to slope and have them drain diffusely or into collection points for pumping into stable vegetated areas or sediment collection ponds. Several rows evenly spaced apart might be needed if slopes exceed 10 meters in length. Install perimeter sediment controls (e.g. silt fence). Discharge any collected sediment or pumped water into stable (flat) vegetated areas or sediment traps.	No equipment inside Tree Protection Zone (TPZ). No excavation inside TPZ. All anticompaction within TPZ should be rig mats or equivalent and all anticompaction between TPZ and specified distances should be 20 cm (8 in) mulch with plywood on top Avoid rutting and handling of saturated soils.	Revegetation done in accordance to COE landscape design and construction standards (Vol 5, Jan 2021). COE-IM-GUIDE-0010	Weather related Freeze/thaw
Shallow trench	Up to 1-2 meters deep Irrigation, power and communications	Ponding and pooling of water in excavated areas and compacted soils Runoff on/over exposed ground, slope increases risk and requirements for E & S controls	See above	See above	See above	See above	Lower risk than deep trench Weather related Freeze/thaw
Surfaces	Flat areas, polygon/linear Roads, trails and parking lots Final grading and landscaping	Ponding and pooling of water on compacted soils Runoff on/over exposed ground, slope increases risk and requirements for E & S controls	See above	Install silt fences perpendicular to slope to drain diffusely. Several rows might be needed depending on slope length. Install perimeter sediment controls (e.g. silt fence).	See above	See above	Weather Freeze/thaw
Soil Stockpile/ laydown areas	Storage of soils during excavation Temporary storage of fill/soil material	Movement (slumping) Runoff on exposed sloped surfaces and/or along ground	Stabilize all soils by establishing cover. Short term stockpiling can be covered with tarps prior to end dump/moving to larger piles or disposal off site. Medium term (< 6 months or overwinter/thaw) stockpiling can use measures such as mulch, geotextile fabrics or jute type mats for interim cover. Longer term (>1 growing season or spring melt) establishment of vegetation is recommended. Steeper piles (>3:1) should be hydroseeded.	Silt fence/barrier installed around perimeter of exposed areas and stockpiles.	See above	See above	Weather Freeze/thaw
Outfall	3590 HP foliage removal 230112(NW) 3590 HP foliage removal (S)	25% slope at 220 degrees, SW towards SSR Potential for erosion/sediment into SSR via overland flow & direct runoff	Stabilize all soils temporarily by establishing cover. Erosion matting / barrier installed around perimeter of exposed areas/works and above high water mark of SSR Non-erodible material (e.g. rip-wrap) sized for design flow should be added to outfall apron. Outfall channel must be adequately armoured to prevent erosion. Long term measures should include live staking and bioengineering aspects to increase slope, stream bank and channel stability. Live staking (e.g. willows) could be used to deter human proximity and use of the immediate area as well as stabilize the soils around the site. Any disturbance to the bank below the high water mark must be restored.	Install perimeter sediment controls (e.g. silt fence). Any runoff should be directed into flat vegetated surfaces to infiltrate or into setting basins. Runoff should not be directed towards or into SSR. Silt fence or filtersox/berms installed on slopes. Turbidity curtains or similar measures should be installed if there is instream work and sediment release has been authorized.	See above Heavy equipment should not be permitted within 8 meters of the high water mark. Long reach or lighter equipment should be used to reduce impacts and decrease risk of soil disturbance / mobilization of sediments in close proximity to SSR.	See above	Proximity to water (Increased risk) Restricted Activity Periods (Fish)* Weather related Freeze/thaw
Other	Storm water management areas	Direct drainage to storm system	Stabilize all soils by establishing cover. Protect areas with concentrated flow(swales/ditches) from erosion . Vegetation, check dams and silt fences can be used to slow down velocity, minimize erosion and capture sediment. If flow is significant volume liners or armouring of the draw/ditch will be required.	Do not allow runoff to enter storm drains. Install sediment barriers (silt fence) around perimeters of exposed soils in proximity to storm drains. Install sediment traps around all storm drains and outfalls.	N/A	See above	Connectivity to surface water
* RAP for Edmonton Area / North Sask Rvr. (parkland prairie zone)							
* RAP fact sheet							

https://www.edmonton.ca/sites/default/files/public-files/assets/PDF/FieldManual.pdf
https://www.edmonton.ca/public-files/assets/document?path=PDF/ControlGuide.pdf
https://open.alberta.ca/dataset/alberta-transportation-erosion-and-sediment-control-manual
https://www.edmonton.ca/projects_plans/parks_recreation/hawrelak-park-rehabilitation-project
https://www.edmonton.ca/city_government/urban_planning_and_design/city-design-construction-standards
https://open.alberta.ca/dataset/5145cda2-41aa-47ab-96dc-29810e7aca81/resource/b1fef90a-74b6-4d3f-b458-2ec0a711bd2a/download/restrictedperiodsfishspecies10fmzs-jan2010.pdf
https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html

Appendix 7. Erosion and Sediment Control BMP's

Silt Fence Sediment Control	B.M.P. #1

Description and Purpose

- Permeable fabric barriers installed vertically on support posts along contours to collect sediment laden sheet flow runoff
- Causes water to pond allowing sediment to settle out as water filters through fabric
- Entraps and minimizes coarse sediment from sheet flow or overland flow from entering waterbodies
- Perimeter control for sediment transport and deposition

Applications

- Temporary measure
- Used at bottom of cut or fill slopes to collect sediment laden runoff
- Used along streams (or channels) banks
- Used around stockpiles
- Midslope grade-break (using "J-hook" or "smile" pattern to effect ponding, filtering and sedimentation)

Advantages

- Low permeability silt fences have high filtering capabilities for fine sand to coarse silt
- Filter fence more effective than straw bales at filtering out sediment

Limitations

- Applicable for sheet flow, cannot handle concentrated channel flow volumes
- May fail under high runoff events
- Limit to locations suitable for temporary ponding of sediment laden runoff
- Low permeability silt fences may not be strong enough to support weight of water retained behind it and may require reinforcement (i.e., wire mesh and stronger support)
- Sediment build up needs to be removed on a regular basis
- Damage to fence may occur during sediment removal
- Useable life of approximately one year dependent on regular maintenance

Silt Fence Sediment Control	B.M.P. #1

Construction

- Two methods of installation are commonly used
  - Trench method
  - Mechanical (slicing) installation method (e.g. Tommy Silt Fence Machine or equivalent)
- Trench Method
  - Select location of silt fence (usually along contours)
  - Drive support posts a minimum of 0.3 m into ground, spaced a maximum of 2 m apart
  - Excavate trench approximately 0.15 m deep by 0.15 m wide for entire length of fence along upstream side of posts
  - Attach the wire mesh or snow fencing, if used as reinforcement, to upstream side of posts with staples
  - Extend filter fabric to base of trench and attach over wire mesh or snow fence, if used, on upstream side of posts
  - Backfill and compact soil in trench, being careful not to damage fence
- Mechanical Installation Method
  - Select location of silt fence (usually along contours)
  - Use mechanical installation machine to embed the fabric a minimum of 0.15 m into the ground. One mechanical installation method is by slicing (with special equipment) the geotextile fabric embeds into the ground without excavation and backfill. There is only minor disturbance of the ground. Tamping of ground is required for compaction.
  - Drive support posts a minimum of 0.3 m into ground, spaced a maximum of 2 m apart
  - Attach the wire mesh or snow fencing, if used as reinforcement to silt fence fabric, to upstream side of posts with staples
  - Extend filter fabric to base of trench and attach over wire mesh or snow fence, if used, on upstream side of posts

Construction Considerations

- Site Selection

  - Size of drainage area should be no greater than 0.1 ha per 30 m length of silt fence
  - Maximum flow path length above silt fence should be no greater than 30 m
  - Maximum slope gradient above the silt fence should be no greater than 2H:1V
- Fence should be placed on contour to produce proper ponding
- Fence should be placed far enough away from toe of slope to provide adequate ponding area (minimum of 1.8 m away from toe of slope is recommended)
- Ends of fence should be angled upslope to collect runoff
- Fence should not extend more than 0.6 m above grade
- Posts can be wood or metal material dependent on design and ground conditions
- Posts should be placed on downstream side of fence
- Posts should not be spaced greater than 2 m apart
- Wire mesh or standard snow fencing may be placed between the posts and fabric barrier to provide additional strength and support reinforcement
- Geotextile should be cut from a continuous roll to avoid joints (if joints are necessary, the wrapping of fabric around the fence post and a minimum overlap of 0.2 m with staples should be used to attach the fabric to the post)
- Fence (and wire mesh or snow fence, if used) should be attached to posts with heavy duty staples, tie wires, or hog rings
- Fence (and wire mesh or snow fence, if used) should be dug into a trench at least 0.15 m deep to prevent undercutting of fence by runoff
- Trench backfill should be compacted
- Long runs of silt fence are more prone to failure than short runs
  - Maximum length of each section of silt fence should be 40 m
  - Silt fence should be installed in 'J' hook or 'smile' configuration, with maximum length of 40 m, along contours allowing an escape path for ponded water (minimizes overtopping of silt fence structure)

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Repair undercut fences and repair or replace split, torn, slumping or weathered fabric immediately

Silt Fence Sediment Control	B.M.P. #1

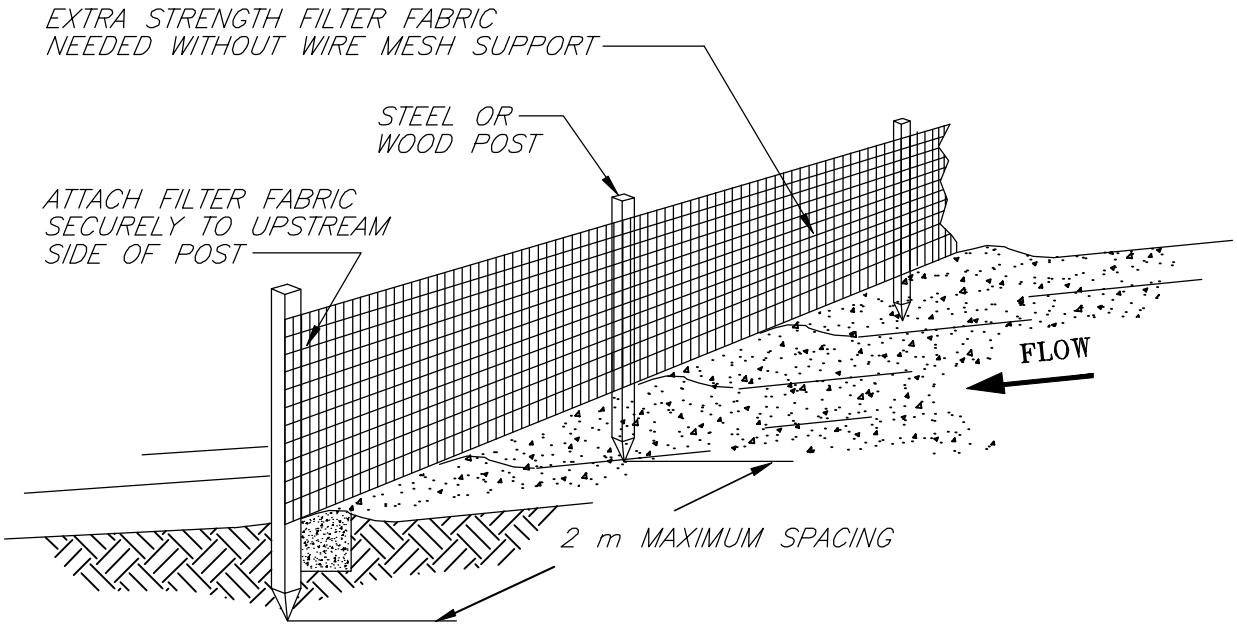
- Sediment build up should be removed once it accumulates to a depth of 0.2 m
- Remove fence after vegetation is established
- Deactivate fabric by cutting-off top portion of fabric above ground; bottom trenched-in portion of fence fabric can be left in-ground thus minimizing ground disturbance

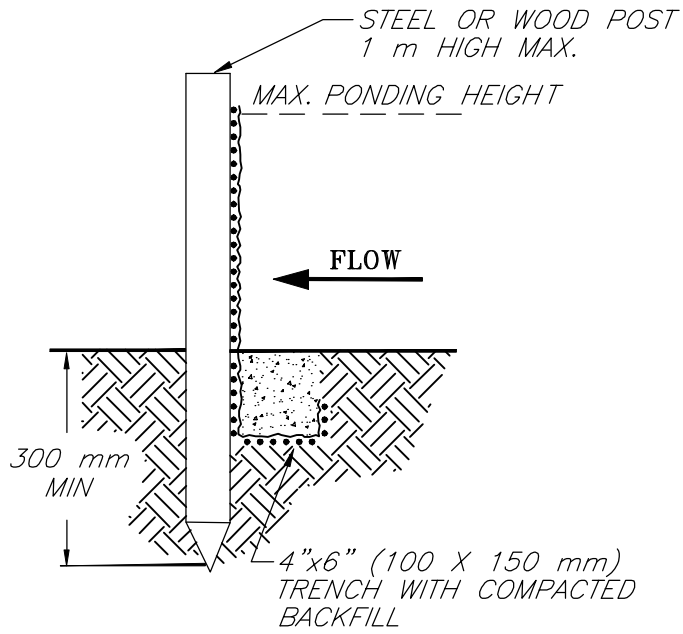
Similar Measures

- Straw Bales
- Rock Barrier
- Permeable/Synthetic Barriers

Design Considerations

- For a silt fence system to work as a system, the following factors should be considered:
  a) quantity – adequate number and frequency of fence for efficient ponding and sedimentation
  b) installation – workmanship
  c) compaction – backfill and trenching of fabric
  d) support – posts adequately embedded, appropriate selection of post material and spacing
  e) attachment – secure fabric to post
- Install silt fences in a 'J' hook or 'smile' configuration





TRENCH METHOD DETAIL

NOTES:

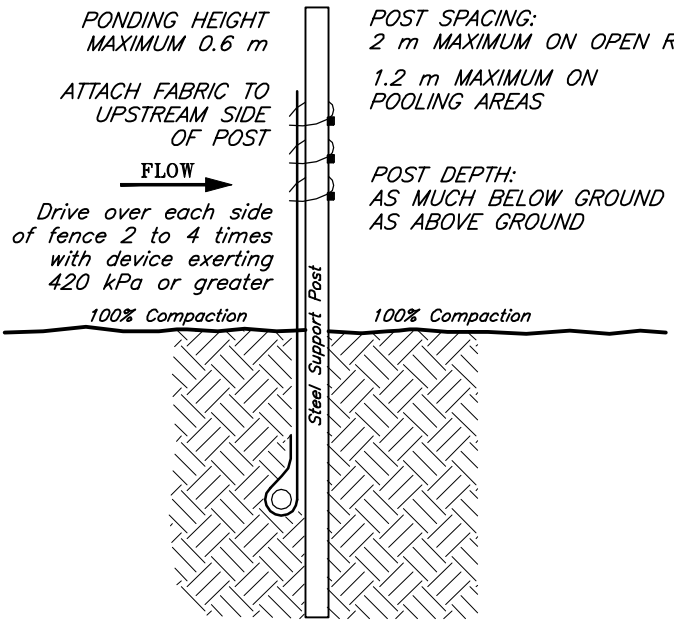
1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. INSPECT AND REPAIR FENCE DAILY AND AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN ACCUMULATED SILT REACHES 200 mm.
3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA WILL NOT CONTRIBUTE SEDIMENT OFF-SITE.
4. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

NOT TO SCALE

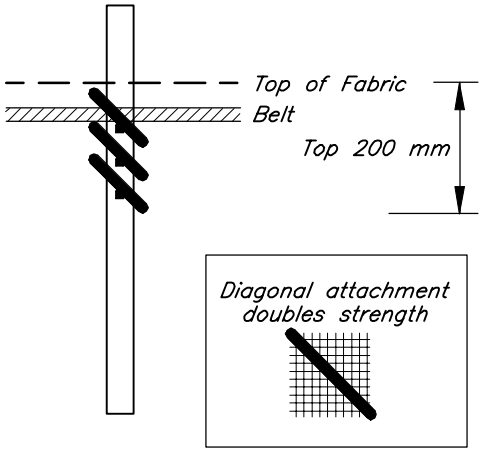
SILT FENCE

(TRENCH METHOD)

FILE: SILTFENC



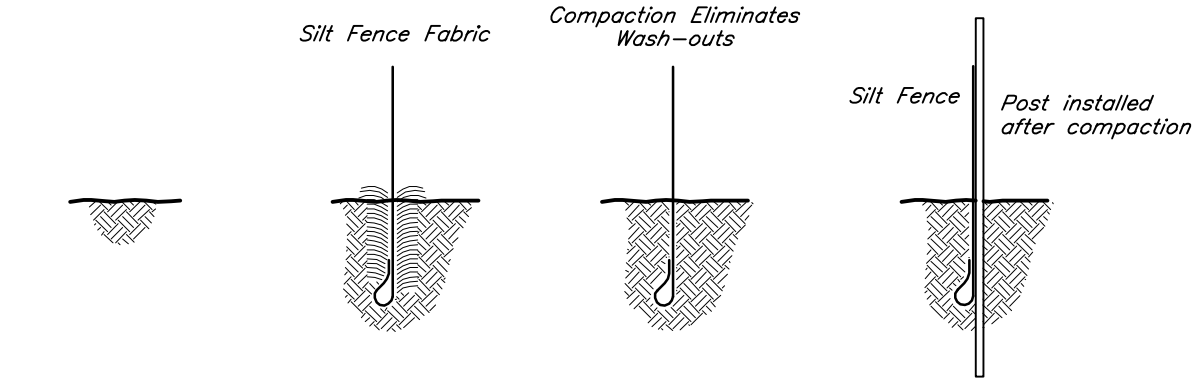
NO MORE THAN 0.6 m OF A 0.9 m FABRIC
IS ALLOWED ABOVE GROUND



ATTACHMENT DETAILS:

- Gather fabric at posts, if needed.
- Utilize three ties per post, all within top 200 mm of fabric.
- Position each tie diagonally, puncturing holes vertically a minimum of 25 mm apart.
- Hang each tie on a post nipple and tighten securely.
- Use cable ties (50 lbs) or soft wire.

MECHANICAL (SLICING) METHOD



a) Before Installation

b) During fabric insertion. Disrupted soil.

c) After Compaction. Greater stability.

d) Completed Installation

MECHANICAL (SLICING) METHOD INSTALLATION SEQUENCE

NOTES:

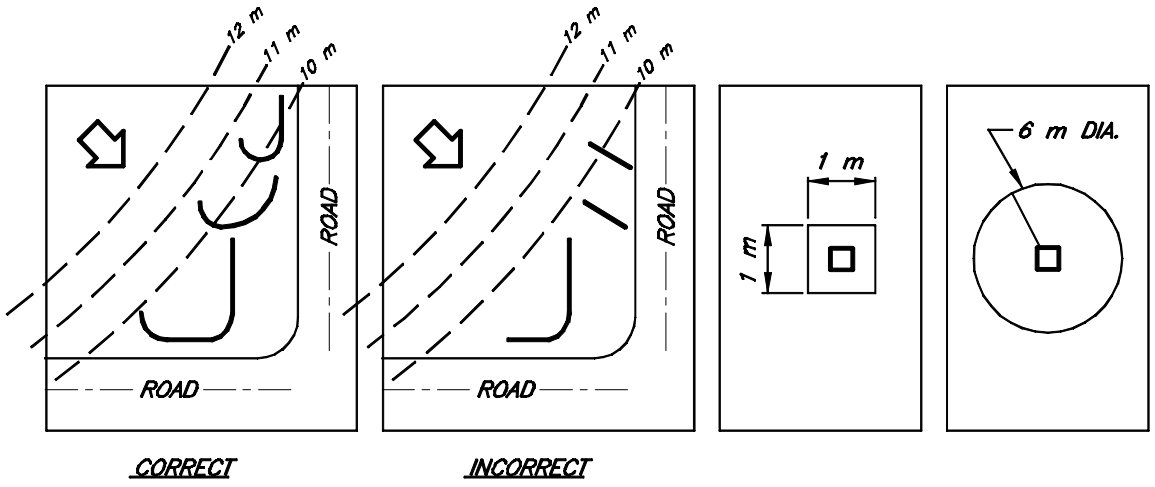
1. INSTALLATION MACHINE MUST ALLOW CONTINUOUS SLICING AND EMBEDMENT OF GEOTEXTILE INTO GROUND WITH MINOR GROUND DISTURBANCE.
2. INSTALLATION MACHINE TYPES WILL VARY WITH MANUFACTURER.
3. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

NOT TO SCALE

SILT FENCE

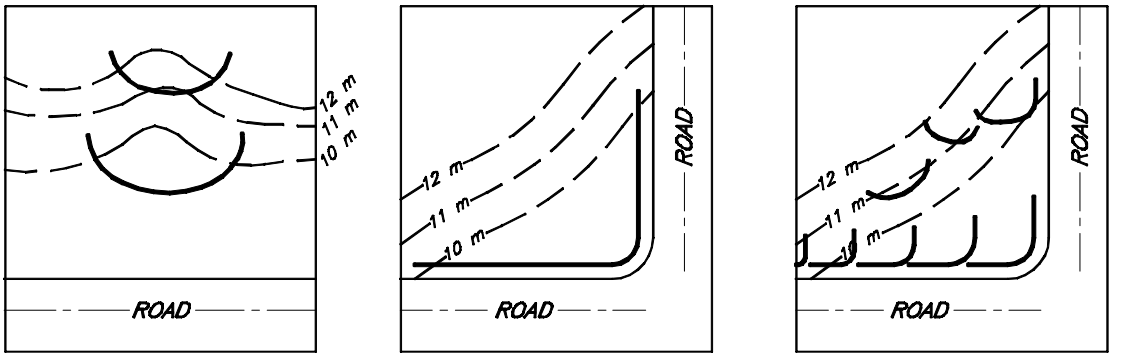
(MECHANICAL METHOD)

SOURCE: CARPENTER T. 2000



"J" CONFIGURATION

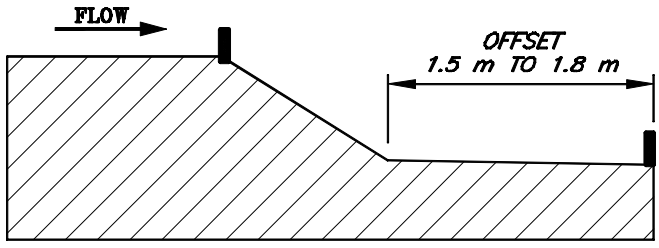
SILT FENCE BARRIER AT STORM INLET



"SMILE" CONFIGURATION

AVOID LONG INSTALLATION

COMBINATION OF "SMILE" AND "J" CONFIGURATIONS



LOCATION AT TOP AND BOTTOM OF SLOPE

NOT TO SCALE

NOTE:

1. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

SOURCE: CARPENTER T. 2000

SILT FENCE
(CONFIGURATION PLAN)

Continuous Perimeter Control Structures Sediment Control	B.M.P. #4

Description and Purpose

- Constructed of sand or gravel-filled geotextile, or formed structures comprised of compost, shredded wood mulch, and natural fibres
- Used to divert and intercept sheet or overland flow
- May be used to form ponds and allow sediment to settle out
- Compost should possess no objectionable odours or substances toxic to plants
- Compost contains plant nutrients but is typically not characterized as a fertilizer

Applications

- Temporary measure
- May be used in place of silt fences or straw bale barriers to retain sediment on construction sites
- Compost used on AT projects must meet Canadian Council of Ministers of the Environment (CCME) Guidelines for Compost Quality (trace elements, maturity/stability, pathogens), which are adopted by Alberta Transportation and found on AT Products List (www.transportation.alberta.ca).
- May be used in place of silt fences or straw bale barriers to retain sediment on construction sites

Advantages

- Trenching may not be required as weight and flexibility of structure typically allows continuous contact with ground surface

Limitations

- Sand or gravel filled geotextile requires Continuous Structure Machine (CBM) for construction
- Requires specialized blower truck, hose and attachments for berm installation

Construction

- Install structure a minimum of 2 m away from toe of slope to provide adequate ponding area on upstream side of structure
- Follow operating procedures for CBM
- Use of woven geotextile is preferred due to higher tensile strength and small deformation

- If required, PVC drainage pipes (e.g., 50 mm) may be inserted in downstream side of structure, spaced 100 to 150 mm apart, to facilitate drainage
- If required and appropriate, slits may be cut in upstream side of structure to facilitate filtering and drainage

Compost filter berm installation:

- Parallel to the base of the slope, or around the perimeter of affected areas, construct a trapezoidal berm at the following dimensions:

Annual Rainfall/Flow Rate	Total Precipitation	Berm Dimensions (height x width)
Low	25 mm – 635 mm	30 cm x 60 cm – 45 cm x 90 cm
Average	635 mm – 1270 mm	30 cm x 60 cm – 45 cm x 90 cm
High	>1270 mm	45 cm x 90 cm – 60 cm x 120 cm

- Base of berm is twice the height
- Compost shall be uniformly applied using an approved spreader unit - including pneumatic blowers, specialized berm machines, etc
- Seeding the berm may be done in conjunction with pneumatic blowing
- Compost can be blown into a netted sock to be used as a berm

Construction Considerations

- Structure constructed of sand, aggregate, or other pervious soil encased in geotextile fabric
- Maximum structure height is approximately 0.4 m
- Higher permeability fill materials should be used in ‘drainage chambers’ in low areas
- Compost filter berm dimensions and blanket application rates vary with soil characteristics, existing vegetation and climatic conditions
- Use larger berm application rate in high rates of precipitation and rainfall intensity, and snow melt
- Use larger berms in severe grade and long slope lengths
- Berms may be placed at the top and the base of a slope
- A series of berms may be used down a slope (5 to 8 m apart)
- Berms may be used in conjunction with a compost blanket, especially in regions with spring melt, and sites with severe grades and long slopes

- Use smaller berm application rate in lower precipitation rates and rainfall intensity regions
- Use larger berms where they are required to be in place or function for more than one year

Inspection and Maintenance

- Inspection frequency should be in accordance with PESC and TESC Plans.
- Inspect for sediment accumulation and remove sediment when depths reach approximately one-third the structure height
- Inspect for toe undermining, weathered/deteriorated geotextile, and end runs and erosion of the filter and repair immediately
  - Damaged sections may be repaired by restapling or placing another section of continuous structure upstream of the damaged section to provide seal
- If the structure is encased in a geotextile fabric, removal of structure is accomplished by splitting the structure, spilling fill material and removing fabric
- Removal of berm is accomplished by splitting the berm and sock, spilling fill material and removing sock

Similar Measures

- Structures/Barriers
- Sand/Gravel Bag Barriers
- Silt Fence
- Compost Berm

Berm Interceptor Sediment Control	B.M.P. #5

Description and Purpose

- Earth dyke barrier constructed of compacted soil to intercept and divert flow of runoff water away from erodible slopes, sensitive areas or water bodies
- A spillway outlet of erosion-resistant granular material constructed to allow exit of diverted water to less sensitive areas

Applications

- Temporary or permanent measure
- Used instead of, or in conjunction with, diversion ditches
- Perimeter control
- Placed along contours and/or at toe of slope to divert run-off from sensitive areas
- Used to divert water to sediment control structures

Advantages

- Easy to construct
- Can be converted to sedimentation/impoundment pond with the design of a permeable filter berm at the exit spillway area (see BMP #13)

Limitations

- Generally, earth dyke barriers can be 1 to 2 m in height. Design by a geotechnical engineer is required for barriers greater than 3 m in height in accordance with dam design guidelines and regulatory requirements. The consequences of failure will influence the level of design and construction requirements

Construction

- Construct barrier from bottom up by placing and compacting subsequent lifts of soil
- Degree of compaction of each lift to be specified by the design engineer based on consequences of failure

Berm Interceptor Sediment Control	B.M.P. #5

Construction Considerations

- The barrier should be trapezoidal in cross-section
- Low barriers should have the slopes suited to the construction material used
  - 1.5H:1V for granular soils
  - 2H:1V or flatter for compacted mixed or fine grained soils
    - Slope should be flattened to a minimum of 3H:1V for uncompacted fine grained soils

Inspection and Maintenance

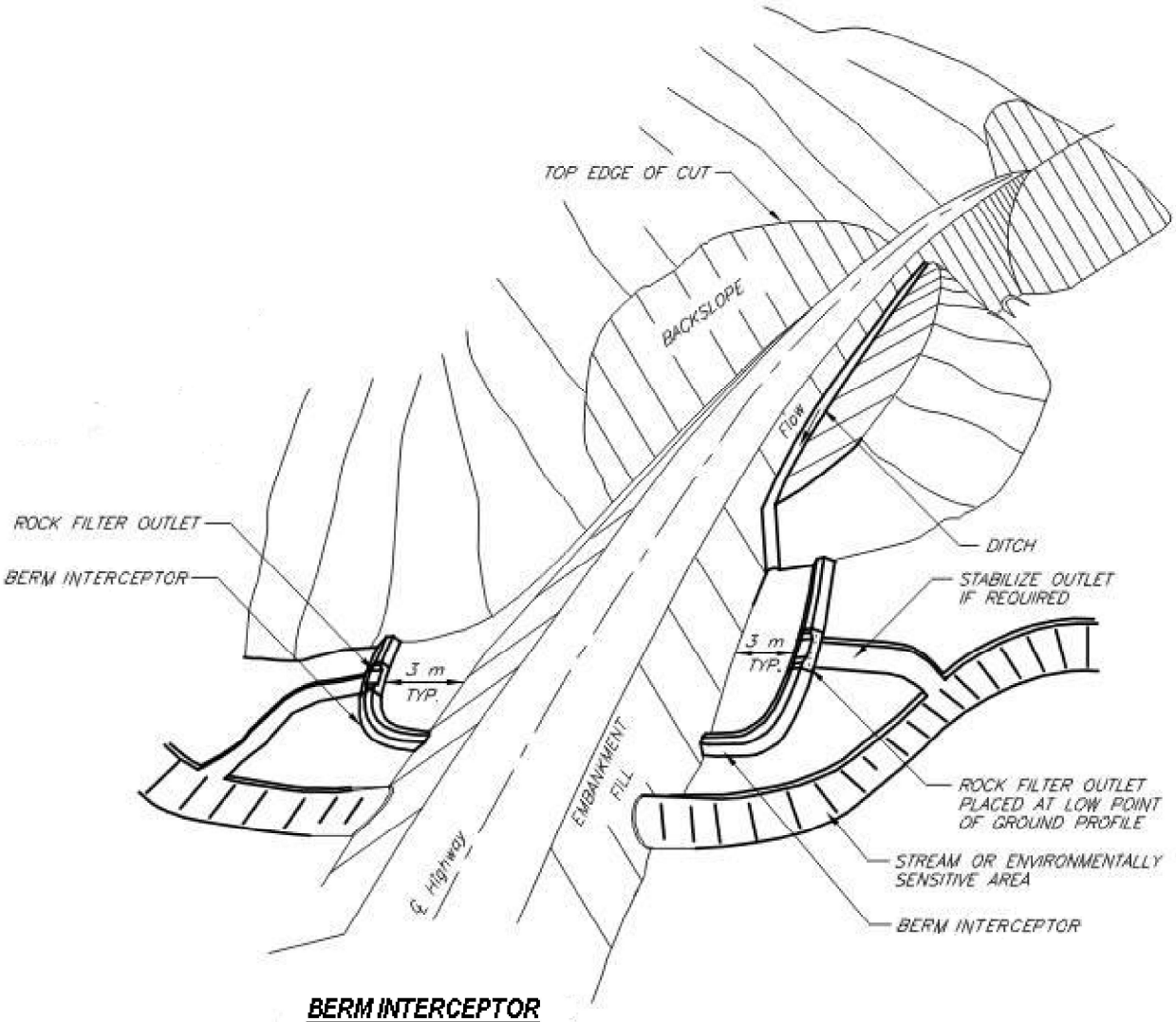
- The degree and extent of inspection and maintenance performed on a earth dyke barrier is directly related to the consequences of failure. An engineer experienced in embankment design and inspection may be required for design, inspection, design of remedial measures, and supervision of their implementation
- Inspection frequency should be in accordance with the PESC and TESC Plans
- Piping failures may be remedied by replacing saturated soils with drier compacted soil and/or by placement of geotextile over the failed area and placing a stabilizing toe berm constructed of granular materials
- Inspect for sediment accumulation and remove sediment when depths reach approximately one-half the barrier height
- Deactivate and remove barrier once slope soils have stabilized and return barrier location to an acceptable condition

Similar Measures

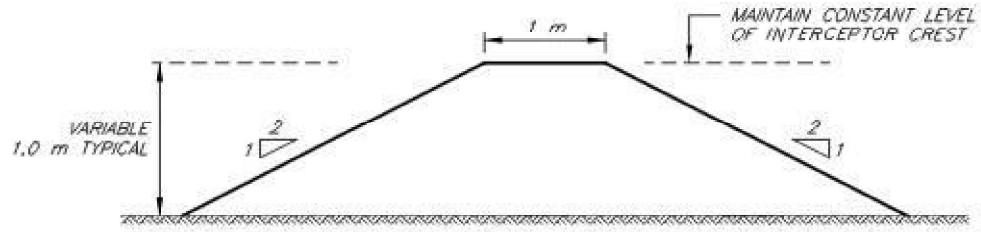
- Berms
- Sand/Gravel Bag Barriers

Design Considerations

- Geotechnical design required for barriers constructed of fine grained soils and greater than 3 m in height



BERM INTERCEPTOR
TYPICAL LOCATION



TYPICAL SECTION
BERM INTERCEPTOR

NOTES:
1. SILT ACCUMULATION TO BE REMOVED WHEN HALF BERM INTERCEPTOR HEIGHT COVERED.
2. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

BERM INTERCEPTOR

Storm Drain Inlet Sediment Barrier (a-f) Sediment Control	B.M.P. #6 (a-f)

Description and Purpose

- Temporary devices constructed to minimize the amount of sediment entering a storm drain by ponding sediment laden runoff at the inlet
- Storm Drain Inlet protection can consist of the following measures:

a) Block and Gravel Sediment Barrier – Option 1

b) Block and Gravel Curb Inlet Sediment Barrier – Option 2

c) Sand Bag Curb Inlet Sediment Barrier – Option 1

d) Sand Bag Curb and Gutter Sediment Barrier – Option 2

e) Straw Bale / Gravel Sediment Barrier - Option

f) Silt Fence Sediment Barrier - Option

Applications

- Temporary measure
- Used where storm drains are operational prior to establishing vegetation on disturbed drainage areas
- Can be effective where drainage enters municipal sewers or watercourses
- Used for small, nearly level (less than 5% grade) drainage areas
- Used as curb inlet barriers in gently sloping ditches and gutters
- Used where drainage area is 0.4 ha (1 ac) or less
- Used in open areas subjected to sheet flow and concentrated flows less than 0.014 m^3/s (0.5 cfs)
- Block and gravel bag barriers are applicable when sheet flows or concentrated flows exceed 0.014 m^3/s (0.5 cfs) and is necessary to allow for overtopping to prevent flooding
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected and overflow capacity is required

Advantages

- Easy to install and remove
- Sand bags may be reusable

Limitations

- Ponding around inlet may result in excessive local flooding
- Use only when ponding will not encroach into vehicular traffic, onto erodible surfaces and slopes or beyond the limits of the construction site
- Frequent removal of sediment required for high flow situations

Construction

- Place inlet sediment barrier around entrance to drain/pipe. The option appropriate for use is dependent on site conditions.
- Silt fence barrier can be used for soil surfaces
- Gravel or aggregate filled sand bags should be used for asphalt or concrete surfaces
- Aggregate filled sand bags
  - Place sand bags stacked one or two bags high around inlet
- Gravel barriers
  - Place concrete blocks stacked one or two blocks high, with cavities of blocks aligned with direction of flow, around inlet
  - Wrap 13 mm (1/2 inch) wire mesh around concrete blocks
  - Place 25 mm to 38 mm diameter rock around block and wire mesh assembly ensuring rock extends down from top of blocks to asphalt or concrete surfacing
- Gravel filter curb inlet
  - Place concrete blocks stacked one or two blocks high around inlet, with cavities of blocks aligned with direction of flow, forming a 'U' shape
  - Wrap 13 mm (1/2 inch) diameter wire mesh around concrete blocks
  - Place 25 mm to 38 mm diameter rock around block and wire mesh assembly ensuring rock extends down from top of blocks to asphalt or concrete surfacing

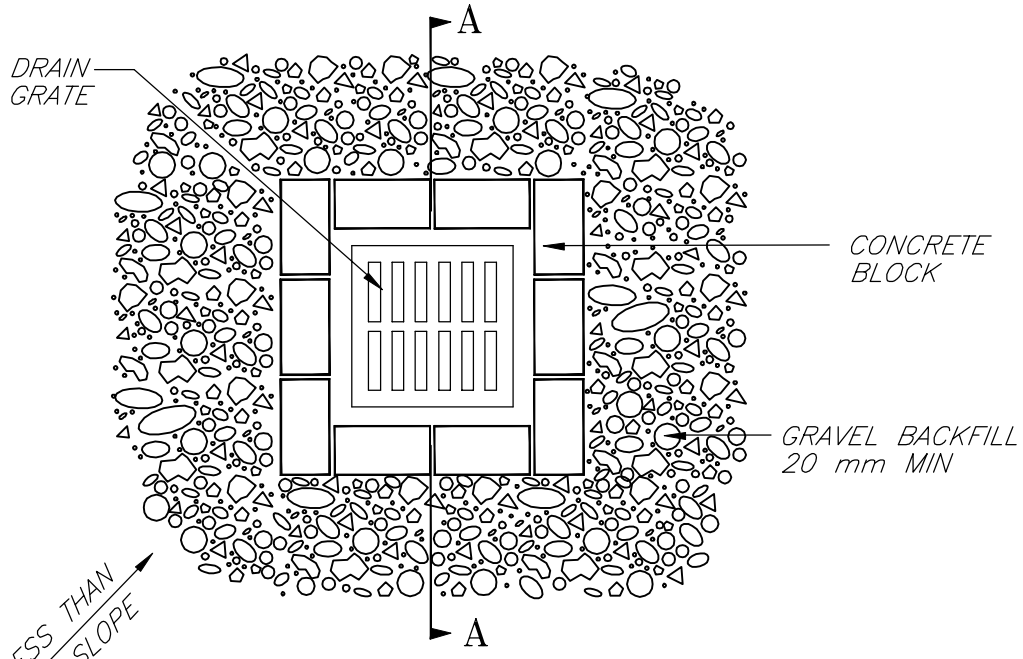
Construction Considerations

- Gravel or aggregate filled sand bags should be used for asphalt or concrete surfaces
- Aggregate filled sand bags
  - Sand bags should be filled with pea gravel, drain rock, or other free draining material

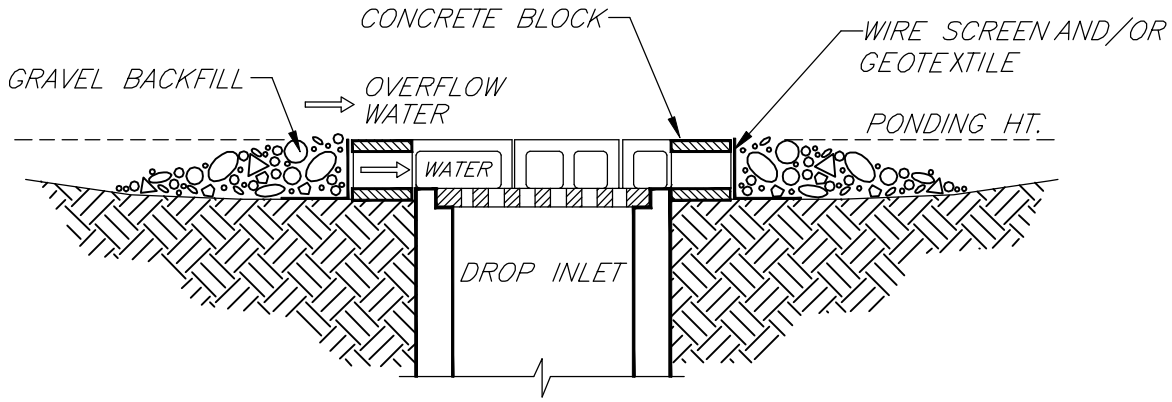
  - Gravel or aggregate filled sand bags should be filled only ¾ full to allow sand bag to be flexible to mould to contours, maintaining continuous contact with surface
  - Barrier should be placed at least 0.1 m from inlet to be protected
  - Several layers of sand bags should be overlapped and tightly packed against one another
  - A one sand bag wide gap should be left in the lowest point of the upper layer to act as an emergency spillway
- Gravel filter inlet berm and gravel filter curb inlet
  - Slope gravel towards inlet at a maximum slope of 2H:1V
  - Maintain at least 0.3 m spacing between toe of gravel and inlet to minimize gravel entering inlet
  - 25 mm wire mesh may be placed over inlet to prevent gravel from entering inlet
- For drainage areas larger than 0.4 ha (1 ac) runoff should be directed towards a sediment retention device designed for larger flows before allowing water to reach inlet protection structure
- Use aggregate sand bags filled with 25 mm diameter rock in place of concrete blocks for gravel filter inlet berm or gravel filter curb inlet

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Remove sediment build up after each storm event
  - Sediment and gravel should not be allowed to accumulate on roads
- Replace gravel if it becomes clogged with sediment
- Remove all inlet protection devices when inlet protection is no longer required



PLAN VIEW



SECTION A – A

NOTES:

1. STORM DRAIN DROP INLET SEDIMENT BARRIERS ARE TO BE USED FOR SMALL, NEARLY LEVEL DRAINAGE AREAS. (LESS THAN 5%).
2. EXCAVATE A BASIN OF SUFFICIENT SIZE ADJACENT TO THE STORM DRAIN DROP INLET.
3. THE TOP OF THE STRUCTURE (PONDING HEIGHT) MUST BE WELL BELOW THE GROUND ELEVATION DOWNSLOPE TO PREVENT RUNOFF FROM BYPASSING THE INLET. A TEMPORARY DYKE MAY BE NECESSARY ON THE DOWNSLOPE SIDE OF THE STRUCTURE.
4. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

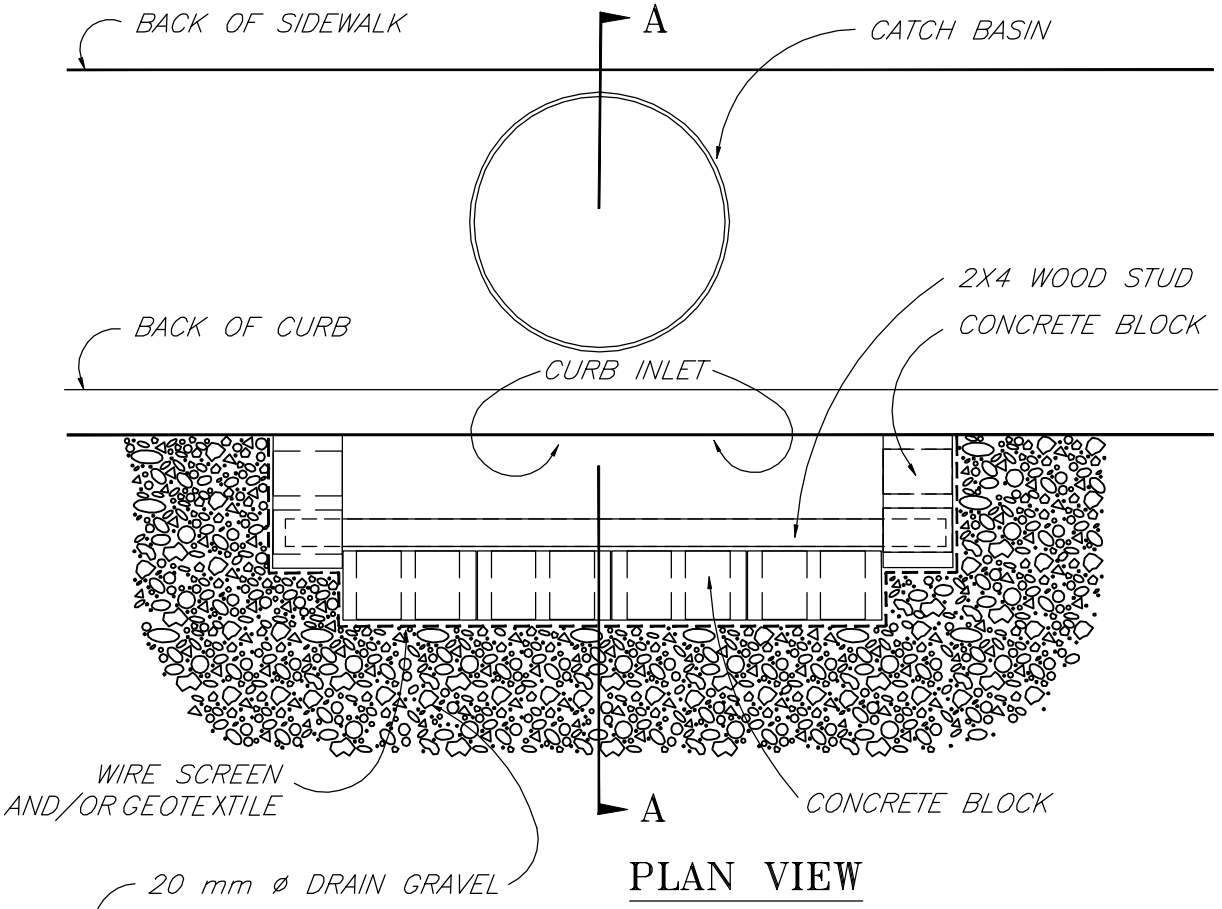
STORM DRAIN DROP INLET SEDIMENT BARRIER

(BLOCK AND GRAVEL – OPTION 1)

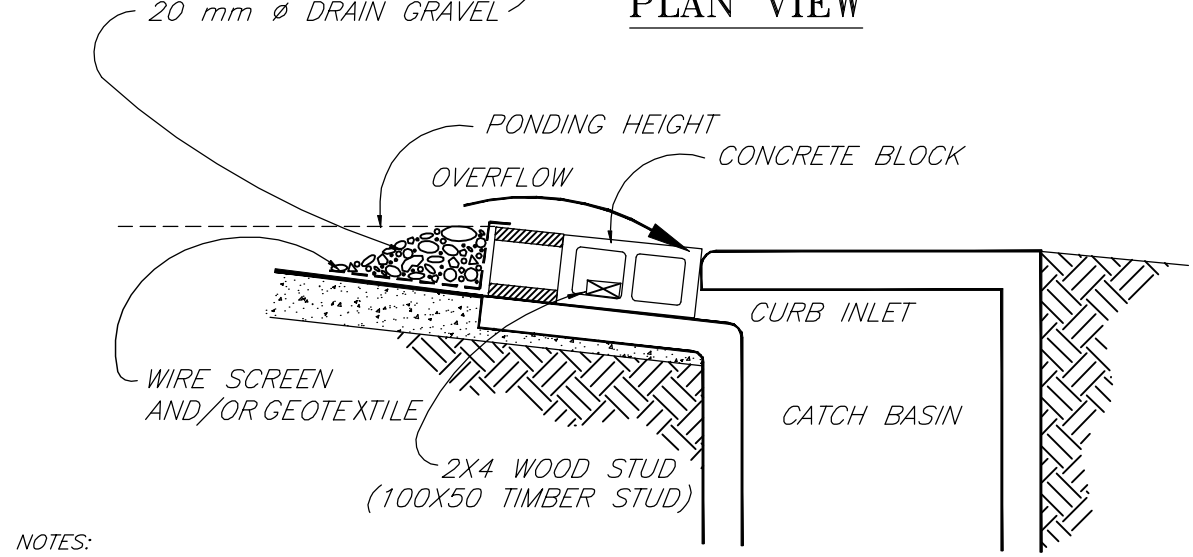
FILE: BGSEDBAR

Government of Alberta ■
Transportation

B.M.P. #6a
Typical Section



PLAN VIEW



SECTION A – A

NOTES:

1. USE BLOCK AND GRAVEL TYPE SEDIMENT BARRIER WHEN CURB INLET IS LOCATED IN GENTLY SLOPING STREET SEGMENT, WHERE WATER CAN POND AND ALLOW SEDIMENT TO SEPARATE FROM RUNOFF.
2. BARRIER SHALL ALLOW FOR OVERFLOW FROM SEVERE STORM EVENT.
3. INSPECT BARRIERS AND REMOVE SEDIMENT AFTER EACH STORM EVENT. SEDIMENT AND GRAVEL MUST BE REMOVED FROM THE TRAVELED WAY IMMEDIATELY.
4. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

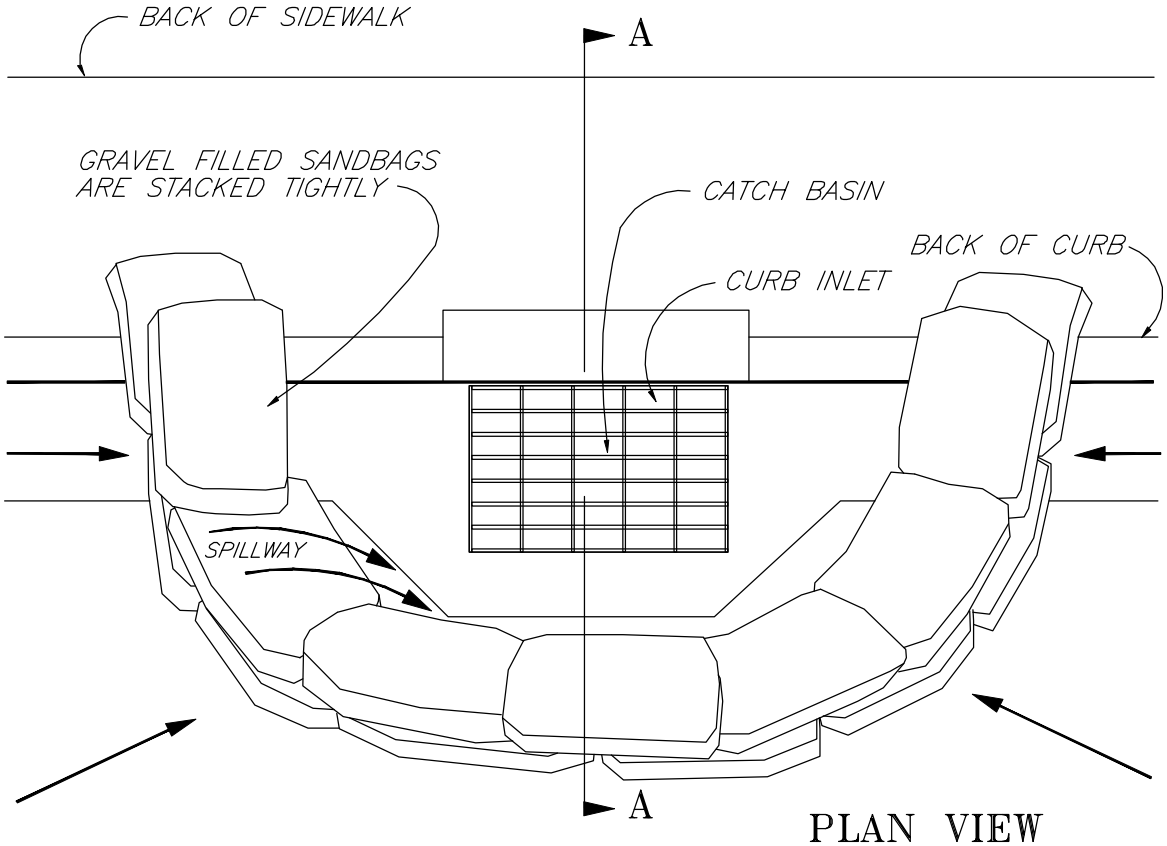
FILE: BLCKCURB

STORM DRAIN CURB INLET SEDIMENT BARRIER

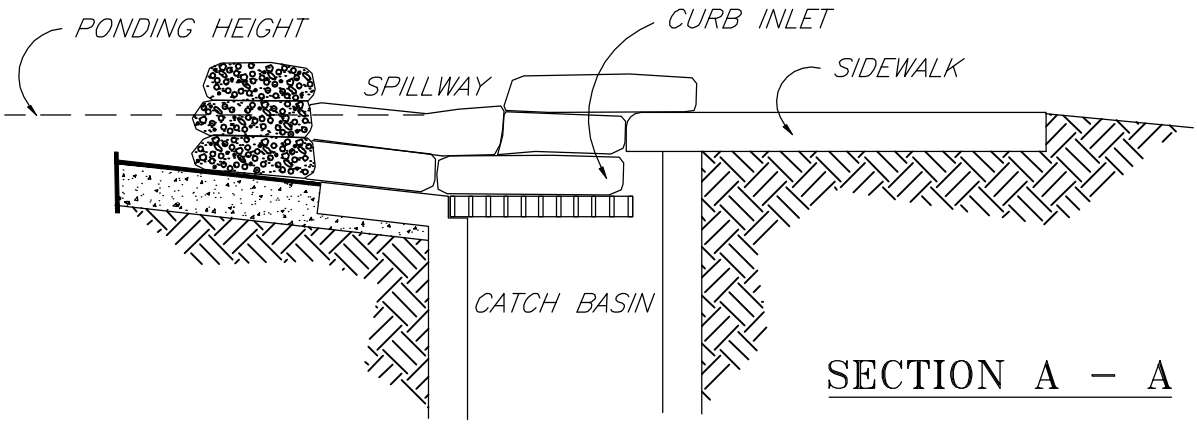
(BLOCK AND GRAVEL – OPTION 2)

Government of Alberta ■
Transportation

B.M.P. #6b
Typical Section



PLAN VIEW



SECTION A – A

NOTES:

1. PLACE CURB TYPE SEDIMENT BARRIERS ON GENTLY SLOPING STREET SEGMENTS WHERE WATER CAN POND AND ALLOW SEDIMENT TO SETTLE OUT.
2. SANDBAGS, OF EITHER BURLAP OR WOVEN GEOTEXTILE FABRIC, ARE FILLED WITH GRAVEL, LAYERED AND PACKED TIGHTLY.
3. LEAVE ONE SANDBAG GAP IN THE TOP ROW TO PROVIDE A SPILLWAY FOR OVERFLOW.
4. INSPECT BARRIERS AND REMOVE SEDIMENT AFTER EACH STORM EVENT. SEDIMENT AND GRAVEL MUST BE REMOVED FROM THE TRAVELED WAY IMMEDIATELY.
5. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

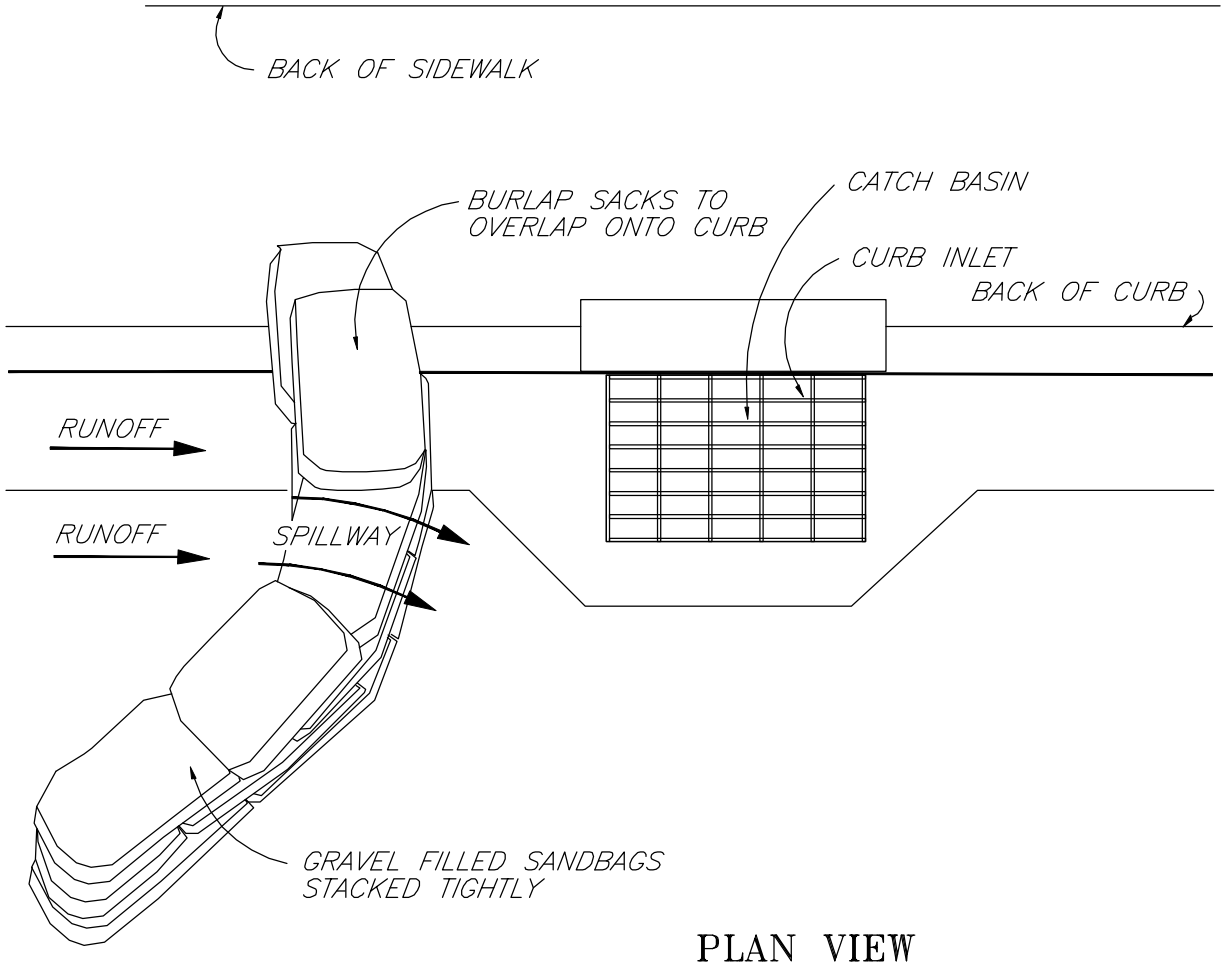
STORM DRAIN CURB INLET SEDIMENT BARRIER

(SANDBAGS – OPTION 1)

FILE: SANDCURB

Government of Alberta ■
Transportation

B.M.P. #6c
Plan View and Section



PLAN VIEW

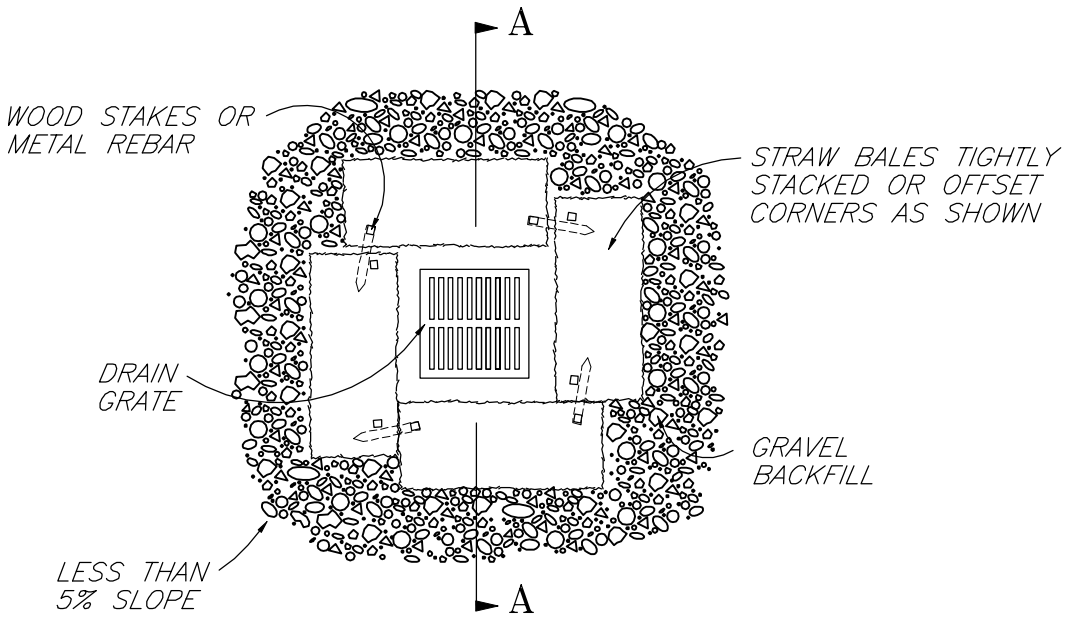
NOTES:

1. PLACE CURB TYPE SEDIMENT BARRIERS ON GENTLY SLOPING STREET SEGMENTS, WHERE WATER CAN POND AND ALLOW SEDIMENT TO SETTLE OUT.
2. SANDBAGS OF EITHER BURLAP OR WOVEN 'GEOTEXTILE' FABRIC, ARE FILLED WITH GRAVEL, LAYERED AND PACKED TIGHTLY.
3. LEAVE A ONE SANDBAG GAP IN THE TOP ROW TO PROVIDE A SPILLWAY FOR OVERFLOW.
4. INSPECT BARRIERS AND REMOVE SEDIMENT AFTER EACH STORM EVENT. SEDIMENT AND GRAVEL MUST BE REMOVED FROM THE TRAVELED WAY IMMEDIATELY.
5. DESIGN CENTRE SPILLWAY LOWER THAN OUTSIDE EDGE TO MINIMIZE FLOW OUTFLANGING.
6. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

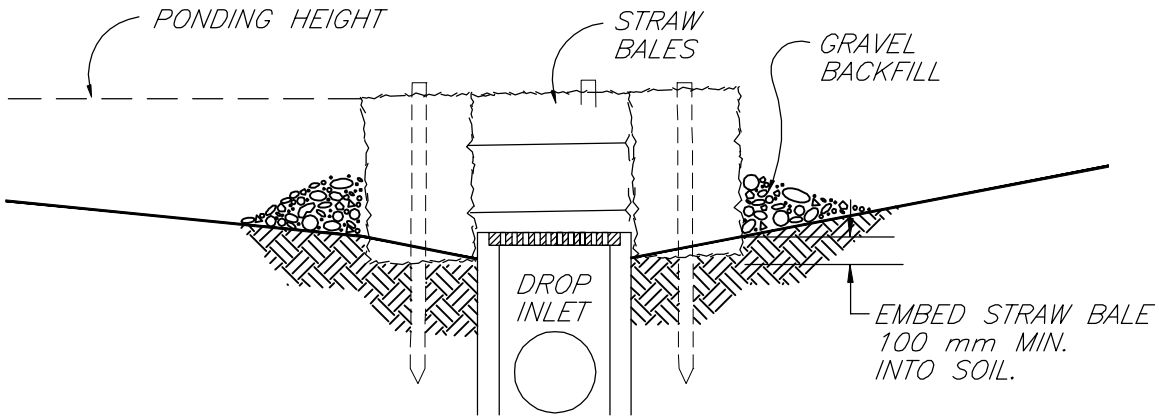
STORM DRAIN INLET CURB AND GUTTER SEDIMENT BARRIER

(SANDBAGS – OPTION 2)

FILE: CURBGTTR



PLAN VIEW



SECTION A–A

NOTES:

1. DROP INLET SEDIMENT BARRIERS ARE TO BE USED FOR SMALL, NEARLY LEVEL DRAINAGE AREAS. (LESS THAN 5%)
2. EMBED THE BALES 100 mm INTO THE SOIL AND OFFSET CORNERS OR PLACE BALES WITH ENDS TIGHTLY ABUTING. GRAVEL BACKFILL WILL PREVENT EROSION OR FLOW AROUND THE BALES.
3. THE TOP OF THE STRUCTURE (PONDING HEIGHT) MUST BE WELL BELOW THE GROUND ELEVATION DOWNSLOPE TO PREVENT RUNOFF FROM BYPASSING THE INLET. EXCAVATION OF A BASIN ADJACENT TO THE DROP INLET OR A TEMPORARY DIKE ON THE DOWNSLOPE OF THE STRUCTURE MAY BE NECESSARY.
4. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

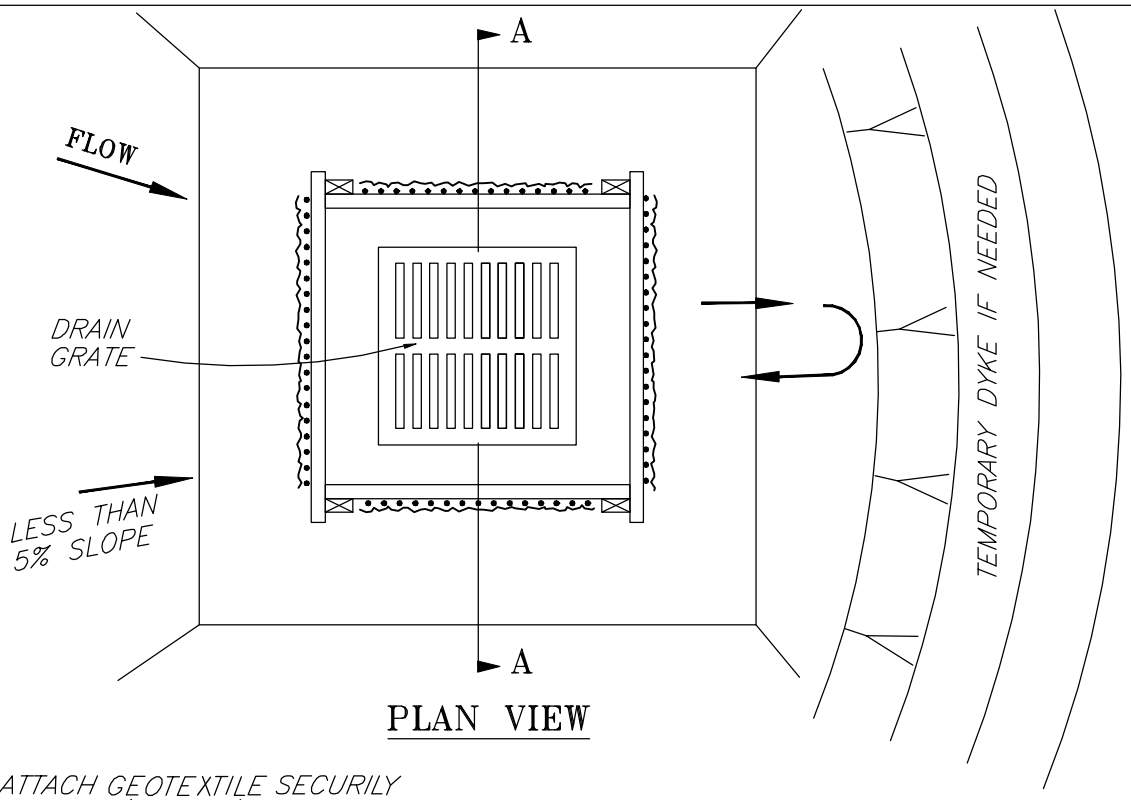
STORM DRAIN DROP INLET SEDIMENT BARRIER

(STRAW BALE / GRAVEL – OPTION)

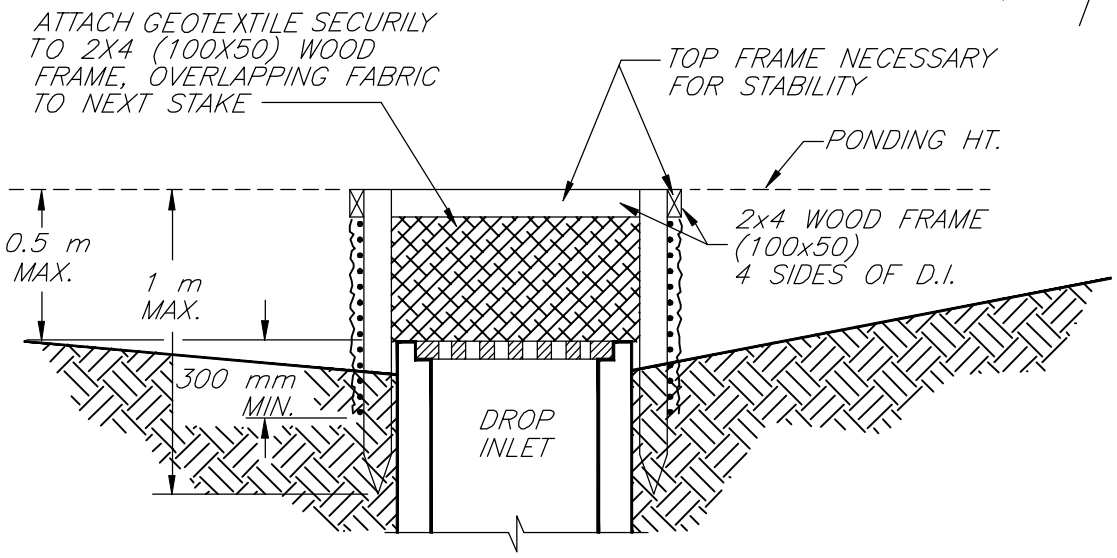
FILE: STRWGRVB

Government of Alberta ■
Transportation

B.M.P. #6e
Typical Section



PLAN VIEW



SECTION A–A

NOTES:

1. DROP INLET SEDIMENT BARRIERS ARE TO BE USED FOR SMALL, NEARLY LEVEL DRAINAGE AREAS. (LESS THAN 5%)
2. USE 2"X4" (100X50mm) WOOD OR EQUIVALENT METAL STAKES, 1 m MINIMUM LENGTH.
3. INSTALL 2"X4" (100X50mm) WOOD TOP FRAME TO INSURE STABILITY.
4. THE TOP OF THE FRAME (PONDING HEIGHT) MUST BE WELL BELOW THE GROUND ELEVATION DOWNSLOPE TO PREVENT RUNOFF FROM BY–PASSING THE INLET. A TEMPORARY DYKE MAY BE NECESSARY ON THE DOWNSLOPE SIDE OF THE STRUCTURE.
5. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

NOT TO SCALE

STORM DRAIN DROP INLET SEDIMENT BARRIER

(SILT FENCE – OPTION)

FILE: SILTFDIB

Government of Alberta ■
Transportation

B.M.P. #6f
Typical Section

Rock Check Dam Erosion Control and Sediment Control	B.M.P. #7

Description and Purpose

- Small dam constructed of rock placed across steep channel
- Decrease flow velocities to reduce erosion caused by storm runoff
- Sediment laden runoff is detained allowing sediment to settle out

Applications

- Temporary or permanent measure
- Reduces long steep grade to intervals of gentle grades between successive structures
- Reduces flow velocities and kinetic energy to decrease erosion potential caused by runoff
- Sediment laden runoff is retained behind structure allowing sediment to settle out
- May be used in channels that drain 4 ha (10 ac) or less
- May be used in steep channels where storm water runoff velocity is less than 1.5 m/s (5 fps)

Advantages

- Cheaper than using riprap armouring or gabion structures in a ditch
- Easy to construct

Limitations

- Not appropriate for high flow velocity >1.5 m/sec; (use gabion structures for flow velocity >1.5 m/sec)
- Not appropriate for channels draining areas larger than 4 ha (10 ac)
- Not to be placed in grass lined channels unless erosion is anticipated
- Susceptible to failure if water undermines or outflanks structure

Construction

- Excavate a trench key a minimum of 0.15 m in depth at the rock check structure location
- Place non-woven geotextile fabric over footprint area of rock check
- Construct structure by machine or hand
- Structure should extend from one side of the ditch or channel to the other

- Structure should be constructed so that centre of the crest is depressed to form a centre flow width which is a minimum of 0.30 m lower than the outer edges
- Height of structures should be less than 0.8 m in height to avoid impounding large volumes of runoff
- Downstream slope of the check dam should be 5H:1V (minimum)
- Upstream slope of the check dam should be 4H:1V (minimum)

Construction Considerations

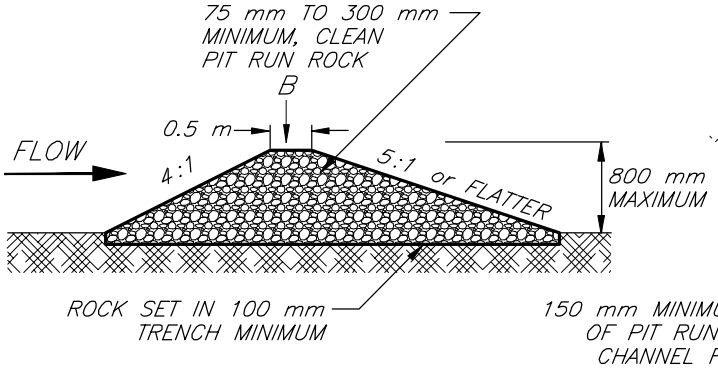
- Should be designed with roadside design clear zone requirements in mind.
- Height and spacing between structures should be designed to reduce steep channel slope to intervals of flatter gradient
- Rock check structures should be constructed of free draining aggregate
- Aggregate used should have a mean diameter (D_{50}) of between 75 mm and 150 mm and must be large enough to remain in place during high velocity flow situations. Maximum rock diameter should not exceed 150 mm if the structure is to be used as a sediment trap.
- If rock check structures are to be placed in channels with significant high flows, they must be properly designed for stone size and structure spacings

Inspection and Maintenance

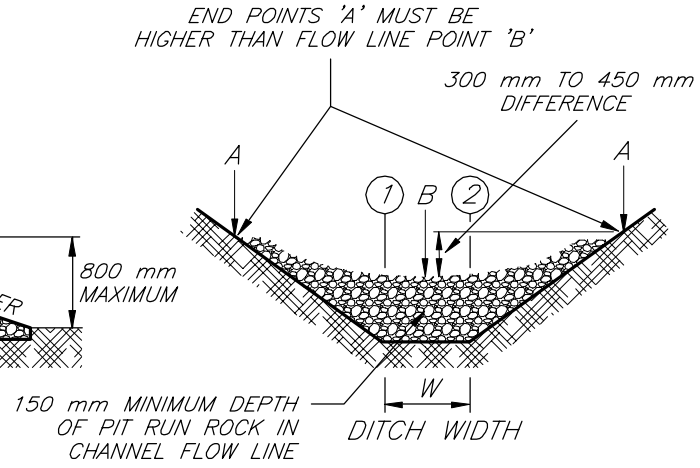
- Inspection frequency should be in accordance with the PESC and TESC Plans
- Remove sediment build up before it reaches one half the check structure height
- Erosion repairs should be made immediately to prevent failure of the structure
- Replace dislodged aggregate immediately with heavier aggregate or gabion structures

Similar Measures

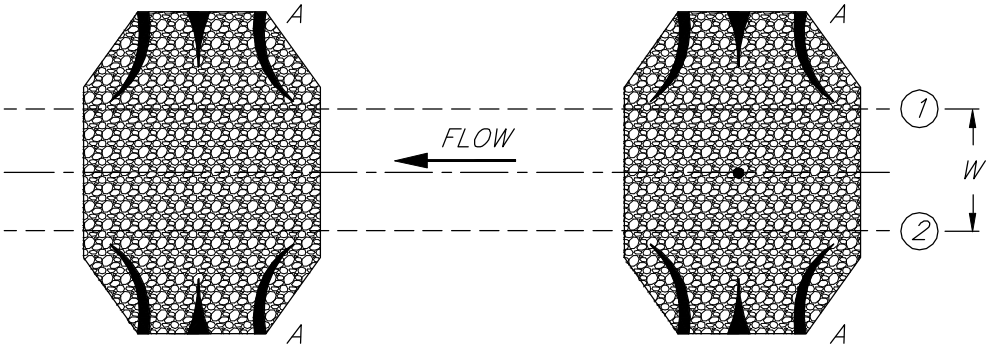
- Synthetic Permeable (Ditch) Barriers

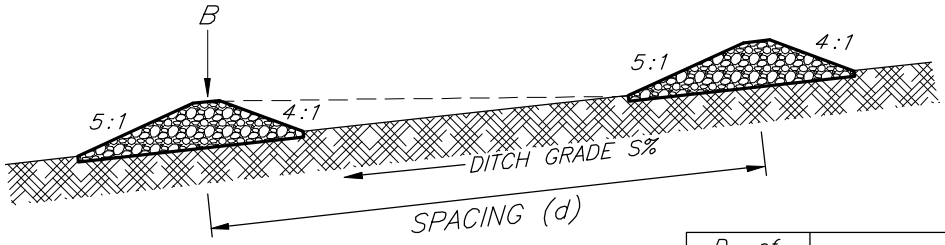


SIDE VIEW



FRONT VIEW





D_{50} of ROCK (mm)	MAXIMUM FLOW DEPTH OVER ROCK (mm)
75	50
150	100

SUGGESTED ROCK DIAMETER AND OVERFLOW DEPTHS

NOTES:

1. SUITABLE FOR FLOW VELOCITY ≤ 1.5 m/s.
2. SUITABLE FOR DRAINAGE AREA ≤ 4 ha.
3. SUITABLE FOR GRADES FROM 5% TO 8%.
4. SPACING (d) AND ROCK SIZE (D_{50}) TO BE DETERMINED BY ENGINEER BASED ON HYDRAULIC CONDITIONS.
5. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

NOT TO SCALE

ROCK CHECK DAM

Government of Alberta ■
Transportation

B.M.P. #7
Typical Section

Synthetic Permeable Barrier Erosion Control and Sediment Control	B.M.P. #10

Description and Purpose

- Double panel, low profile, uni-body porous synthetic barriers used to dissipate flow energy and reduce velocity
- Barriers of patented design constructed of lightweight and durable synthetic materials
- May be used to create a grade break to reduce flow energy and velocities allowing some sediment to settle out at the upstream barrier panel of the barrier structure
- Can be used to dissipate flow energy and trap sediment during the period of revegetation; should be removed at successful re-establishment of vegetation

Applications

- Temporary structure
- May be placed across trapezoidal ditch to dissipate flow energy and reduce flow velocities
- Can be used to supplement as grade breaks along ditch interval between permanent drop structures along steep ditch grades
- May be used as midslope grade breaks along contours of midslope or at toe of disturbed slopes
- Usually used as grade breaks along ditch (3 to 7% grade) in conjunction with erosion control matting or non-woven geotextile as soil covering mattings; usually used in conjunction with permanent gabion structure (i.e., gabion) at steep grade (+6%) areas
- Designed to be reusable

Advantages

- Prefabricated
- Reusable/moveable
- More appropriate for installing at transition areas of changing grades of channels so that hydraulic jumps (or change of flow regime from supercritical to subcritical) may be simulated to dissipate flow energy, thus minimizing erosion potential
- Provide portable drainage control for construction sites, ditches, channels, roads, slopes
- The double panel porous barrier may allow significant energy loss as the flow of water undergoes from supercritical flow to sub-critical flow from the upstream panel

to the downstream panel with a more laminar flow evolving downstream and roughly parallel to the stream bed. Less turbulence and erosion energy may be created when compared with cascading, over-topping and tumbling flow from drop structures (i.e., gabions, check structures, straw bales)

- Barriers constructed of UV resistant material may be left in place for final channel stabilization as UV degradation is low
- Biodegradable synthetic option available
- Observed to enhance aggregation of silt material and to function as a sediment barrier with the formation of an earth block at behind the upstream barrier panel area; the downstream flow exiting at the downstream barrier panel may be of laminar nature and less erosive

Limitations

- More appropriate for use as a grade break and may be installed between permanent drop structures
- Partially effective in retaining some sediment and reducing flow velocities
- Less sturdy as drop structures in resisting high flow impact
- Not to be designed as drop structures
- Must be hand installed
- Become brittle in winter and may be easily damaged by highway maintenance activities or by public
- At the time of deactivation of the structure after vegetation establishment, metallic anchor pins, if not biodegradable, may require removal at time of completed revegetation
- Stick-up of metallic anchor pin above ground may be a nuisance and may be a human hazard and cause damage to maintenance equipment
- The use of biodegradable anchor pins is advisable

Construction

- Install as per manufacturers recommended installation instructions
- Normally installed in conjunction with erosion control matting in ditches and channels
- Prepare soil surface
- Install basal layer of erosion mat or geotextile fabric; key-in basal mat/fabric at upstream end

- Place and anchor barrier panels with adequate pin anchors to basal soils

Construction Considerations

- Maintain intimate contact between base of barrier and soil with laying of basal matting/fabric intimate to ground surface
- Ensure side panel of barrier is extended to outer edges of channel to sufficient height to provide freeboard of channel flow

Inspection and Maintenance

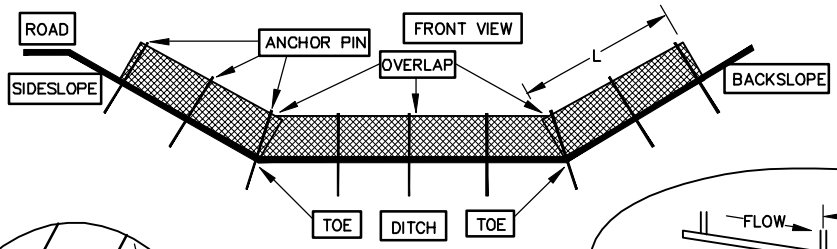
- Inspection frequency should be in accordance with the PESC and TESC Plans
- Remove sediment build-up before it reaches one-half the check structure height
- Do not damage barrier panel during removal of sediment
- Partial or non-removal of sediment build-up will create a non-permeable barrier and low level earth mini-drop structure which will force water flow over-topping the barrier. The option of non-removal of sediments may be open to converting the sediment build-up into a "vegetated earth mini-drop structure" along the ditch with the non-removal of synthetic permeable barrier in-place. This will require topsoil and seeding (or intensive mulch seeding) to promote vegetation growth
- If erosion is noted at the toe or upslope edges of the structure, hand regrading or suitable repairs should be made immediately to prevent failure of the structure
- Remove and deactivate at 1 year after vegetation is established

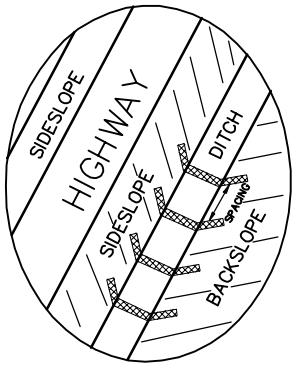
Similar Measures

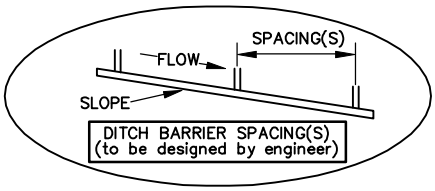
- Silt fences or straw bales partially equivalent in retaining sediment

Design Considerations

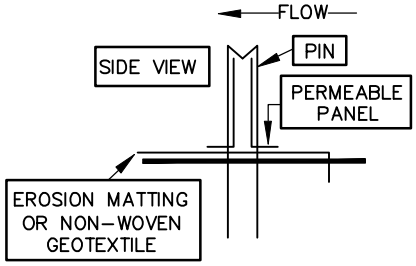
- Install synthetic permeable barrier along ditch interval between permanent drop structures (i.e., gabion); can be economic alternative and supplemental to (i) total hard armouring of complete channel length, or (ii) high frequency of gabion installation required for high flow applications in steep ditch grade



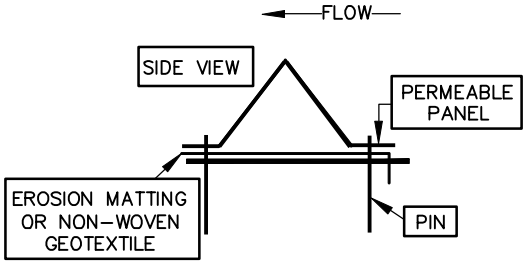




MINIMUM INSTALLATION LENGTH UP SLOPES	
SLOPE	LENGTH: L (m)
2:1	0.55
2.5:1	1.1
3:1	1.1
3.5:1	1.1
4:1	1.1
5:1	1.3
6:1	1.5



1) DOUBLE PANEL



2) TRIANGLE PANEL

SYNTHETIC PERMEABLE DITCH BARRIER

N.T.S.

NOTES:

1. *FOR USE MAINLY AS A GRADE BREAK STRUCTURE FUNCTIONING AS A FLOW ENERGY DISSIPATOR AND VELOCITY RETARDER.*
2. *FOR SECONDARY USE AS SEDIMENT BARRIER.*
3. *REQUIRES NON-WOVEN GEOTEXTILE FABRIC OR BIODEGRADABLE (COCONUT FIBRE PREFERABLE) EROSION BLANKET MAT AT BASE AND KEY-IN TO SOIL AT UPSTREAM END.*
4. *MAY BE INSTALLED AS GRADE BREAK AT GRADE TRANSITION AREAS TO CREATE DISSIPATION OF FLOW ENERGY AND A MORE LAMINAR FLOW REGIME DOWNSTREAM OF STRUCTURE.*
5. *THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.*

SYNTHETIC PERMEABLE BARRIERS

Rolled Erosion Control Products (RECP)

a) Channel Installation
b) Slope Installation
c) Straw Rolls

Erosion Control

B.M.P. #13

Description and Purpose

- Biodegradable or synthetic soil coverings used for temporary or permanent protection of disturbed soils at slopes and channels
- Categories of Rolled erosion control products (RECP) can be:
  - Erosion control blankets (ECB) (generally biodegradable and temporary)
  - Turf reinforcement mats (TRM)
  - Composite turf reinforcement mats (C-TRM)
- RECP may be manufactured of organic material, synthetic material, or as a composite of organic and synthetic materials
- Protect disturbed soils from raindrop impact and surface runoff erosion, increase water infiltration into soil, retains soil moisture and decreases evaporation loss
- Protect seeds from raindrop impact, runoff, and predators
- Stabilizes soil temperature to promote seed germination and enhance vegetation growth

Applications

- Temporary or permanent measure
- May be used to protect disturbed, exposed soils for cut or fill slopes at gradients of 2.5H:1V or steeper
- May be used on slopes where erosion potential is high
  - Silts and sands have higher erosion potential than high plastic clays
- May be used on slopes where vegetation is likely to be slow to develop
- May be used to protect disturbed exposed soils in ditches and channels (with high flow velocities) by providing additional tractive resistance cover in conjunction with a successful high density vegetative growth established

Advantages

- Degree of erosion protection is higher, more uniform, and longer lasting than for sprayed-on products (e.g., mulches)
- Wide range of commercially available temporary (biodegradable) or permanent products

Rolled Erosion Control Products (RECP) a) Channel Installation b) Slope Installation c) Straw Rolls Erosion Control	B.M.P. #13

Limitations

- Non-performance of RECP may result from the following:
  - Low density vegetation growth (beneath RECP) due to non-favourable weather and growth conditions (i.e., soil type, moisture, storm events at critical times). It is noted that values of tractive resistance of RECP products for vegetative growth may be generally tested in laboratory after a growth period (e.g., 3 months) under greenhouse growth conditions. The effectiveness of RECP, especially along channels, is very dependent on success of vegetation growth on site. It is important that the designer should assess the effectiveness of RECP in accordance with site, soil, terrain and vegetation growth conditions
  - Hydraulic uplift of RECP and erosion of underlying soils can occur under rapid snow melt conditions when dammed up melt water generates a hydraulic head and high flow velocity generated in constricted snow melt channel. This situation can occur along steep channels interlaced with drop structures and with RECP lining installed in-between the drop structures. Ponding of melt water and non-anchored RECP joint areas allow flow entry beneath the RECP and generate hydraulic heads to uplift the RECP. This can occur along un-anchored edges of RECP at upper edges of ditch when snow melt occurs at tops of ditch and flow beneath the RECP. This is especially critical when underlying soil is easily erodible. (e.g., fine grained non-cohesive silty soils). It is important to trench-in and anchor the edges of the RECP installations and installed anchor pin (staples) at sufficient dense intervals
  - Ice build-up from groundwater seepage source can uplift and dislocate the RECP and causing flow beneath the RECP to erode the substrate soils. Winter ice accumulation may be related to groundwater regime and investigative design on subsurface drainage by a geotechnical engineer is required
- Can be labour intensive to install
- Must be installed on unfrozen ground
- Temporary blankets may require removal before implementation of permanent measures
- Rolled erosion control products (RECP) are not suitable for rocky sites
- Proper surface preparation is required to ensure intimate contact between blanket and soil
- Plastic sheeting can be used at sensitive slopes with precautions:
  - Plastic sheeting RECP product can be easily torn, ripped, non-biodegradable, and should be disposed of in a landfill

- Plastic sheeting product, if used, results in 100% runoff, thus increasing erosion potential in downslope areas receiving the increased flow volumes
- Plastic sheeting should be limited to temporary covering of sensitive soil stockpiles or temporary covering of small critical unstable slope areas

Construction (Slopes)

- RECP should be installed in accordance with manufacturer's directions

The following is a general installation method:

- Prepare surface and place topsoil and seed
- Surface should be smooth and free of large rocks, debris, or other deleterious materials
- Blanket should be anchored at top of slope in a minimum 0.15 m by 0.15 m trench for the entire width of the blanket
- The blanket should be rolled out downslope
  - (1) Where the blanket roll is not long enough to cover the entire length of the slope, a minimum 0.15 m by 0.15 m check slot should be excavated at the location of the lap, and the downslope segment of blanket anchored in the check slot, similar to the method used for the top of the slope, or (2) when blankets must be spliced down the slope, place blanket end over end (shingle style with approximately 0.10 m overlap. Staple through overlapped area at 0.3 m intervals.
  - The upslope portion of blanket should overlap the downslope portion of blanket, shingle style, at least 0.15 m with staple anchors placed a maximum 0.3 m apart
  - Adjacent rolls of blanket should overlap a minimum 0.1 m
  - Anchors should be placed along central portion of blanket spaced at $4/m^2$ minimum (0.5 m spacing) for slopes steeper than 2H:1V and $1/m^2$ (1 m spacing) for slopes flatter than 2H:1V
  - Anchors along splices between adjacent rolls should be placed 0.9 m apart

Construction (Channels)

- **A Blanket should be installed in accordance with manufacturers directions**

The following is a general installation method

- Prepare surface and place topsoil and seed

- Surface should be smooth and free of large rocks, debris, or other deleterious materials

– Begin by excavating a minimum 0.15 m deep and 0.15 m wide trench at the upstream end of channel and place end of RECP into trench
  - Use a double row of staggered anchors approximately 0.1 m apart (i.e., 0.2 m linear spacing) to secure RECP to soil in base of trench
  - Backfill and compact soil over RECP in trench
– Roll centre RECP in direction of water flow on base of channel
– Place RECP end over end (shingle style) with a minimum 0.15 m overlap downgrade
  - Use a double row of staggered anchors approximately 0.1 m apart to secure RECP to soil
– Full length edge of RECP at top of sideslopes must be anchored in a minimum 0.15 m deep and 0.15 m wide trench
  - Use a double row of staggered staple anchors a maximum of 0.1 m apart (i.e., 0.2 m linear spacing) to secure RECP to soil in base of trench
  - Backfill and compact soil over RECP in trench
– Overlap RECP on sideslopes (shingle style down channel) a minimum of 0.1 m over the centre RECP and secure RECP to soil with anchors spaced a maximum of 0.2 m apart
– In high flow channels, a check slot across the width of the channel is recommended at a maximum spacing of 10 m to anchor the ends of the RECP to the underlying soil
  - Use a double row of staggered staple anchors a maximum of 0.1 m apart (0.2 m linear spacing) to secure RECP to soil in base of check slot
  - Backfill and compact soil over RECP in check slot
– Anchor terminal ends of RECP in a minimum 0.15 m deep and 0.15 m wide trench
  - Use a double row of staggered anchors a maximum of 0.1 m apart (i.e., 0.2 m linear spacing) to secure RECP to soil in base of trench
  - Backfill and compact soil over RECP in trench

Rolled Erosion Control Products (RECP) a) Channel Installation b) Slope Installation c) Straw Rolls Erosion Control	B.M.P. #13

Construction Considerations

- Slopes should be topsoiled and seeded prior to placing RECP
- Ensure blanket is in intimate contact with the soil by properly grading soil, removing rocks or deleterious materials, prior to placing blanket
- In channels, blankets should extend to above the anticipated flow height, with a minimum 0.5 m of free board
- For turf reinforcement mat (TRM), blanket should be placed immediately after topsoiling
- Blanket should be anchored by using wire staples, metal geotextile stake pins, or triangular wooden stakes
  - All anchors should be a minimum of 0.15 to 0.2 m in length
  - For loose soils, use longer anchors
- Blankets should be placed longitudinal to direction of flow, with fabric not stretched but maintaining contact with underlying soil
- It is essential to understand product specifications and follow manufacturers instructions on installation methods

Product Quality Assurance/Quality Control (QA/QC) Certification

RECPs should be certified by the supplier/manufacturer to ensure product performance and compliance with specified property requirements. A certificate for QA/QC testing of manufactured products is required. The performance and QA/QC testing should be carried out by reputable laboratories (e.g., TxDoT – Hydraulic and Erosion Control Laboratory OR equivalent laboratory) to ensure a commonly acceptable QA/QC standard. Dependent on product type and intended performance, the product information certificate should be provided by the product supplier/manufacturer to include the following:

- Manufacturer's Certificate on
- Performance specification
  - Permissible Tractive Resistance (include testing methods and vegetative growth conditions)
  - Permissible Flow Velocity (if available)
  - Longevity (for biodegradable or non-biodegradable products)

- Minimum Average Roll Values (MARVs) along with specified testing methods for
  - Physical properties
    - Mass per unit area
    - Thickness
    - Tensile strength
    - UV Resistance
  - Other physical properties (for non-woven below Erosion Mat (if specified)
    - Grab tensile strength
    - Grab elongation
    - Puncture strength
    - Trapezoidal tear
    - UV Resistance

Inspection and Maintenance

- Areas covered with blankets should be inspected/remediated regularly or in accordance with the PESC and TESC Plans, especially after periods of severe rainfall or storm events, to check for blanket separation or breakage
- Any damaged or poorly performing areas should be repaired/remediated immediately. Regrading of the slope by hand methods may be required in the event of rill or gully erosion.
- Inspection and maintenance should continue until dense vegetation is established
- Areas with low vegetation density should be reseeded
- After approximately one year, a top dressing of fertilizer may be applied to improve vegetation cover and assist degradation of temporary blankets

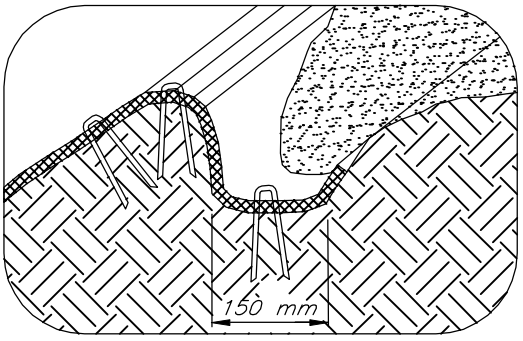
Similar Measures

- Mulching (for slopes only)
- Riprap (primarily in channels)
- Gabion mattresses (primarily in channels)

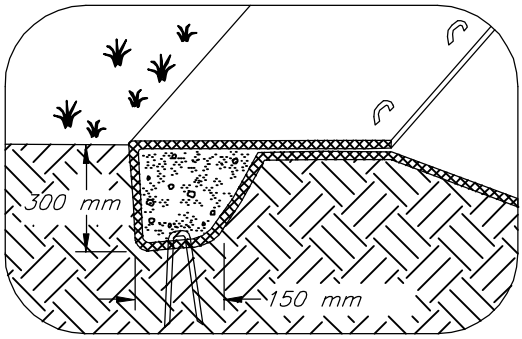
Rolled Erosion Control Products (RECP) a) Channel Installation b) Slope Installation c) Straw Rolls Erosion Control	B.M.P. #13

Design Considerations

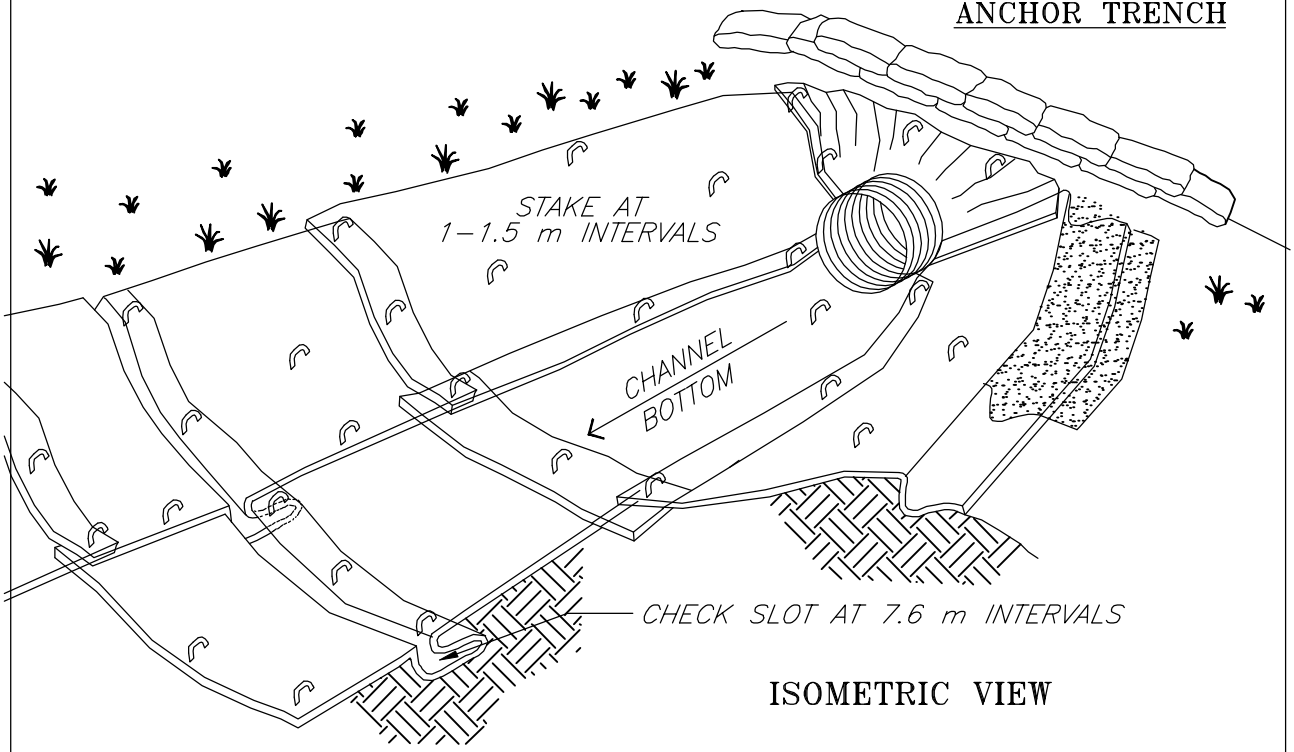
- Assess hydraulic flow conditions and tractive stress on channel
- Assess local soil, weather and growth conditions (favourable/non-favourable) for revegetation (within 3 to 12 months) to allow a determination on use or non-use of RECP as a protective measure. If the revegetation conditions are assessed favourable, the use of RECP can be considered
- Assess suitability of a RECP product using tractive resistance data tested for (i) bare soil, and (ii) vegetated (a specified duration of growth period) condition
- It is noted that tractive resistance data are adopted as selection criteria of RECP and permissible velocity data can be provided for reference.



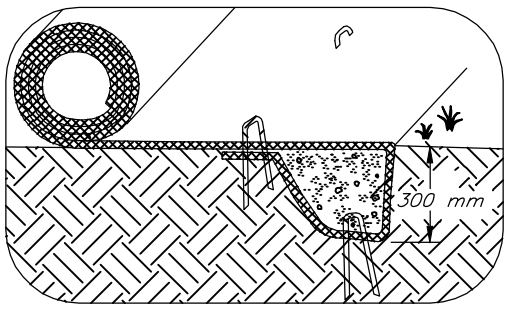
LONGITUDINAL ANCHOR TRENCH



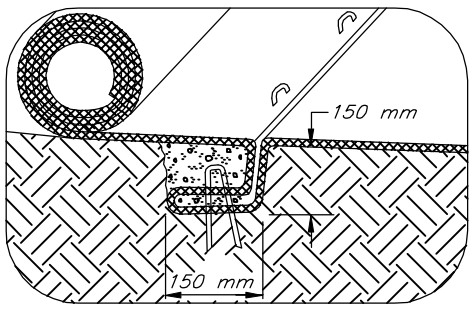
TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH



ISOMETRIC VIEW



INITIAL CHANNEL ANCHOR TRENCH



INTERMITTENT CHECK SLOT

NOTES:

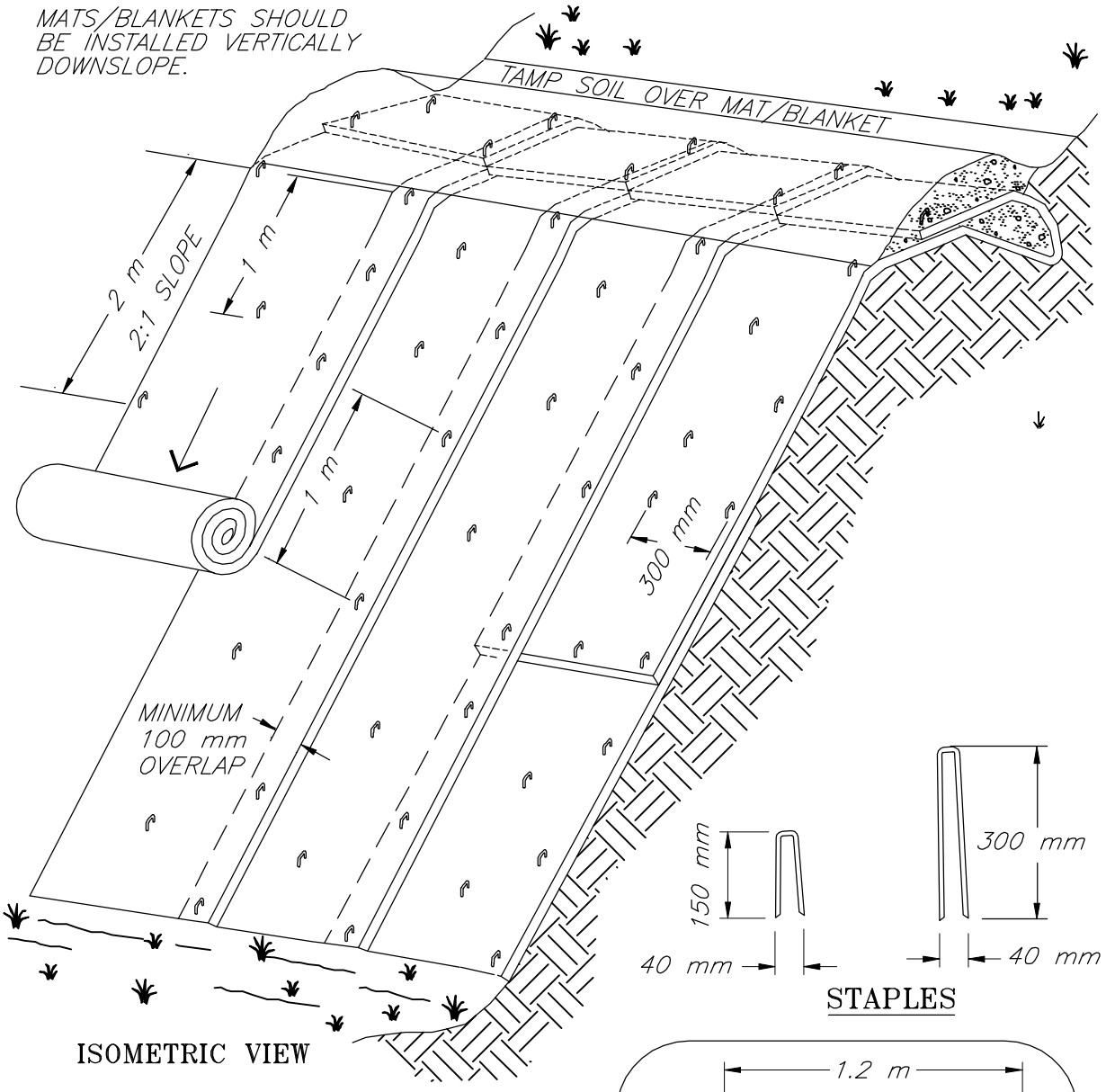
1. CHECK SLOTS TO BE CONSTRUCTED PER MANUFACTURERS SPECIFICATIONS.
2. STAKING OR STAPLING LAYOUT PER MANUFACTURERS SPECIFICATIONS.
3. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

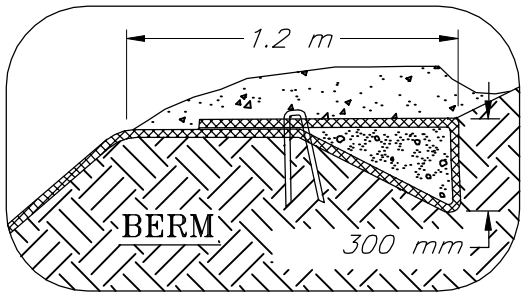
ROLLED EROSION CONTROL PRODUCTS (RECP)

CHANNEL INSTALLATION

Government of Alberta ■
Transportation

B.M.P. #13a
Typical Section





NOT TO SCALE

TYPICAL SLOPE SOIL STABLIZATION

NOTES:

1. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS. MATS/ BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
3. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.
4. CHECK SLOTS, STAKING, STAPLING AND OTHER CONSTRUCTION DETAILS PER MANUFACTURES SPECIFICATIONS.
5. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

ROLLED EROSION CONTROL PRODUCTS (RECP) SLOPE INSTALLATION

Seeding Erosion Control	B.M.P. #22

Description and Purpose

- The planting or placing seed into soils of cut slope or fill embankment slopes after a layer of organic topsoil is spread over the slope
- Provides erosion protection through development of a shallow root structure from seed germination and plant growth

Applications

- Permanent or temporary measure
- Temporary seeding with rapidly growing plants may be applied to interim stockpile/excavation areas which will be exposed for more than 30 days
- Permanent seeding may be applied to exposed bare soil areas which have been graded to final contours
- Permanent seeding may be applied to landscape corridors, slopes and channels by broadcasting, furrowing or spraying on with mulch tackifier
- Provides habitat for wildlife after vegetation establishment
- Can be enhanced with a protective layer of mulches or rolled erosion control products (RECPs) to improve growth environment

Advantages

- Enhances terrestrial and aquatic habitat with vegetation growth re-establishment
- Aesthetically pleasing with vegetation cover
- Grows stronger with time as root structure develops
- Generates vegetation to enhance infiltration of runoff and transpiration of groundwater
- Seeding with a mixture of grasses and herbaceous legumes in disturbed areas is an inexpensive method of stabilizing the soil, particularly if the area is flat to gently sloping
- Cost of seeding disturbed areas is relatively low and its effectiveness on a long-term basis is relatively high

Limitations

- Grasses may require regular maintenance (mowing) along ditches
- Uncut dry grass may present a fire hazard and site distance obstruction adverse to highway safety

- Seeding of steep slopes may be difficult without using measures such as RECP's or hydroseeding-hydromulching methods
- Seasonal windows on planting (early spring or fall) may not coincide favourably with construction schedule
- Areas that have not been covered with seeded topsoil are susceptible to erosion until vegetation is established if RECPs are not used
- Use of topsoil and mulch can reduce rain drop erosion potential during germination and until vegetation is established
- Additional erosion control measures, such as RECPs, may be required for steep slopes and channels
- Reseeding will be required in areas of limited plant growth
- Time to establish root structure may be unacceptable for some high risk areas; shallow sodding should be considered for these areas

Construction

- The site to be seeded should be prepared prior to seeding
- Surface should be graded to design grades and then topsoiled
- Seedbed should be 75 to 150 mm deep, with the top 75 mm consisting of topsoil free of large clods or stones
- Seed should be applied immediately after seedbed preparation using broadcast seed spreaders, cyclone (broadcast) spreaders, or seed drills to ensure uniformity of application
- Seedbed should be harrowed, raked, or chain-dragged to ensure proper seed-soil contact
- Fertilizer should then be applied after seeding

Construction Considerations

- Seeding rate for all mixes should be 25 kg/ha minimum
- Fall rye may be added to each mix to provide early growth and protection from soil erosion.
- Fall rye seeding rate is 5 kg/ha
- Selection of proper vegetation seed mix depends on soil conditions, climate conditions, topography, land use, and site location

- Planting of seeds by hydraulic seeding and mulching techniques should be considered for slopes steeper than 3H:1V where seedbed preparation is difficult, or where application of seed, mulch, and fertilizer in one continuous operation is desirable
- Sod may be installed for faster results, however it is very costly but essential for high risk sensitive areas
- If mulch is placed as a germination medium for seeds, the mulch layer may be further protected with a biodegradable matting to prevent mulch from being washed or blown away

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Freshly seeded areas should be inspected frequently to ensure growth is progressing
- Additional stormwater control measures should be considered for areas damaged by runoff
- Reseedings may be required within 1 to 5 year intervals after initial seeding
- Small bare spots may need to be reseeded several times at subsequent years after initial application
- Larger areas may need to be completely retreated
- Cutting or mowing grasses will encourage the establishment and spread of the grass

Similar Measures

- Hydraulic seeding and mulching
- Sodding

Design Considerations

- Seed application rate of 25 kg/ha may be used; if fall rye is to be added, it should have an application rate of 5 kg/ha
- When using a seed drill or Brillion seeder, grasses and legumes shall not be planted deeper than 1 cm
- Bacterial inoculants must be used when seeding with legumes
- A specific inoculant shall be used for the legume being seeded in accordance with the supplier’s recommendations

- Fertilizer, in lieu of a soil test, shall be as stated in the design, or follow supplier's recommendations
- Fertilizer shall be applied at a rate of 50 to 75 kg of nitrogen/ha, depending upon site conditions
- Fertilizer use shall be carefully controlled as this may increase nutrient loading to receiving streams if runoff is not controlled properly
- Seeding shall occur during periods when germination can be successful and plants have sufficient time to become established before the end of the growing season (approximately May 15 to June 1 and/or August 15 to September 15)
- Seeding should not occur after the 50% frost probability date for the site
- Mulch is required when broadcast seeding or if seeding is carried out after the date specified in which fall seeding should not be carried out
- For specific needs of local growth environment, specific design and advice from local seed supplier or Professional Agrologist may be required

Alberta Transportation has adopted seed mixes (provided below) depending on site location. The various areas of the province used in selecting the seed mix are presented (Alberta Transportation Seed Mixture Zones Map).

Alberta Transportation
Grass Seed Mixtures used on Highway and Bridge Projects

*This Special Provision (*Spc_G039.wpd (2005)) *is to be used in conjunction with AT Standard Specification 2.20 "Seeding" and Design Bulletin No. 25. The Consultant must perform the vegetation assessment and the soil testing for fertilizer (if required) as part of his design work.*

Zone 1 - Peace River District - north and west of High Level:

Seed Mix Zone	Native Seed Mix - Zone 1		% by Dry Weight
	Common Name	Latin Name	
1 Wetland Mixedwood	Slender Wheat Grass	*Agropyron trachycaulum*	40%
	Fringed Brome (1)	*Bromus ciliatus*	15%
	Tufted Hairgrass	*Deschampsia cespitosa*	15%
	Northern Wheat Grass	*Agropyron dasystachyum*	10%
	Rocky Mountain Fescue	*Festuca saximontana*	10%
	Fowl Bluegrass	*Poa palustris*	10%

Note (1): Fringed Brome seed shall be coated.

Agronomic Seed Mix - Zone 1		
Common Name	Latin Name	% by Dry Weight
Pubescent Wheat Grass	*Agropyron trichophorum*	40%
Dahurian Wildrye	*Elymus dahuricus*	22%
Sheep Fescue	*Festuca ovina*	30%
Perennial Ryegrass	*Lolium perenne*	8%

Zone 2 - Athabasca District (south of Athabasca) and Grande Prairie District

Seed Mix Zone	Native Seed Mix - Zone 2		% by Dry Weight
	Common Name	Latin Name	
2 Dry Mixedwood	Slender Wheat Grass	*Agropyron trachycaulum*	35%
	Fringed Brome (1)	*Bromus ciliatus*	20%
	Tufted Hairgrass	*Deschampsia cespitosa*	10%
	Northern Wheat Grass	*Agropyron dasystachyum*	15%
	Rocky Mountain Fescue	*Festuca saximontana*	10%
	Fowl Bluegrass	*Poa palustris*	10%

Note (1): Fringed Brome seed shall be coated.

Agronomic Seed Mix - Zone 2		
Common Name	**Latin Name**	**% by Dry Weight**
Pubescent Wheat Grass	*Agropyron trichophorum*	40%
Dahurian Wildrye	*Elymus dahuricus*	22%
Sheep Fescue	*Festuca ovina*	30%
Perennial Ryegrass	*Lolium perenne*	8%

Zone 3 - Athabasca District (north of Athabasca) and Hwy. Nos. 88, 750, 986

Seed Mix Zone	**Native Seed Mix - Zone 3**		**% by Dry Weight**
	Common Name	**Latin Name**	
3 Central Mixedwood	Slender Wheat Grass	*Agropyron trachycaulum*	35%
	Fringed Brome (1)	*Bromus ciliatus*	10%
	Tufted Hairgrass	*Deschampsia cespitosa*	10%
	Canada Wildrye	*Elymus canadensis*	10%
	Rocky Mountain Fescue	*Festuca saximontana*	20%
	Tickle Grass	*Agrostis scabra*	10%
	Fowl Bluegrass	*Poa palustris*	5%

Note (1): Fringed Brome seed shall be coated.

Agronomic Seed Mix - Zone 3		
Common Name	**Latin Name**	**% by Dry Weight**
Pubescent Wheat Grass	*Agropyron trichophorum*	40%
Dahurian Wildrye	*Elymus dahuricus*	22%
Sheep Fescue	*Festuca ovina*	30%
Perennial Ryegrass	*Lolium perenne*	8%

Zone 4 - Lethbridge District (east of Hwy 22), Calgary District (east of Hwy 22), and Hanna District

Seed Mix Zone	Native Seed Mix - Zone 4		% by Dry Weight
	Common Name	Latin Name	
4 Mixedgrass and Dry Mixedgrass	Slender Wheat Grass	*Agropyron trachycaulum*	30%
	Canada Wildrye	*Elymus canadensis*	15%
	Mountain Brome	*Bromus carinatus*	15%
	Northern Wheat Grass	*Agropyron dasystachyum*	10%
	Western Wheat Grass	*Agropyron smithii*	5%
	Indian Rice Grass	Orzyopsis hymenoides	5%
	Alkali Grass	Puccinellia distans	10%
	Needle and Thread Grass	Stipa comata	10%

Agronomic Seed Mix - Zone 4		
Common Name	**Latin Name**	**% by Dry Weight**
Pubescent Wheat Grass	*Agropyron trichophorum*	32%
Dahurian Wildrye	*Elymus dahuricus*	30%
Sheep Fescue	*Festuca ovina*	30%
Cereal Rye	*Secale cereale*	8%

Zone 5 - Stony Plain, Vermillion, and Red Deer (east of Hwy 22) Districts:

Seed Mix Zone	Native Seed Mix - Zone 5		% by Dry Weight
	Common Name	Latin Name	
5 Central Parkland	Slender Wheat Grass	*Agropyron trachycaulum*	25%
	Northern Wheat Grass	*Agropyron dasystachyum*	10%
	Fringed Brome [(1)]	*Bromus ciliatus*	15%
	Green Needle Grass	*Stipa viridula*	15%
	Canada Wildrye	*Elymus canadensis*	10%
	Indian Rice Grass	*Orzyopsis hymenoides*	10%
	Nuttall's Alkali Grass	*Puccinellia nuttalliana*	10%
	Western Wheat Grass	*Agropyron smithii*	5%

Note [(1)]: Fringed Brome seed shall be coated.

Agronomic Seed Mix - Zone 5		
Common Name	**Latin Name**	**% by Dry Weight**
Pubescent Wheat Grass	Agropyron trichophorum	32%
Dahurian Wildrye	Elymus dahuricus	30%
Sheep Fescue	Festuca ovina	30%
Cereal Rye	Secale cereale	8%

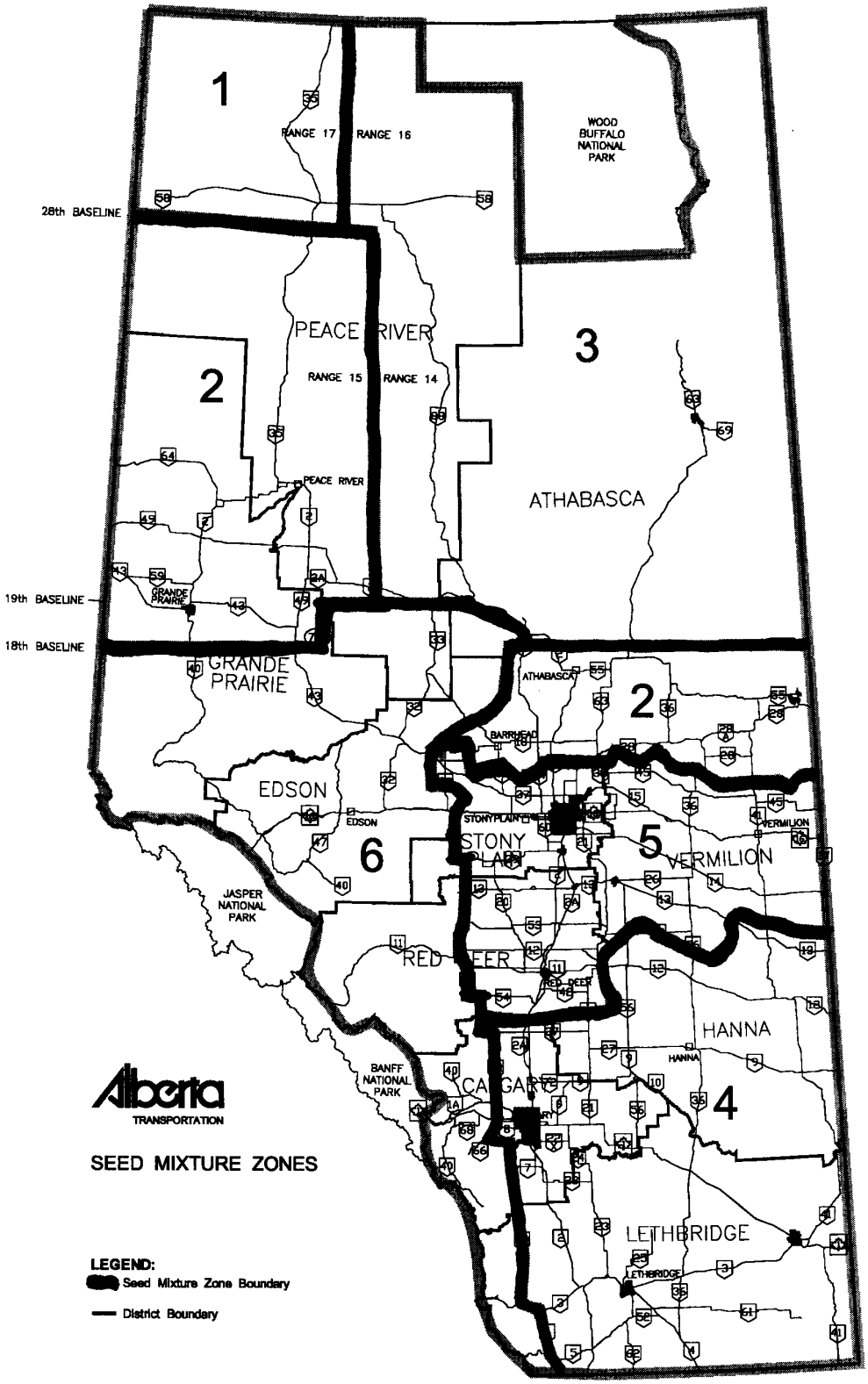
Zone 6 -Lethbridge, Calgary, and Red Deer Districts all located west of Hwy 22):

Seed Mix Zone	**Native Seed Mix - Zone 6**		**% by Dry Weight**
	Common Name	**Latin Name**	
6 Lower Foothills	Slender Wheat Grass	Agropyron trachycaulum	30%
	Smooth Wildrye	Elymus glaucus	20%
	Northern Wheat Grass	Agropyron dasystachyum	10%
	Tickle Grass	Agrostis scabra	10%
	Fringed Brome (1)	Bromus ciliatus	10%
	Tufted Hairgrass	Deschampsia cespitosa	10%
	Foothills Rough Fescue	Festuca campestris	10%

Note (1): Fringed Brome seed shall be coated.

Agronomic Seed Mix - Zone 6		
Common Name	**Latin Name**	**% by Dry Weight**
Pubescent Wheat Grass	Agropyron trichophorum	40%
Dahurian Wildrye	Elymus dahuricus	22%
Sheep Fescue	Festuca ovina	30%
Perennial Ryegrass	Lolium perenne	8%

Seeding Erosion Control	B.M.P. #22



Mulching Sediment Control and Erosion Control	B.M.P. #23

Description and Purpose

- Application of organic material or other normally biodegradable substances as a protection layer to the soil surface (i) to minimize raindrop/runoff erosion and conserve a desirable soil moisture property for plant growth, and/or (ii) to promote seed germination and plant growth
- Mulches conserve soil moisture, reduce runoff velocities and surface erosion, control weeds, help establish plant cover, and protect seeds from predators, raindrop impact, and wind/water erosion

Applications

- Temporary measure
- Can be used as an organic cover or growth medium for seeds where topsoil is not readily available
- Can be used to provide temporary and permanent erosion control
- May be used with or without seeding in areas that are rough graded or final graded
- May be applied in conjunction with seeding to promote plant growth
- May comprise organic mulches (such as straw, wood fibres, peat moss, wood chips, pine needles, compost) or chemical mulches (such as vinyl compounds, asphalt, rubber, or other substances mixed with water)
- Chemical mulches may be used to bind other mulches in a hydroseeding-hydromulching application

Advantages

- Relatively cheap method of promoting plant growth and slope protection

Limitations

- Application of mulch may be difficult on steep slopes
- May require spray-on method to apply mulch with tackifier to provide adhesion to steep slopes

Installation

- Prepare soil surface by removing large rocks or other deleterious materials
- Apply topsoil and seed, if required, and if topsoil is readily available
- Apply mulch as per supplier's recommendations

- Certain mulches may require additional anchoring to minimize loss of mulch due to wind or water erosion

Construction Considerations

- Install mulches as per manufacturers' or suppliers' recommendations
- Organic Mulches
  - Straw
    - Refers to stalks or stems of small grain (primarily wheat) after drying and threshing
    - Straw should be free of weeds
    - Loose straw is very susceptible to movement by blowing wind and water runoff and should be anchored either with chemical tackifier or some form of netting
    - When properly secured to surface, straw is highly suitable for promoting good grass cover quickly, however, it may be a fire hazard in dry conditions
  - Raw Wood Fibre
    - Mixture of cellulose fibres; a minimum of 4 mm in length extracted from wood
    - Wood fibres usually require a soil binder and should not be used as erosion control during periods of hot dry weather in the summer or for late fall seeding unless it is used in conjunction with another suitable mulch as it is prone to removal by blowing wind or water runoff
    - Wood fibre is primarily used in hydroseeding-hydromulching operations where it is applied as part of a slurry and when used in conjunction with a tackifier; it is well suited for tacking straw mulch on steep slopes
  - Peat Moss
    - Comprises partly decomposed mosses and organic matter under conditions of excessive moisture
    - Usually available in dried and compressed bundles
    - Should be free of coarse material
    - Useful soil conditioner to improve organic content of soil promoting plant growth
    - Highly susceptible to removal by blowing wind and water runoff if dry and spread on top of soil
  - Wood Chips
    - By-products of timber processing comprised of small, thin pieces of wood

- Decompose slowly
- Suitable for placing around individual plants (shrubs and trees) and for areas that will not be closely mowed
- Highly resistant to removal by blowing wind and water runoff

– Bark Chips (Shredded Bark)

- By-products of timber processing comprised of small, thin pieces of tree bark
- Suitable for areas that will not be closely mowed
- Have good moisture retention properties and are resistant to removal by blowing wind and water runoff

– Pine Needles

- Comprise needles from coniferous trees (pine, spruce)
- Needles should be air dried and free of coarse material
- Decompose slowly
- Suitable for use with plants that require acidic soils
- Resistant to removal by blowing wind and water runoff

– Compost (Straw Manure)

- Comprised of organic residues and straw that have undergone biological decomposition until stable
- Should be well shredded, free from coarse material, and not wet
- Has good moisture retention properties and is suitable as a soil conditioner promoting plant growth
- Relatively resistant to removal by blowing wind and water runoff if not dried out completely

– Chemical Mulches

- Comprised of acrylic co-polymers, vinyl compounds, asphalt, rubber, or other substances mixed with water
- Usually used in hydroseeding-hydromulching applications
- Should be applied in accordance with suppliers' recommendations

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Areas damaged by washout or rilling should be regraded if necessary and recovered with mulch immediately
- Additional stormwater control measures should be considered for areas of severe rilling erosion damaged by runoff
- Small bare spots may need to be reseeding and recovered with mulch

Similar Measures

- Topsoiling
- Hydraulic seeding and mulching (hydroseeding, hydromulching)
- Rolled erosion control products (RECP)

Hydroseeding Sediment Control and Erosion Control	B.M.P. #24a

Description and Purpose

- The spraying-on of a slurry to a slope or channel surface to provide a layer of seed and growth bedding medium
- The slurry consists of seed, fertilizer, mulch, tackifiers, and water which are mixed together in a tank
- Enables quick re-vegetation of very steep or rocky/gravelly slopes where re-vegetation by any other method would be very difficult or unsafe; frequent re-seeding and special mix design may be required
- When sprayed on the soil, the slurry forms a continuous blanket with seeds and protects the soil from wind and water erosion and raindrop impact by aggregating (or adhering) them in place
- The slurry conserves moisture, reduces soil moisture evaporation, and decreases soil surface crusting due to evaporation or drying of soil

Applications

- Temporary measure
- Slurry is held in suspension through consistent agitation and is sprayed onto disturbed areas using high pressure pumps
- Can be used for spray-on seeding covering large areas efficiently after placement of topsoil
- Can be used to provide temporary and permanent erosion control prior to establishment of vegetation
- May be used to provide soil stabilization for seeding disturbed soil areas
- Can also be used with higher efficiency and large area coverage with advantages over conventional methods (broadcast seeders, drill seeders)
- Can be used in areas where little topsoil is available

Limitations

- Site must be accessible to hydroseeding equipment
  - Usually mounted on trucks
  - Maximum hose range of approximately 150 m
- May require subsequent spraying to reseed bare spots or areas with low growth

Hydroseeding Sediment Control and Erosion Control	B.M.P. #24a

Construction

- Prepare soil surface by removing large rocks or other deleterious materials
- Apply topsoil if available
- Spray on hydroseed-hydromulch as per supplier's recommendations

Construction Considerations

- Seed
  - Seed selection should be made in accordance with Alberta Transportation approved seed mixes
  - Alberta Transportation has adopted seed mixes used on Alberta Highway and Bridge Projects depending on site location (see BMP #22 Seeding)
  - The various areas of the province used in selecting the seed mix are presented in the Seed Mix Zones map (see BMP #22 Seeding)
  - Seed mixes have been developed based on historic performance results throughout Alberta

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Areas damaged by runoff may need to be repaired and/or protected from further erosion
- Small bare spots may need to be reseeded

Similar Measures

- Seeding
- Mulching
- Rolled erosion control products (RECP)

Hydromulching Sediment Control and Erosion Control	B.M.P. #24b

Description and Purpose

- The spraying-on of a slurry to a slope or channel surface to provide a layer of growth bedding medium
- The slurry consists of seed, fertilizer, mulch, tackifiers, and water which are mixed together in a tank
- The slurry conserves moisture, reduces soil moisture evaporation, and decreases soil surface crusting due to evaporation or drying of soil

Applications

- Temporary measure
- Can be used in areas where little topsoil is available

Advantages

- Relatively cheap and efficient spraying method of promoting plant growth as well as erosion protection
- Allows spray-on re-vegetation of steep slopes where conventional re-vegetation methods are very difficult
- Minimizes effort required to re-vegetate disturbed areas as hydromulching usually only requires one spray-on operation in comparison with planting and farrow method
- Relatively efficient operation with high coverage rates
- Provides dust control and protection from wind erosion

Limitations

- Site must be accessible to hydromulching equipment
  - Usually mounted on trucks
  - Maximum hose range of approximately 150 m

Live Staking Streambank Stabilization Technique	B.M.P. #27a

Description and Purpose

- Consists of installing woody plantings (trees and shrubs) to develop a root matrix within the soil, increasing subsurface soil strength and stabilizing slopes with deeper root systems than grasses
- Reduces erosion potential of slopes and channel banks

Applications

- Temporary or permanent measure
- May be used on slopes stable enough to support vegetation; however, there is a low success rate for steep slopes and channel banks with gradients greater than 1H:1V
- May be used on slopes and channel banks with adequate sunlight, moisture, and wind protection to support vegetation
- May be used as bio-engineering stabilization in cases where there have been historical shallow slope instability, soil movements on eroded slopes and gullies
- May be used along channels to provide higher channel roughness to reduce flow velocity and in sedimentation ponds to provide higher sedimentation duration of runoff impoundment

Advantages

- Promotes development of organic mat
- Dense leaves and large diameter plant stalks increases channel roughness and reduces flow velocities in channel thus decreasing erosion potential
- Traps sediment laden runoff and stabilizes soil
- Aesthetically pleasing once developed
- Grows stronger with time as root structure develops
- Usually has deeper root penetration than grass with greater depth of stabilization
- Manual planting may be attempted on steep slopes that are sensitive to machinery disturbance or represent an area of high erosion potential

Live Staking Streambank Stabilization Technique	B.M.P. #27a

Limitations

- Can be labour intensive to install
- Some level of uncertainty as success of plant growth is dependent on various unknown site parameters (i.e., moisture, soil, terrain, weather, seeding conditions, etc.)
- Re-vegetated areas are susceptible to erosion until vegetation develops; and should be used in conjunction with hydroseeding and/or mulching
- Plants may be damaged by wildlife
- Potential for low success rate
- Few precedents as this measure is generally not used on AT construction projects

Construction

- Used on cut or fill slopes or in ditches/channels
- Comprised of willow or poplar stakes inserted into the ground; other indigenous plants may be acceptable
- Individual dormant willow or poplar stakes should be cut to a minimum length of 0.5 m using pruning shears
  - Cuts should be made at a 45° angle a minimum of 0.05 m (5 cm) below a leaf bud
  - All side shutes should be trimmed to within 0.05 m of the main stem
- Install live stakes in a 1 m by 1 m grid
- Make a pilot hole a minimum of 0.3 m in depth to insert live stake into
  - Use iron bar, broom handle or other tool to make pilot hole
- Insert live stake into pilot hole and lightly tamp soil around live stake
- A minimum of two leaf buds should remain above grade

Construction Considerations

- Successful installation requires the use of freshly cut branches or stakes
  - Storage time of cut branches/stakes on-site prior to installation should be kept to as short a time period as possible
- Successful growth dependant on soil moisture and rainfall conditions
- Consultation with agrologist, greenhouse growers, local expertise can be beneficial in selecting and procuring appropriate species for planting

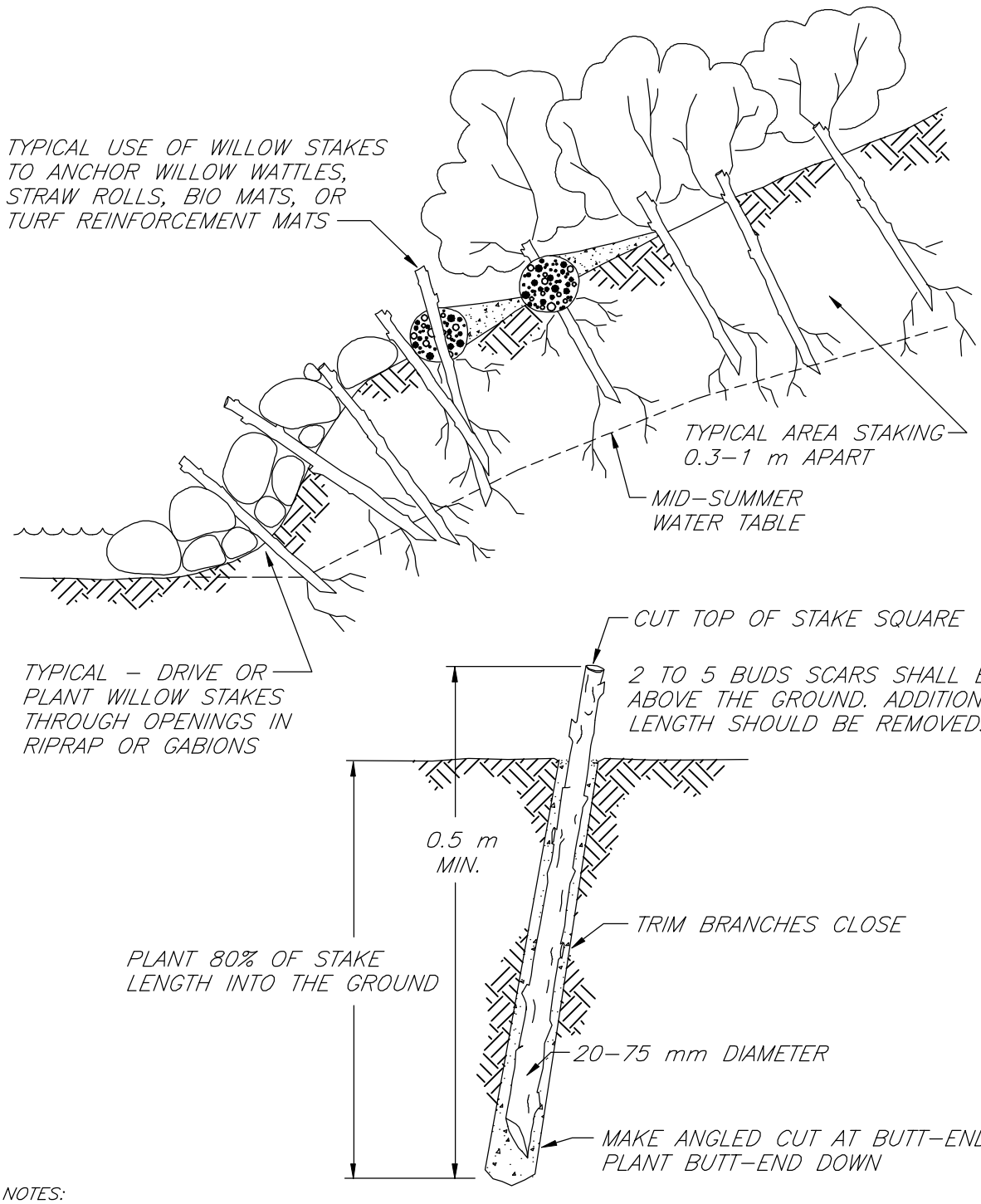
Live Staking Streambank Stabilization Technique	B.M.P. #27a

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
  - Areas damaged by washout or erosion rilling should be replanted immediately
- Additional stormwater control measures should be considered for severe rilling areas damaged by runoff
- Watering plants is required for first one to two months after planting

Similar Measures

- Seeding
- Mulching
- Hydroseeding
- Hydromulching
- Rolled erosion control products (RECP)
- Brush layering



NOTES:
1. HARVEST AND PLANT STAKES DURING THE DORMANT SEASON.
2. USE HEALTHY, STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD.
3. MAKE CLEAN CUTS AND DO NOT DAMAGE STAKES OR SPLIT ENDS DURING INSTALLATION, USE A PILOT BAR IN FIRM SOILS.
4. SOAK CUTTINGS FOR 24 HOURS (MIN.) PRIOR TO INSTALLATION.
5. TAMP THE SOIL AROUND THE STAKE.
6. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

NOT TO SCALE

LIVE STAKING

FILE: LIVESTK

Government of Alberta ■
Transportation

B.M.P. #27a
Typical Section

Brushlayering Streambank Stabilization Techniques	B.M.P. #27b

Description and Purpose

- Consists of installing woody plantings (trees and shrubs) to develop a root matrix within the soil, increasing subsurface soil strength and stabilizing slopes with deeper root systems than grasses
- Reduces erosion potential of slopes

Applications

- Temporary or permanent measure
- May be used on slopes stable enough to support vegetation; however, there is a low success rate for steep slopes with gradients greater than 1H:2V
- May be used on slopes with adequate sunlight, moisture, and wind protection to support vegetation
- May be used as bio-engineering stabilization in cases of historical shallow slope instability soil movements on eroded slopes and gullies
- May be used to reduce flow velocity and in sedimentation ponds to provide higher sedimentation duration of runoff impoundment
- Particularly appropriate for highway embankments that encroach upon riparian areas or floodways
- Slopes that need additional geotechnical and erosion reinforcement are good candidates for brushlayering
- Steeper slopes require the use of inert reinforcements such as geotextiles (ECBs, TRMs, coir netting), wire (twisted or welded gabion wire) or geogrids
- If either steady, long term seepage or temporary bank return flows after flood events are a problem, the brushlayers act as a horizontal drainage layer or conduits that relieve internal pore water pressure

Advantages

- Promotes development of organic mat
- Dense leaves and large diameter plant stalks increases channel roughness and reduces flow velocities in channel thus decreasing erosion potential
- Traps sediment laden runoff and stabilizes soil
- Aesthetically pleasing once developed
- Grows stronger with time as root structure develops

- Usually has deeper root penetration than grass with greater depth of stabilization
- Manual planting may be attempted on steep slopes that are sensitive to machinery disturbance or represent an area of high erosion potential
- Of all vegetative biotechnical techniques, brushlayering has the greatest capacity for becoming successfully established, even in severe sites
- The use of synthetic geotextiles or geogrids provides long-term durability and greater security, especially if woody and herbaceous vegetation is established
- Can be used with other toe protection such as, rootwads, coir rolls, and log toes. Combining live brushlayering with rock toes is an effective and relatively low cost technique for re-vegetating and stabilizing streambanks
- Provide immediate soil stability and habitat
- Brushlayers and the pioneer vegetation that develops with them allow the establishment of a stable soil-root complex
- Both living and non-living brushlayers along streambanks enhance fish habitat, while slowing velocities along the bank during flooding flows
- They provide a flexible strengthening system to fill slopes. A bank can sag or distort without pulling apart the brushlayers
- Act as horizontal drains and favourably modify the soil water flow regime

Limitations

- Can be labour intensive to install
- Some level of uncertainty as success of plant growth is dependent on various unknown site parameters (i.e., moisture, soil, terrain, weather, seeding conditions, etc.)
- Plants may be damaged by wildlife
- Potential for low success rate
- Few precedents as this measure is generally not used on AT construction projects
- Brushlayers are vulnerable to failure before rooting occurs, and they are not effective at counteracting failure along very deep-seated failure planes

Construction

- First construct any lower bank or in-stream stabilizing measures such as a rock or log toe structure
- Excavate the first horizontal bench, sloping back into the hillslope at about 10%

- Install any drainage required along the back of each bench
- Place branches that are at least 1.8 m long on the bench
- Branches should crisscross at random with regard to size and age
- Place 20 branches per linear m on the bench, with the butts of the branches along the inside edge of the bench
- 20-45 cm of the growing tip should protrude beyond the face of the slope
- Cover and compact (add water if necessary) the brushlayer with 15 cm lifts of soil to reach the designed vertical spacing, typically 0.5 m to 1.2 m apart
- Slope the top of each fill bench back into the hill
- Construct another brushlayer
- When placed, the protruding tips of the cuttings are above the butts due to the back slope of the bench
- Proceed up the bank as desired
- The erosion and failure potential of the slope (i.e., drainage, soil type, rainfall, and length and steepness of the slope) determine spacing between the brushlayers
- On long slopes, brushlayer spacing should be closer at the bottom and spacing may increase near the top of the slope

Construction Considerations

- Successful installation requires the use of freshly cut branches or stakes
  - Storage time of cut branches/stakes on-site prior to installation should be kept to as short a time period as possible
- Successful growth dependant on soil moisture and rainfall conditions
- Consultation with agrologist, greenhouse growers, local expertise can be beneficial in selecting and procuring appropriate species for planting
- Installed during soil fill operations which result in the branches being inserted deeply into the slopes and thereby increasing the likelihood that the branches will encounter optimum soil and moisture conditions
- Live cuttings are most effective when implemented during the dormancy period of chosen plant species
- Live willow branches (or cuttings of other adventitiously-rooting species) at least 1.8 m long, with a minimum diameter of 20 mm
- Heavy equipment is usually employed for the construction of embankments

- A bucket loader and/or backhoe or excavator can facilitate the work
- Water should be available for achieving optimum soil moisture

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Inspect planted areas at least twice per year or after significant storm events (1:2 year storm and/or 40 mm rainfall in 24 hours)
  - Areas damaged by washout or erosion rilling should be replanted immediately
- Additional stormwater control measures should be considered for severe rilling areas damaged by runoff
- Watering plants is required for first one to two months after planting
- The live cuttings or branches should establish successfully without irrigation requirements given the proximity to water
- Inspect the cuttings for adequate vegetative establishment (as evidenced by root and shoot production from the imbedded stems) and for signs of localized erosion such as rilling from runoff or sloughing from stream scour
- Brushlayer treated streambanks should also be inspected for localized slope movements or slumps
- These localized slope failures and/or areas of poor vegetative establishment can often be repaired by re-installing the brushlayers in these zones
- The site should be examined for possible signs of flanking erosion, which must be addressed with ancillary protective measures lest the flanking threatens the integrity and effectiveness of the protective brushlayer fill
- As with all resistive streambank structures, flanking is always a potential problem
- If frozen soil is employed in constructing the soil lifts between brushlayers, some settlement may occur when the soil thaws. This settlement may falsely signal a slope failure
- The most likely causes of failure are the following:
  - Inadequate reinforcement from the brushlayer inclusions, i.e., too large a vertical spacing or lift thickness for the given soil and site conditions, slope height, slope angle, and soil shear strength properties
  - Inadequate tensile resistance in the brushlayers as result of too small an average stem diameter and/or too few stems per unit width

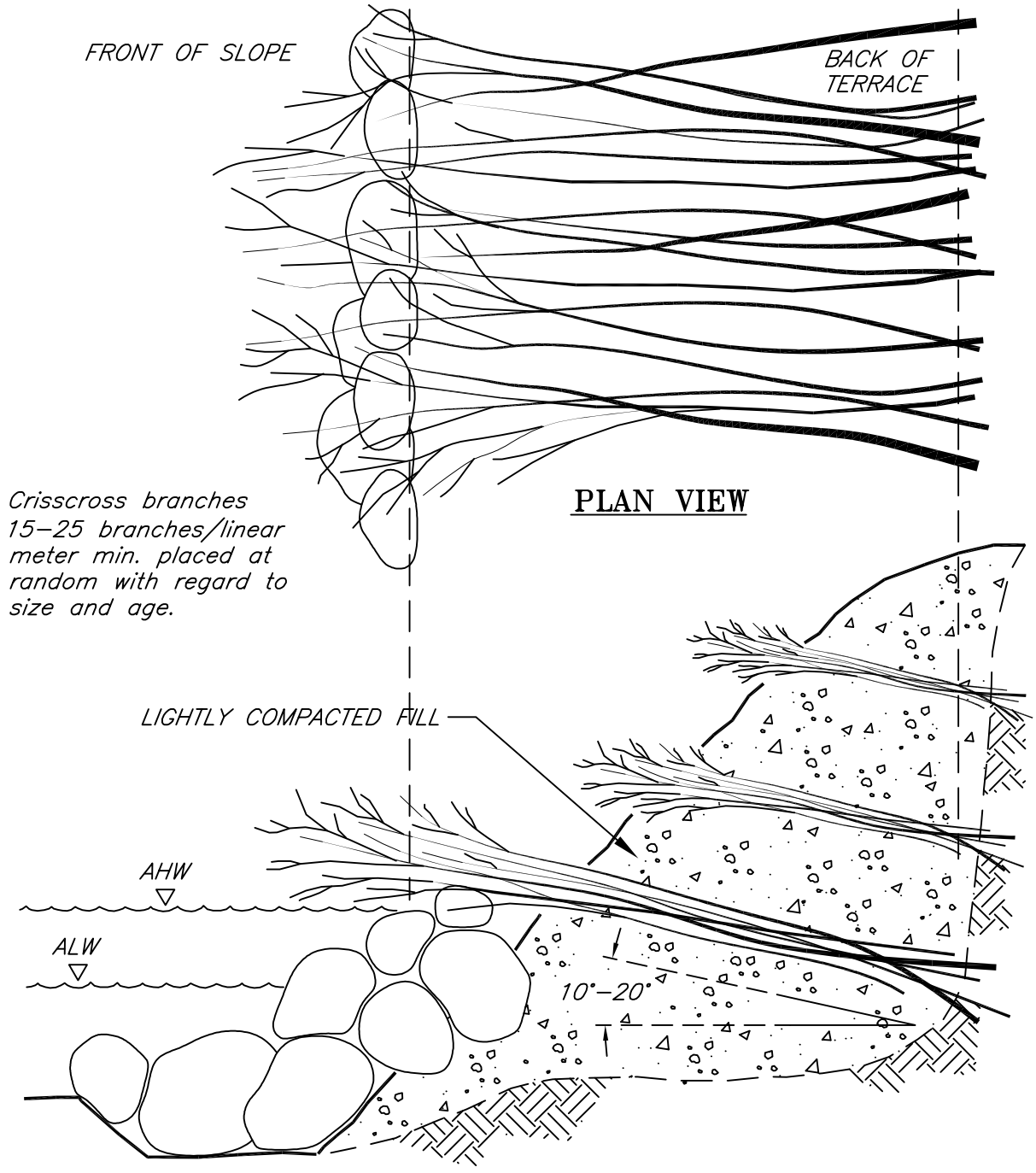
- Failure to properly consider seepage conditions and install adequate drainage measures, e.g., chimney drain, behind brushlayer fill, and conversely inadequate moisture applied during installation, and inadequate attention to construction procedures and details

Design Considerations

- Live branches and brushy cuttings are used to make brushlayers
- Up to 30% of the brush may be non-rooting species that provide immediate strength to the soil mass, but will then rot away
- Plant material harvesting and installation should be performed during its dormant season (late fall to early spring) or in other seasons if soil moisture is available
- The ideal plant materials for brushlayers are those that:
  - root easily
  - are long, straight and flexible
  - are in plentiful supply near the job site
- Willow makes ideal brushlayer material, and some species of *Baccharis*, *Cornus*, and *Populus* also have very good rooting ability
- All cuttings should be soaked for a minimum of 24 hours, whether they are stored or harvested and immediately installed
- Brushlayer reinforced fills must have adequate internal stability
- This means that the tensile inclusions, i.e., the brushlayers, should have a sufficient unit tensile resistance and/or be placed in sufficient numbers to resist breaking in tension
- The inclusions must also be sufficiently long and "frictional" enough to resist failure by pullout
- Allowable velocity for brushlayering is 3.7 m/s and allowable shear stress is 19 to 300 N/m^2 depending on how long the brushlayers have had to establish
- Schiechtl & Stern (1996) suggest an allowable shear stress of 140 N/m^2

Similar Measures

- Seeding
- Mulching
- Hydroseeding
- Hydromulching
- Rolled erosion control products (RECP)
- Live Staking



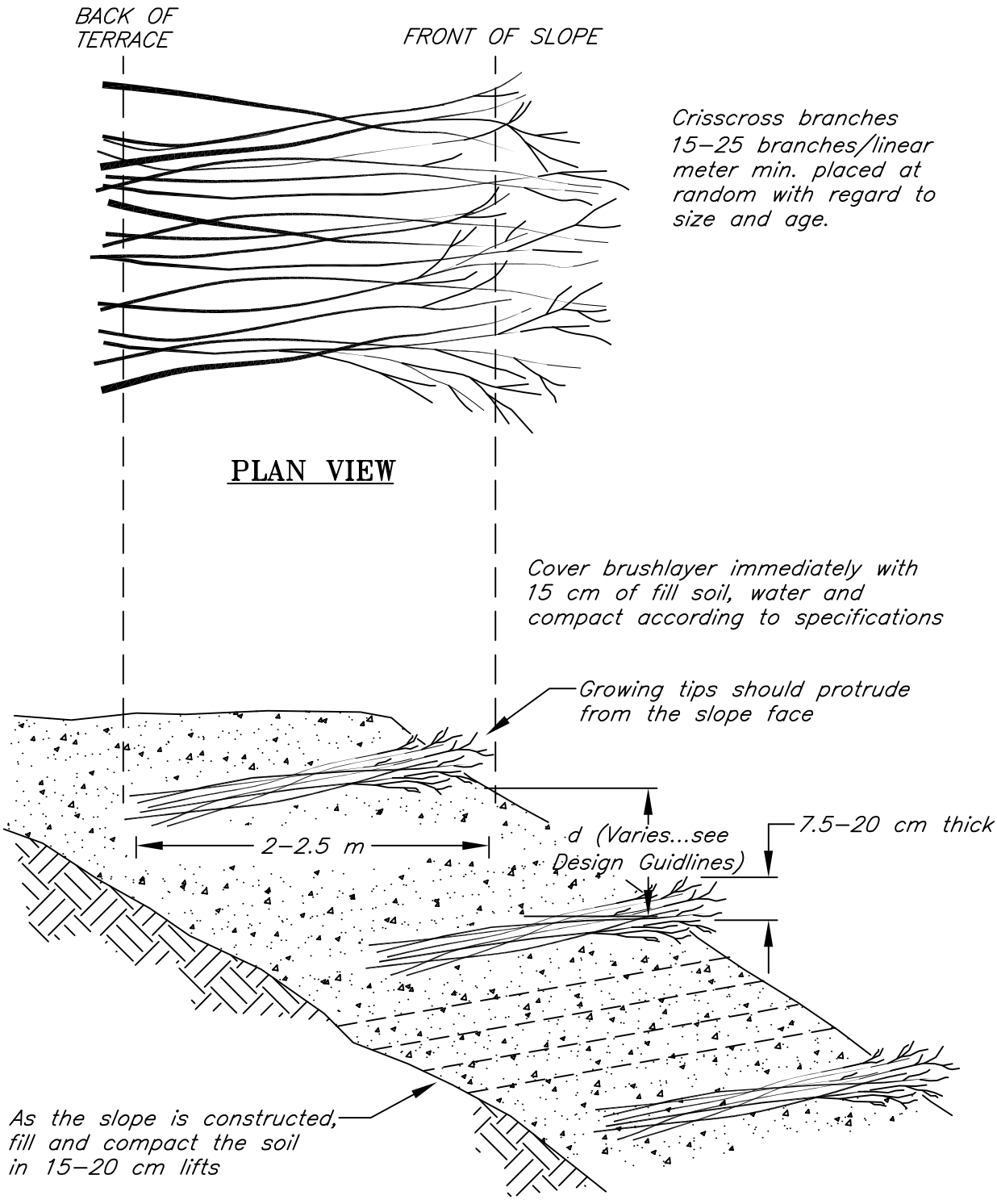
NOTES:
1. Tilt branches down into the slope 10°–20° min.
2. Brushlayering may be constructed with non–compacted or compacted backfill without damage to the brush layer.
3. Branches irrespective of length, should protrude 20–45 cm beyond the face of the slope.

BRUSHLAYERING WITH ROCK TOE PROTECTION

FILE: BRLAY–RT

Government of Alberta ■
Transportation

B.M.P. #27b1
Typical Section



TYPICAL BRUSHLAYERING WITH SLOPE CONSTRUCTION

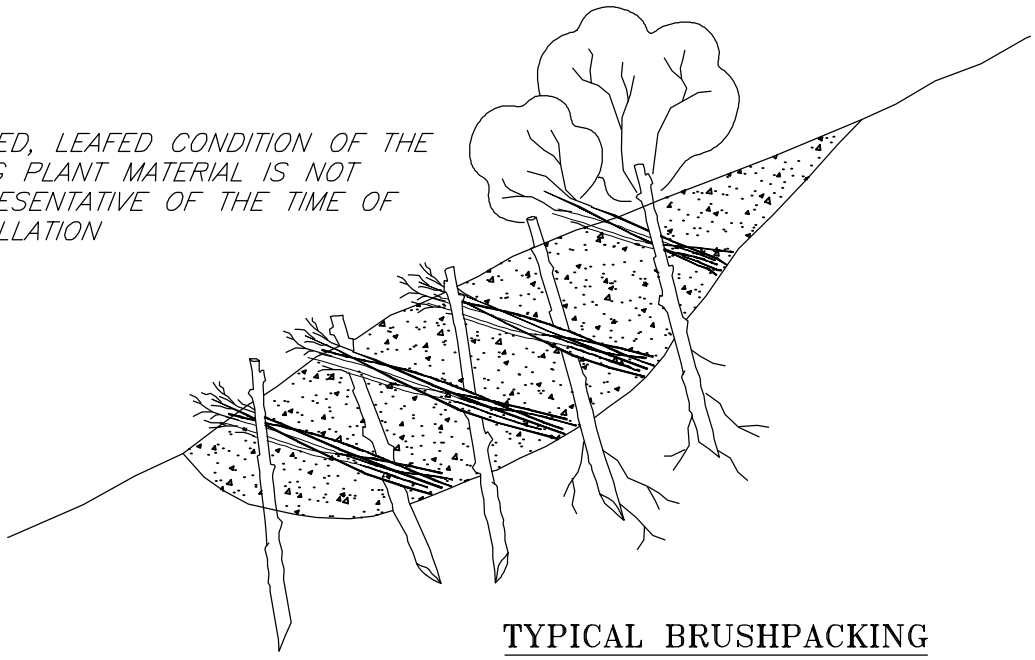
BRUSHLAYERING

FILE: BRSHLAYR

Government of Alberta ■ Transportation

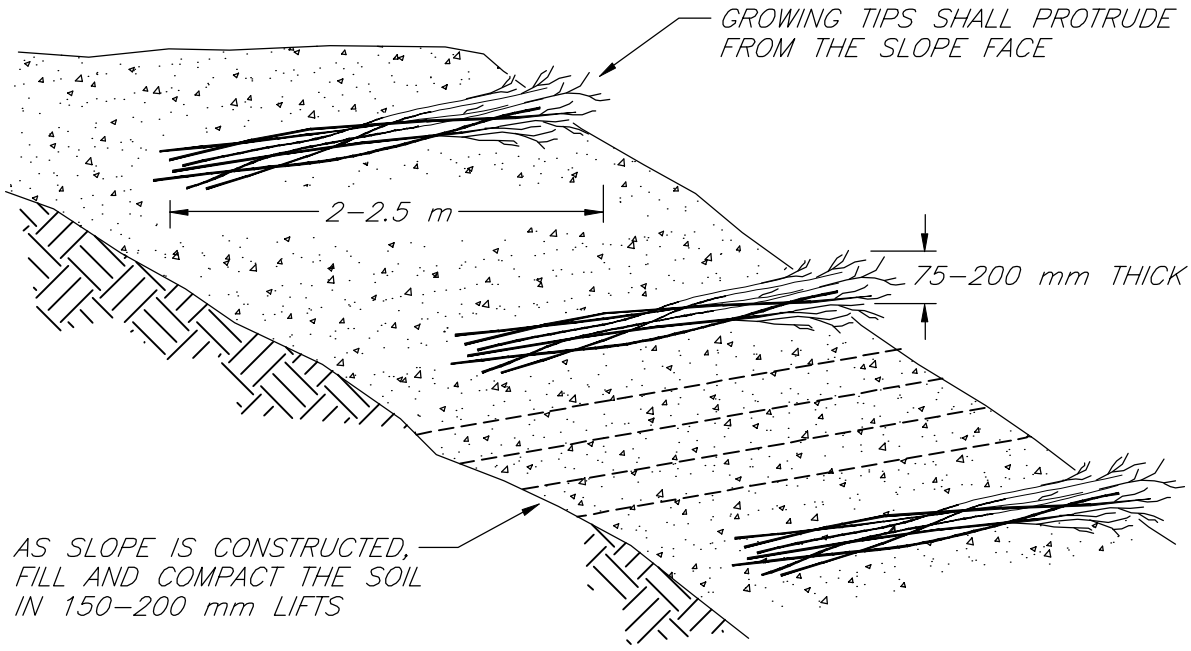
B.M.P. #27b2
Typical Section

NOTE:
ROOTED, LEAFED CONDITION OF THE LIVING PLANT MATERIAL IS NOT REPRESENTATIVE OF THE TIME OF INSTALLATION



TYPICAL BRUSHPACKING

COVER BRUSHLAYER IMMEDIATELY WITH 150 mm OF FILL SOIL, WATER AND COMPACT ACCORDING TO SPECIFICATIONS



TYPICAL BRUSHLAYERING WITH SLOPE CONSTRUCTION

NOTE:

1. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

BRUSHLAYERING

FILE: BRSHLAYR

Riparian Zone Preservation Sediment Control and Erosion Control	B.M.P. #30

Description and Purpose

- Protection of existing plants and trees adjacent to all natural water bodies (riparian zones) adjacent to construction areas
- Existing vegetation acts as an effective vegetative buffer strip as a form of erosion and sediment control measure

Applications

- Permanent measure
- Existing established vegetation acts as an effective sediment control and erosion control buffer strip barrier to slow down flows and allow sedimentation filtration to occur
- May be used along property boundaries to minimize sediment transport off construction site despite non-presence of watercourse adjacent

Advantages

- Existing dense vegetation is more effective than any man-made structures or devices for sediment or erosion control, however, other forms of sediment and erosion control measures may be required on construction sites in addition to preserved riparian zones
- Any denuding of vegetation along steep valley slope with highly erodible soil will be detrimental and inducive to long-term sedimentation yield; it is important only to strip necessary areas along the footprint of construction. Preservation of riparian zone is mandatory along river valley slopes and along the edge corridor of waterbodies

Limitations

- Preservation of riparian zones may interfere with construction efficiency
- Careful planning is required to work around preserved riparian zones

Construction

- It is highly important to preserve an established vegetative buffer as freshly planted vegetation generally require substantial growth periods before they are as effective as established riparian zones
- Wherever possible, retain as much existing vegetation as possible between construction areas and sensitive zones (wetlands, marshes, streams, floodplains, etc.) to entrap sediment and to minimize sediment transport off of the construction site into the sensitive zones

Riparian Zone Preservation Sediment Control and Erosion Control	B.M.P. #30

- Define and delineate riparian zones to be preserved in Environmental Construction Operations Plan (ECO Plan) prior to commencement of construction
- Clearly mark riparian zones to be preserved in the field (with construction fencing, survey flagging, or other highly visible measure) so all personnel involved with construction operations can identify areas to be preserved

Construction Considerations

- Riparian zones must be fenced off immediately to minimize trespassing and to ensure effectiveness of riparian zone is maintained
- Do not allow equipment to enter areas not necessary to construction
- Based on site-specific situations established buffer zones of adequate width

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Maintain fences protecting riparian zones from trespassing

Pumped Silt Control Systems (Filter Fabric Bags) Sediment Control and Erosion Control	B.M.P. #31

Description and Purpose

- The extraction of sediment is effected by pumping sediment laden runoff into a bag manufactured with a permeable geotextile. Water will filter through the filter bag with the sediment being retained within the filter bag

Applications

- Temporary measure
- Can be used in high risk areas to supplement performance of containment pond systems
  - An example area would be where containment pond space is limited on construction site and appropriate sized containment pond cannot be constructed adjacent to high risk areas
- Useful for additional extraction of sediment dewatering sumps, sediment ponds, or other retention facilities with accumulations of sediment laden runoff

Advantages

- Filter bag is lightweight and portable
- Simple cleanup and disposal
- Sediment is captured within filter bag for removal from site

Limitations

- May be expensive
  - Extra costs associated with cost of filter bags and costs of pumping out retention facilities
- Power supply for pumps may be required
- Useful for only short periods of time and small volumes of water
- Can only retain particle sizes larger than the Apparent Opening Size (AOS) of the filter fabric bag
- Refer to manufacturers' product performance information
- Generally for available non-woven filtration geotextile, AOS values of 0.15 mm range or lower can be realistically manufactured. Potentially, only particle size larger than the design AOS value can be removed from the bag types. It is important to require manufacturer to provide performance specification and physical properties of the bags. The designer and supplier of the filter bag should choose

the fabric and AOS based on the anticipated gradation of the sediments to ensure the sediments are retained in the bag.

- Few precedents as this measure is generally not used on AT construction projects, however, it can be resorted as emergency measure for highly sensitive sites

Implementation

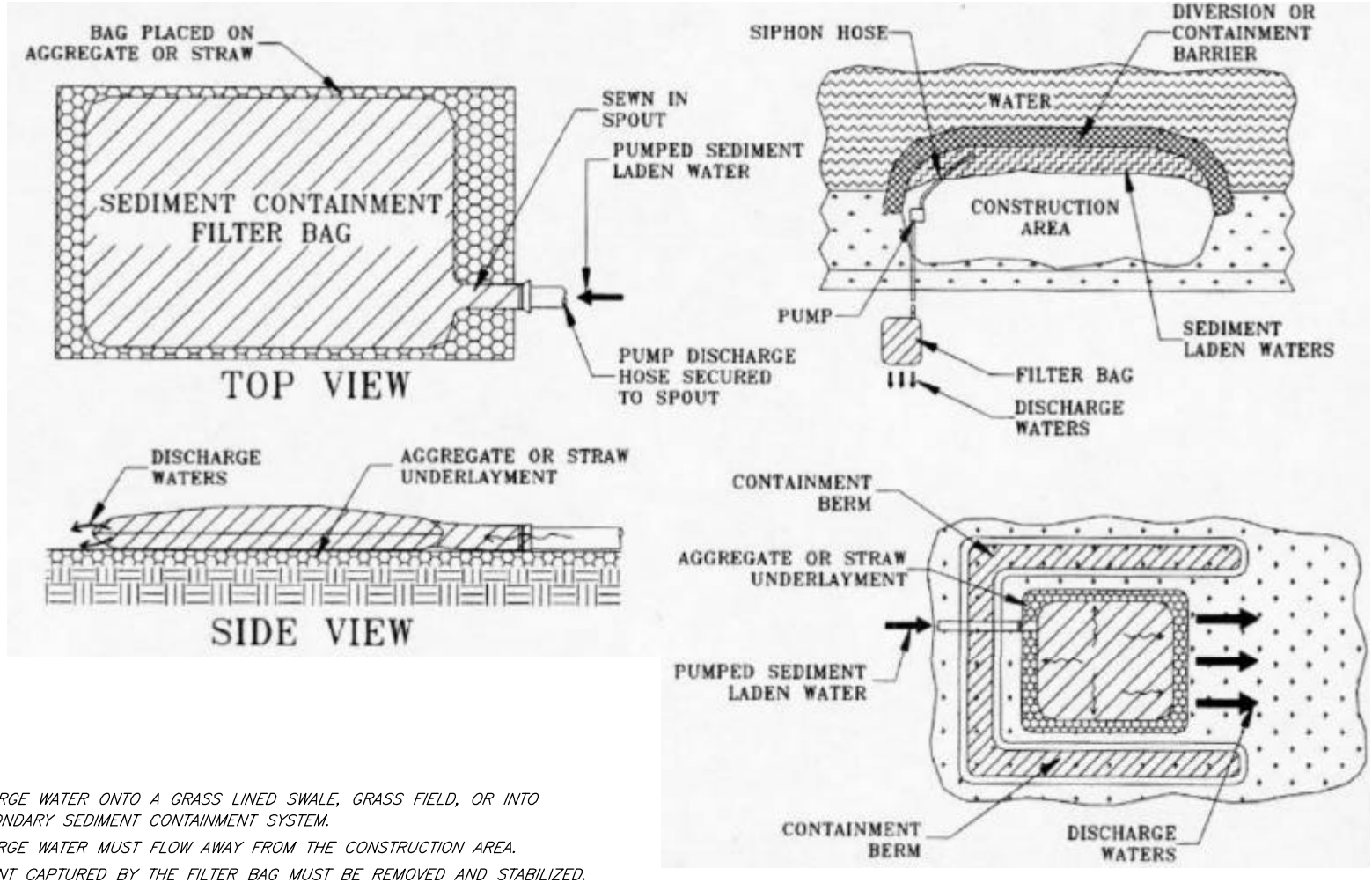
- Place filter bag on free-draining base (such as gravel pad or straw pile) on a slight slope, with opening to silt bag facing upslope
- Attach hose to opening of filter bag
  - Ensure tight seal to prevent discharge of sediment laden runoff outside of bag
- Attach hose to pump and insert extraction hose into retention facility to be dewatered
- Turn on pump and remove sediment laden water until filter bag is full of sediment
- Disengage pump once filter bag is full, tightly close opening to filter bag to prevent spilling of sediment and remove bag
- Repeat process (using new filter bags) until retention facility is dewatered to acceptable levels

Implementation Considerations

- Full filter bags can be removed from site or buried in designated locations on-site
- Care should be taken to ensure filter bag is not overfilled, which may cause filter bag to tear, spilling sediment
- Care should be taken when transporting full filter bags to ensure filter bag is not torn

Inspection and Maintenance

- Inspect all hoses and connections before and during pumping operations to minimize leaks



NOTES:

1. *DISCHARGE WATER ONTO A GRASS LINED SWALE, GRASS FIELD, OR INTO A SECONDARY SEDIMENT CONTAINMENT SYSTEM.*
2. *DISCHARGE WATER MUST FLOW AWAY FROM THE CONSTRUCTION AREA.*
3. *SEDIMENT CAPTURED BY THE FILTER BAG MUST BE REMOVED AND STABILIZED.*
4. *THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.*

SOURCE: FIFIELD 2001

PUMPED SILT CONTROL SYSTEM

Scheduling Sediment Control and Erosion Control	B.M.P. #32

Description and Purpose

- Scheduling the sequence and timing arrangement of construction activities (1) to efficiently maximize the amount of erosion protection installed (such as topsoiling and seeding) as soon as a portion of grade construction is completed, and (2) to limit the portion of land disturbance (construction) compatible with the efficient rate of construction of erosion control measures achievable
- Incorporating erosion and sedimentation control concerns during the scheduling phase will minimize the amount and duration of bare soil exposure to erosion elements and ensure erosion and sedimentation control measures are implemented at an appropriate time
- Scheduling may be designed during planning stages by the contractor and altered during construction to suit actual conditions encountered

Applications

- Temporary measure

Advantages

- Ensures erosion and sedimentation control issues are identified during the planning stage by the Contractor
- May be used to minimize bare soil exposure and erosion hazard with careful planning and utilization of equipment in construction projects

Limitations

- May be more costly as erosion control measures (such as topsoiling and seeding) have to be implemented immediately after completion of each phase or a short section of construction

Implementation

- Incorporate a schedule with erosion protection perspective to form part of the overall construction plan
- Determine sequencing and timetable for the start and end of each item, such as clearing, grubbing, stripping, etc.
- Incorporate installation of appropriate erosion and/or sediment control measures in construction schedule
- Allow sufficient time before rainfall begins to install erosion and/or sediment control measures

- Whenever possible, schedule work to minimize extent of site disturbance at any one time
- Incorporate staged topsoiling and revegetation of graded slopes as work progresses
  - Don't leave all topsoiling and revegetation until the very end of the project

Inspection and Maintenance

- Routinely verify that construction activities and the installation of erosion and sediment control measures is progressing in accordance with schedule
  - If progress deviates from schedule, take corrective action
- When changes to the project schedule are unavoidable, alter the schedule as soon as practicable to maintain control of erosion

Stabilized Worksite Entrances Sediment Control and Erosion Control	B.M.P. #33

Description and Purpose

- Comprised of a gravel pad located at site access points (entrances) that are used to reduce the amount of sediment carried off construction sites by vehicles
- Collect sediment from vehicle washing and retains sediment on construction site
- Should include water supply to wash off excess soil from vehicles prior to exiting the constructions site

Applications

- Temporary measure
- For use anywhere vehicles enter or exit a construction site

Advantages

- Retains sediment on construction site, where it belongs
- Reduces deposition of sediments on public roads which may be carried by runoff into natural watercourses or drains

Limitations

- Sediment control measures should be installed to collect sediment laden runoff from gravel pad
- Installation of gravel pads may be limited by space constraints

Implementation

- Install gravel pad at planned entrances to worksite
  - Gravel pad (minimum of 15 m in length) should be of sufficient length to accommodate longest anticipated vehicle entering or exiting the site
  - Width of pad should be sufficient to accommodate the widest anticipated vehicle entering or exiting the site (minimum of 3.6 m in width)
  - Thickness of gravel pad should be a minimum of 0.30 m thick (0.3 m thickness is preferred for highway projects) and should comprise 50 to 150 mm diameter coarse aggregate placed on top of woven geotextile filter fabric
- Install temporary sediment control measures (such as straw bale barriers or silt fences) to collect washed off sediment from gravel pad

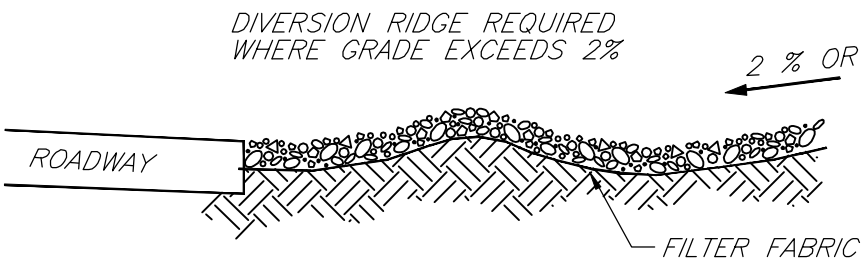
Stabilized Worksite Entrances Sediment Control and Erosion Control	B.M.P. #33

Construction Considerations

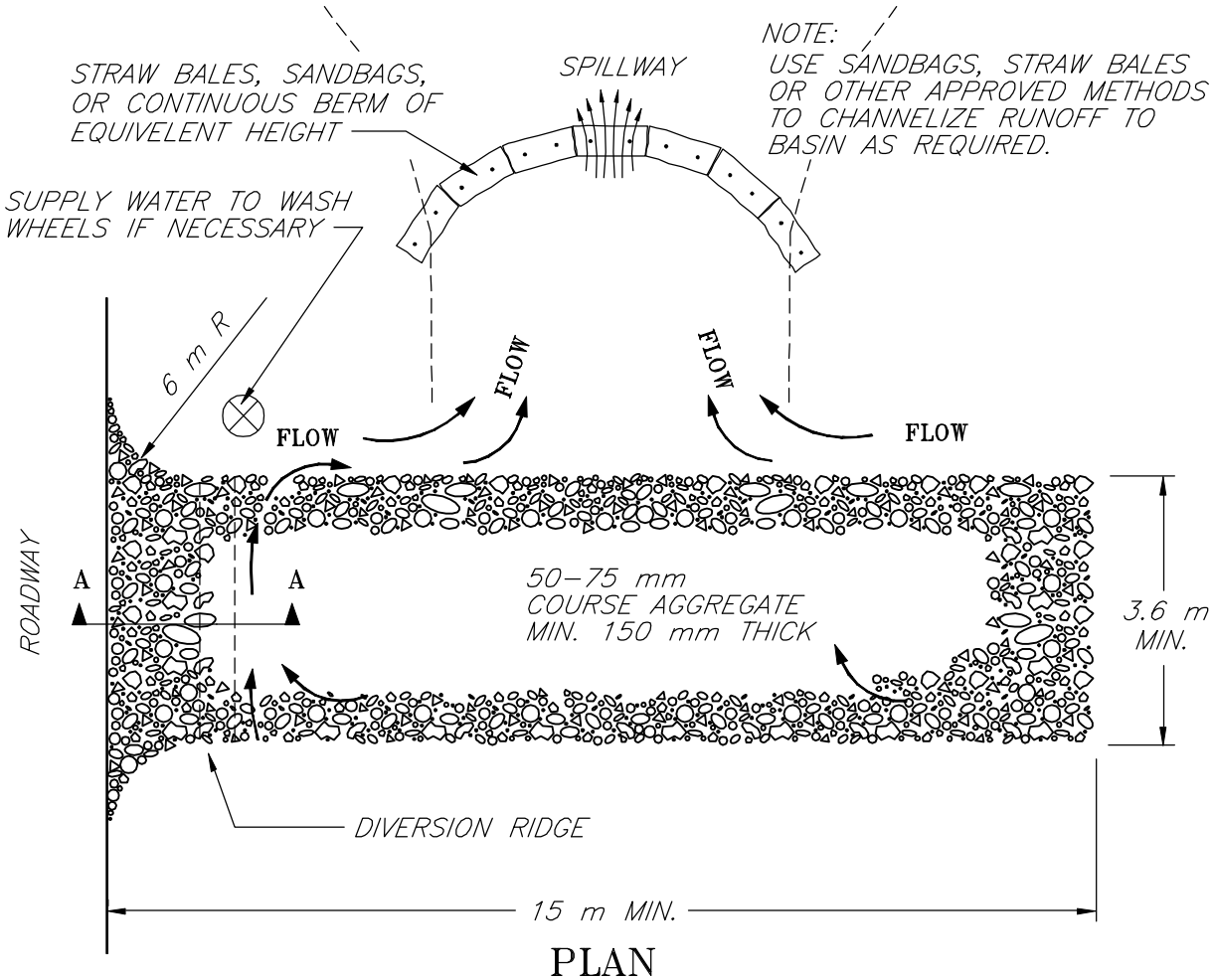
- Should be constructed at all access points to construction sites
  - If impractical to construct at all access points, limit vehicle access traffic to stabilized worksite entrances only
- Entrances located with steep grades or at curves on public roads should be avoided
- Woven geotextile filter fabric should be used as underlay below gravel pad as strength requirement
- Install an elevated ridge adjacent to roadway if gradient of the gravel pad is steeper than 2%, sloped towards the roadway

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Granular material should be regraded when required
  - Material may need to be added to fill large voids to maintain a minimum pad thickness of 0.30 m
- Inspect and clean out downstream sediment control measures at least once per week and after periods of significant rainfall
- Material accidentally deposited onto public roads should be cleaned as soon as possible



SECTION A – A



PLAN

NOTES:

1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT–OF–WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT–OF–WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABLIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.
4. FOR HIGHWAY CONSTRUCTION, 300mm THICKNESS OF GRAVEL IS PREFERRED.
5. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT

FILE: ENTRANCE

Slope Texturing (a-c) Sediment Control	B.M.P. #34 (a - c)

Description and Purpose

- Texturing of slopes, either by roughening the surface, tracking the surface, or installing grooves or benches
- Texturing reduces the runoff velocity, traps sediment, and increases the infiltration of water into the soil

a) Surfacing Roughening

b) Grooved or Serrated Slope

c) Benched Slope

Applications

- Temporary measure
- May be used to roughen the exposed soils on the slope surface in the direction of water flow to minimize erosion and to entrap some sediments
- May be used on fresh cut or fill slopes (8 m length or longer; practical travel reach of a dozer) with gradients of generally 3H:1V or steeper (2H:1V as general steepness limit) constructed in cohesive soils
- May be used on slope subgrade that will not be immediately topsoiled, vegetated or otherwise stabilized
- May be applied to topsoiled slope to provide track serration to further reduce erosion potential
- May be used in graded areas with smooth and hard surfaces
- As part of slope design, benching may be used to effect a reduction of erosion hazard where a long slope length needs to be shortened into smaller sectional lengths with mid-benches; normally a 3 m wide bench can be appropriate
  - Benching is usually a permanent slope design feature and should only be designed by a qualified geotechnical engineer
  - Benching of a long slope section to divide into short sections can reduce erosion hazard in the range of 30 to 50% (e.g., sediment yield for 15 m high 3H:1V slope with mid-bench)

Slope Texturing (a-c) Erosion Control	B.M.P. #34 (a - c)

Advantages

- Reduces erosion potential of a slope
- Texturing will create protrusions to increase surface roughness to reduce overland flow velocities and erosion energy
- Texturing will create minor spaces to entrap a portion of the coarse sediment and reduces amount of sediment transported downslope
- Texturing of slopes will benefit development of vegetation
- Texturing of slopes aids in performance of mulches and hydroseeding
- Texturing with track-walking up/downstream may effect a 50% reduction of sediment yield compared with untracked slope

Limitations

- Surface roughening and tracking may increase grading costs
- Surface roughening and tracking may cause sloughing in certain soil types (i.e., sandy silt) and seepage areas; geotechnical advice is recommended
- Texturing provides limited sediment and erosion control and should be used as a temporary measure prior to topsoiling
  - Should be used in conjunction with other erosion and sediment control measures (i.e., offtake ditches) to limit the sheet flow downslope

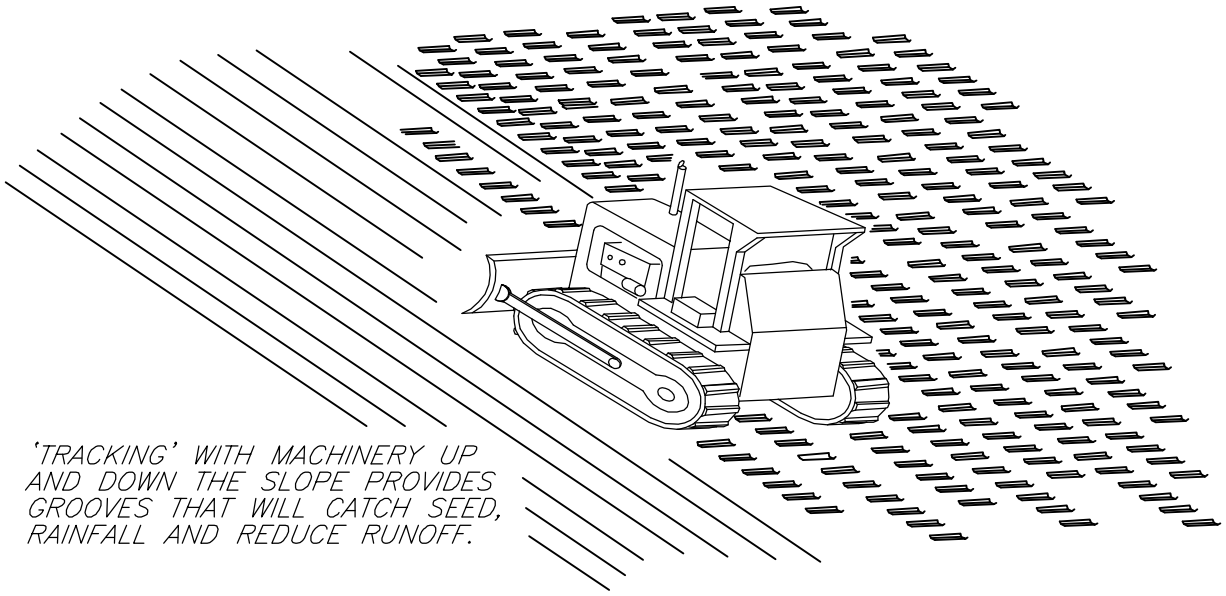
Construction

- Surface Roughening
  - Leave soil in rough grade condition, do not smooth grade soil
  - Large lumps of soil will aid in decreasing runoff velocities, trap sediment, and increase infiltration of water
- Surface Tracking
  - Using tracked construction equipment to move up and down the slope, leaving depressions perpendicular to the slope direction; limit passes to prevent overcompaction of the surface
  - Depressions in the soil will aid in decreasing runoff velocities, trap sediment, and increase infiltration of water
- Grooving
  - Excavating shallow furrows across the width of the slope, perpendicular to the direction of the slope

  - If used, contour grooves should be approximately 0.1 to 0.2 m in depth
- Grooves can be made by using equipment or hand
- Benching
  - Construction of narrow, flatter sections of soil on the slope, perpendicular to the direction of the slope
  - Benches should be designed by qualified geotechnical engineer

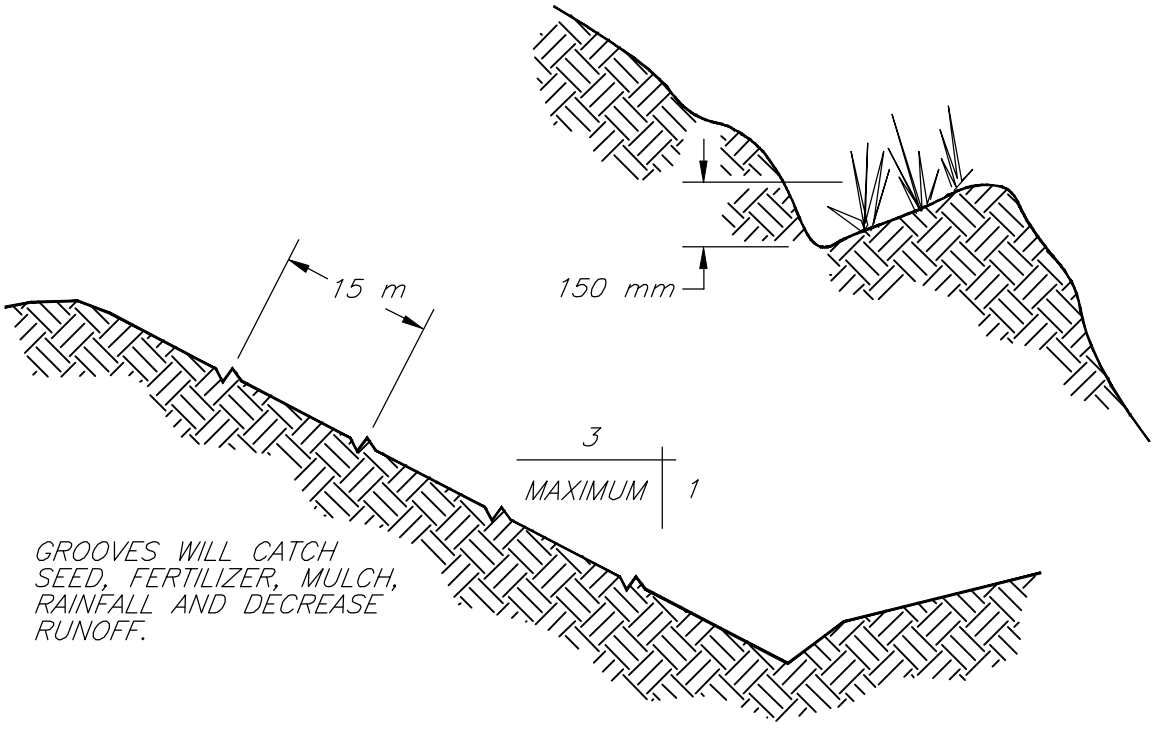
Construction Considerations

- During tracking operations, care must be taken to minimize disturbance to the soil where the equipment turns or changes direction
- Minimize the number of tracking passes to 1 or 2 times to avoid overcompaction, which can negatively impact the vegetation growth
- It is practical to track roughen a slope length of greater than 8 m for practical up/down slope operation of a small bulldozer. It is important to minimize the loosening of soil caused by turning movement of the bulldozer at the end of each pass. As the erosion potential is lower for slope of low vertical height (<3 m height and 3H:1V slope), the tracking of low height slope is not required and not practical for bulldozer tracking operation.



'TRACKING' WITH MACHINERY UP AND DOWN THE SLOPE PROVIDES GROOVES THAT WILL CATCH SEED, RAINFALL AND REDUCE RUNOFF.

TRACKING



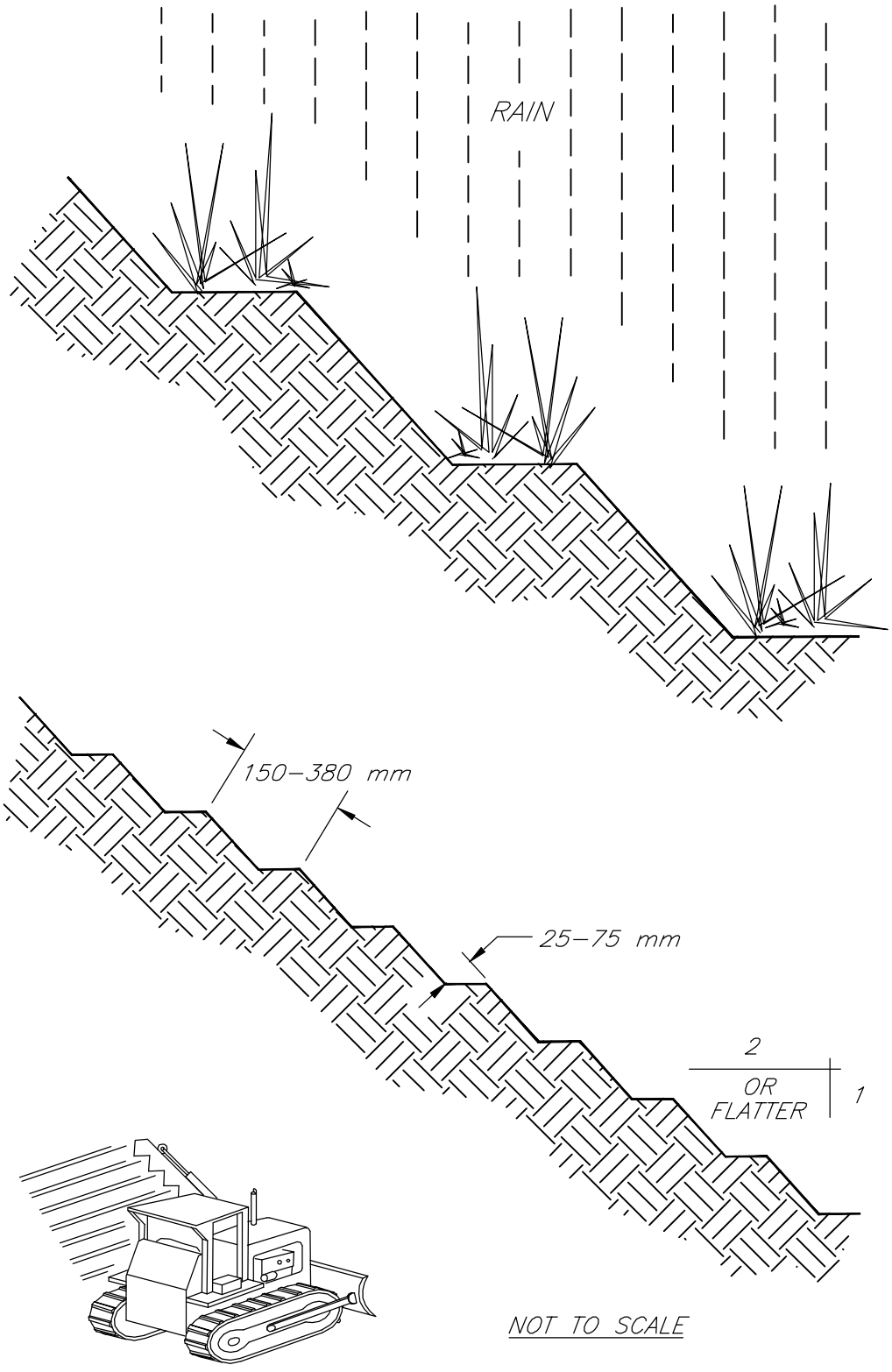
CONTOUR FURROWS

SURFACE ROUGHENING

FILE: SRFROUGH

Government of Alberta ■
Transportation

B.M.P. #34a
Typical Section



NOT TO SCALE

NOTE:

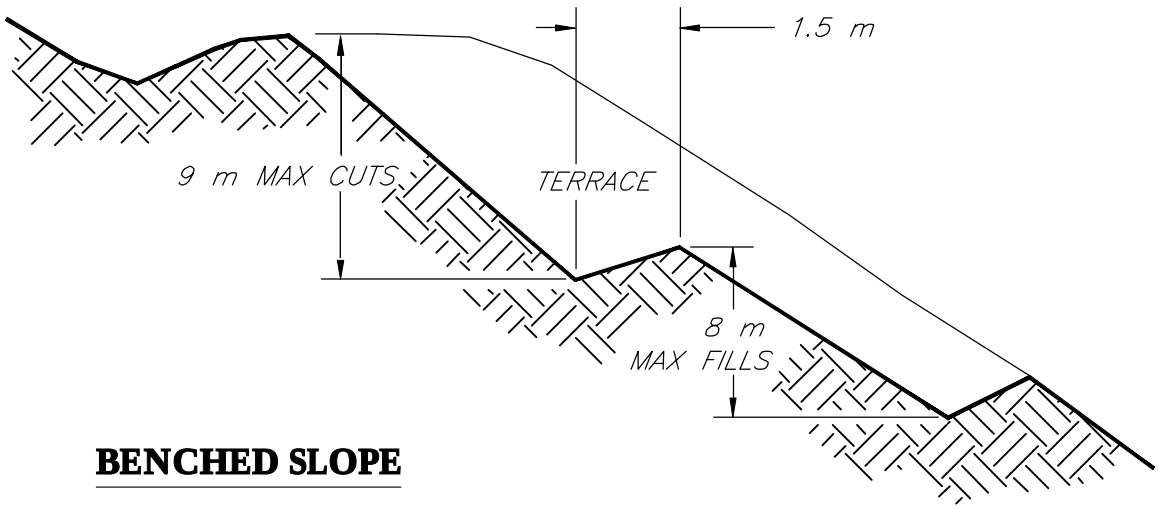
GROOVE BY CUTTING SERRATIONS ALONG THE CONTOUR. IRREGULARITIES IN THE SOIL SURFACE CATCH RAINWATER, SEED, MULCH AND FERTILIZER.

GROOVED OR SERRATED SLOPE

FILE: SERSLOPE

Government of Alberta ■
Transportation

B.M.P. #34b
Typical Section



BENCHED SLOPE

NOT TO SCALE

BENCHED SLOPE

FILE: STPSLOPE

Government of Alberta ■
Transportation

B.M.P. #34c
Typical Section

Compost Blanket Erosion Control	B.M.P. #37

Description and Purpose

- Compost is the product resulting from the controlled biological decomposition of organic material, occurring under aerobic conditions
- Compost has been sanitized through the generation of heat and stabilized to the point that it is appropriate for its particular application
- Active composting is typically characterized by a high temperature phase that sanitizes the product and allows a high rate of decomposition
- It is followed by a lower temperature phase that allows the product to stabilize while still decomposing at a slower rate
- Compost should possess no objectionable odours or substances toxic to plants
- Compost contains plant nutrients but is typically not characterized as a fertilizer
- May derive from agricultural, forestry, food or industrial residues, bio-solids, leaf and yard trimmings, manure, tree wood, or source-separated or mixed solid waste

Applications

- Compost blanket are commonly used for temporary erosion and sediment control
- The technique is appropriate for slopes up to 2H:1V grade and on level surface
- Only used in areas that have sheet flow drainage patterns (not for areas that receive concentrated flows)
- Compost used on AT projects must meet Canadian Council of Ministers of the Environment (CCME) Guidelines for Compost Quality (trace elements, maturity/stability, pathogens), which are adopted by Alberta Transportation and found on AT Products List (www.transportation.alberta.ca)

Advantages

- Relatively cheap method of promoting plant growth and slope protection

Limitations

- Application of compost may be difficult on steep slopes
- May require spray-on method to apply compost to steep slopes
- Requires specialized blower truck, hose and attachments for blanket installation

Installation

- Slightly roughen (scarify) slopes and remove large clods, rocks, stumps, roots larger than 50 mm in diameter and debris on slopes where vegetation is to be established
- Apply compost at the rates as follows:

Annual Rainfall/Flow Rate	Total Precipitation	Application Rate for Vegetated Compost Surface	Application Rate for Unvegetated Compost Surface
Low	25 mm – 635 mm	12.5 mm – 19 mm	25 mm – 37 mm
Medium	635 mm – 1270 mm	19 mm – 25 mm	37 mm – 50 mm
High	>1270 mm	25 mm – 50 mm	50 mm – 100 mm

- Compost shall be uniformly applied using an approved spreader, e.g., bulldozer, site discharge manure spreaders
- A pneumatic blower unit propels the compost directly at the soil surface, thereby preventing water from moving between the soil-compost interface
- Seeding can be incorporated during the compost application

Construction Considerations

- Use higher blanket application rate in high rates of precipitation and rainfall intensity, and snow melt
- Compost may be used in conjunction with a compost blanket, especially in regions with spring melt, and sites with severe grades and long slopes
- In regions subjecting to wind erosion, a coarser compost product or higher blanket application rate is preferred
- Use lower blanket application rate in lower precipitation rates and rainfall intensity regions

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Areas damaged by washout or rilling should be regraded if necessary and re-covered with compost immediately

Similar Measures

- Rolled erosion control products (RECP)
- Hydroseeding
- Hydromulching

Rolls
a) Coir Roll
b) Fibre Roll
Streambank Stabilization Techniques and Erosion Control

B.M.P. #38

Description and Purpose

- Coir Rolls are long cylindrical tubes that are composed of interwoven coconut fibres which are bound together with durable coir netting. Coir rolls are particularly applicable for wetland, streambank, and shoreline projects. Coir rolls are most commonly available in 300mm diameters and 6m lengths. These rolls can be linked together to form longer tubes, and are often used in combination with other biotechnical techniques, such as brush layering or live siltation. Coir logs encourage siltation and wetland/floodplain creation
- Fibre rolls are installed across slope contours as a grade break to reduce erosion potential by reducing overland flow velocities
- Straw roll consists of bundled straw (or natural fibre) wrapped in photo-degradable open-weave plastic netting staked into the soil along slope contours as a grade break to reduce erosion potential
- Normally live staking can be installed to anchor the Fibre Rolls to provide deep root vegetation with potential favourable moisture retention provided by fibre roll
- Fibre Rolls also capture sediment, organic matter, and seeds carried by runoff

Applications

- The tough, long-lasting coconut fibres make coir rolls appropriate for wetland, streambank, and shoreline applications. Coir rolls work well when immediate erosion control is needed. Brushlayers work well with coir roll applications, adding further stabilization with a live root system, while also providing excellent habitat features. The coir roll provides a base for the brushlayer cuttings to be laid upon at an appropriate angle which benefits the growth of cuttings. The cuttings provide further protection from breaking waves and high flows
- Fibre Rolls may be used on slopes stable enough to support vegetation (steep, confined, slopes and channel banks with gradients greater than 1H:1V may have low success potential)
- Fibre Rolls may be used along long slopes as a grade break to shorten slope length between line of fibre rolls at different contour elevations
- Fibre Rolls may be used as grade breaks, where slopes transition from flatter to steep gradients

Advantages

- The coir material is natural and long lasting (5 to 7 years), and has high tensile strength

- The fibre rolls and mats accumulate sediment while the plants grow and the plant roots develop. Eventually the coir material biodegrades and the cohesive strength of the root systems and flexible nature of the plants become the primary stabilizing element
- The coir roll/brushlayering combination provides immediate shoreline and streambank protection, with additional benefits of riparian enhancement when the cuttings become established
- Coir Rolls address ecological concerns by encouraging vegetation and wildlife habitat, and are an alternative to stone revetments or other structural measures
- The high tensile strength coconut fibres, fibre netting and the wooden stakes used to anchor the material make up the initial structural components of the system, while plant root and top growth increase the strength and baffle effects of the structure
- Fibre Rolls can be used on slopes too steep for silt fences or straw bales sediment barriers
- In time, plastic netting will degrade due to the sunlight and straw will degrade and be incorporated into the soil
- Fibre Rolls primary purpose is erosion control, however fibre rolls do provide some sediment control

Limitations

- This technique should be implemented during the dormancy period of the cuttings used for brushlayering and staking
- Coir Rolls are relatively expensive
- Fibre Rolls are designed for low sheet flow velocities
- Fibre Rolls are designed for short slopes with a maximum gradient of 1H:1V
- Fibre Rolls may be labour intensive to install
- Straw rolls have short life span due to natural degradation
  - Usually only functional for two seasons
- Susceptible to undermining and failure if not properly keyed into the soil
- Labour intensive maintenance may be required to ensure rolls are in continuous contact with the soil, especially when used on steep slopes or sandy soils

Construction

- Determine annual water elevation
- Mark the annual water level on a stake driven into the substrate, 0.3 or 0.6 m offshore. Installing the materials and plants at the correct elevation is the most important aspect to assure success of the installation. Determine, on site, where the installation will begin and end
- Determine soil level by laying a straight cutting on the coir roll with approximately 20% of the cutting sticking out past the roll, and with the basal ends dipping down into the soil
- Begin installation at the downstream end (if using in a streambank project)
- Prepare the site for installation of coir roll and coir mats by removing any large rocks, obstructions or material that may prevent the coir from making direct and firm contact with the soil. Coir rolls must be level, installed along a horizontal contour. Place coir rolls parallel to the stream bank or shoreline. It is very important to key the ends of the coir rolls firmly into the shoreline or stream bank, so waves and flows will not scour behind the rolls and compromise the integrity of the structure
- Install the coir roll such that 50 mm of the roll extends above the annual water elevation
- Adjacent rolls shall be laced together, end-to-end, tightly and securely
- If using brushlayer cuttings prepare soil bed behind installed coir rolls for laying. It is important that the bud ends of the live cuttings angle up to some degree from the basal ends. Lay cuttings in this fashion, slightly crisscrossed for additional strength
- Next, backfill over cuttings with soil, covering the lower 80% of the branches. At this time, soil can be levelled and prepared for a soil wrap for additional height and soil stability
- If simply covering the cuttings with soil, compact slightly and grade slope to appropriate angle. Use water to wash soil in between branch layers
- If using plant materials, such as container-grown, pre-rooted plant plugs or willow stakes, they should be planted into the coir rolls and through the coir mats and netting
- To install plant plugs and willow stakes into the coir roll, use a planting iron or pilot bar into the roll and wedge it back and forth to create a hole for the plant. It is extremely important that the root system of the plant be placed below the water

level for certain species. All plants shall be checked to ensure that they have been firmly installed in the fibre material

- Mulch and seed exposed areas with native species
- Prepare slope face and remove large rocks or other deleterious materials
- Excavate small trenches a minimum of 0.15 m deep and 0.15 m wide across the width of the slope, perpendicular to slope direction, starting at the toe of the slope and working upwards towards crest of slope
- Space trenches a maximum of 3 to 8 m apart along the slope incline, with steeper slopes having trenches spaced closer together
- Place fibre rolls into trench ensuring continuous contact between fibre roll and soil surface
- Butt-joint adjacent fibre roll segments tightly against one another
- Use a metal bar to make pilot hole through middle of the fibre roll a minimum depth of 0.3 m into underlying soil
- Pilot holes should be spaced a maximum of 1 m apart
- Secure fibre roll to soil using wooden stake or other appropriate anchor; live stake may be used as alternate anchor
- Place soil excavated from trench on upslope side of fibre roll and compact to minimize undermining of fibre roll by runoff
- Seed the soil along the upslope and downslope sides of the fibre roll to promote vegetation growth

Construction Considerations

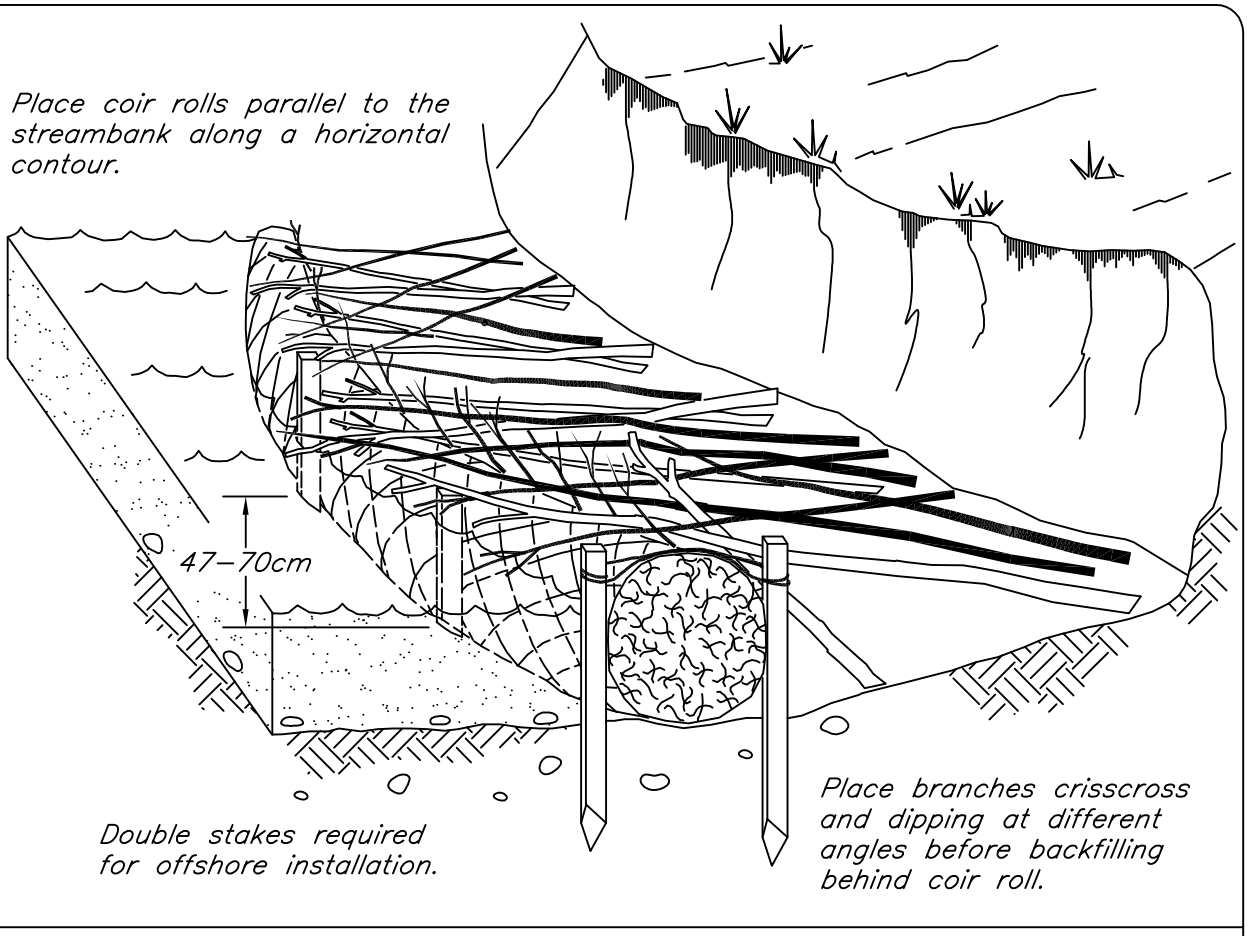
- All work site disturbance should be minimized. Protect any existing plant, when possible, and avoid additional disturbance that can lead to erosion and sedimentation
- Install additional erosion and sediment control measures such as temporary diversion dikes, silt fences and continuous berms, as needed, before beginning work
- Coir rolls can be used in the stream as a sediment barrier, silt curtain, and/or coffer dam to control sediment while work is being done in the water
- Topsoil should be saved, if possible, and replaced once the subsoil has been removed or regraded. Soil shall be stored away from the water's edge and it shall be moved to its final location and stabilized as quickly as possible

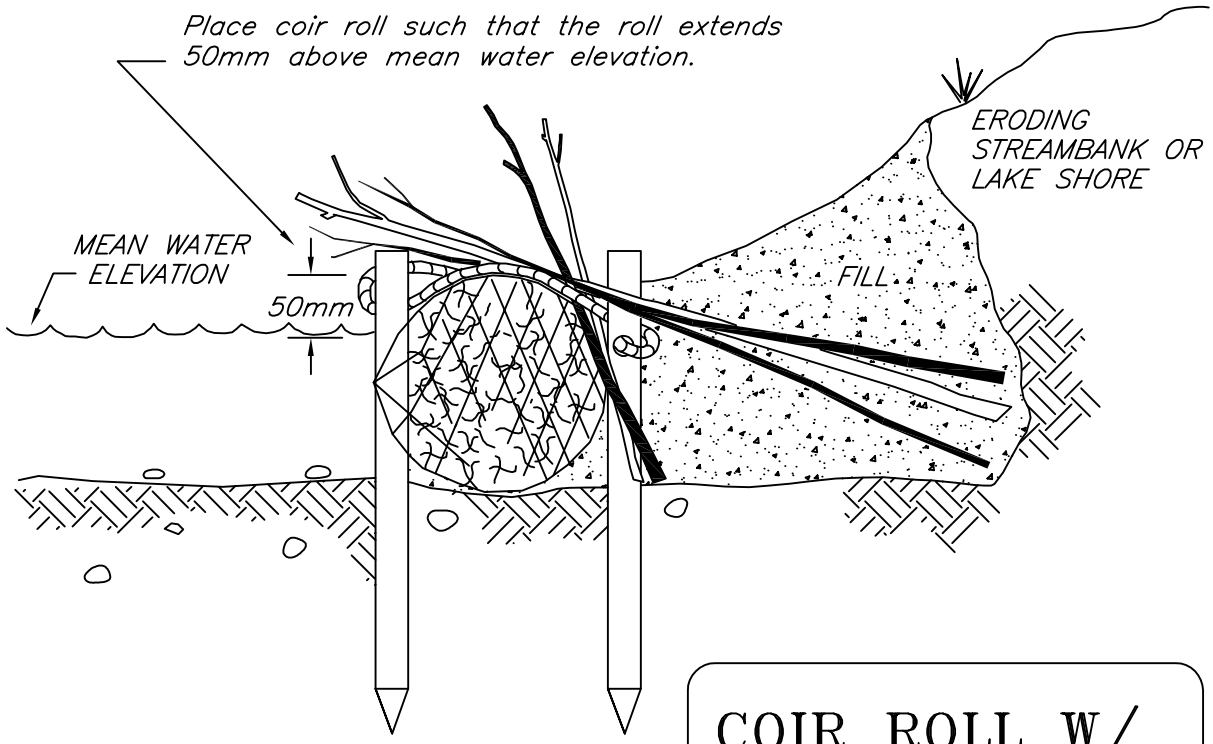
Rolls a) Coir Roll b) Fibre Roll Streambank Stabilization Techniques and Erosion Control	B.M.P. #38

- For typical applications at the water's edge, coir rolls are held in place with a single row of stakes, 300 mm on center. Stakes may be driven through the netting on the outer edge of the roll. It is very difficult to drive stakes through the high-density rolls, however, a stake can be driven with the help of a pilot hole through the low density coir rolls
- Lacing among the stakes is recommended for coir mats exposed to extreme conditions such as ice, waves, or flooding
- Coir rolls shall be placed along streambanks or shorelines at a height sufficient to protect the bank from flows or waves. Additional coir rolls may be placed above the lower rolls, in a tile-like fashion, to protect the upper shore or stream bank
- Use live stakes in place of wooden stakes
- If the slope soil is loose and uncompacted, excavate trench to a minimum depth of 2/3 of the diameter of the fibre roll
- For steep slopes, additional anchors placed on the downslope side of the fibre roll may be required

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Check plants to ensure that they have been firmly installed in the fibre material
- Water plants, if necessary, during the establishment phase
- Check all materials periodically or after storms to ensure they remain properly secured. Make necessary repairs promptly
- All temporary and permanent erosion control practices shall be maintained and repaired as needed to ensure continued performance of their intended use
- Areas damaged by washout or rutting should be repaired immediately
- Additional stormwater control measures should be considered for rilling areas damaged by runoff





COIR ROLL W/ BRUSHLAYERING

FILE: COIRBRLY

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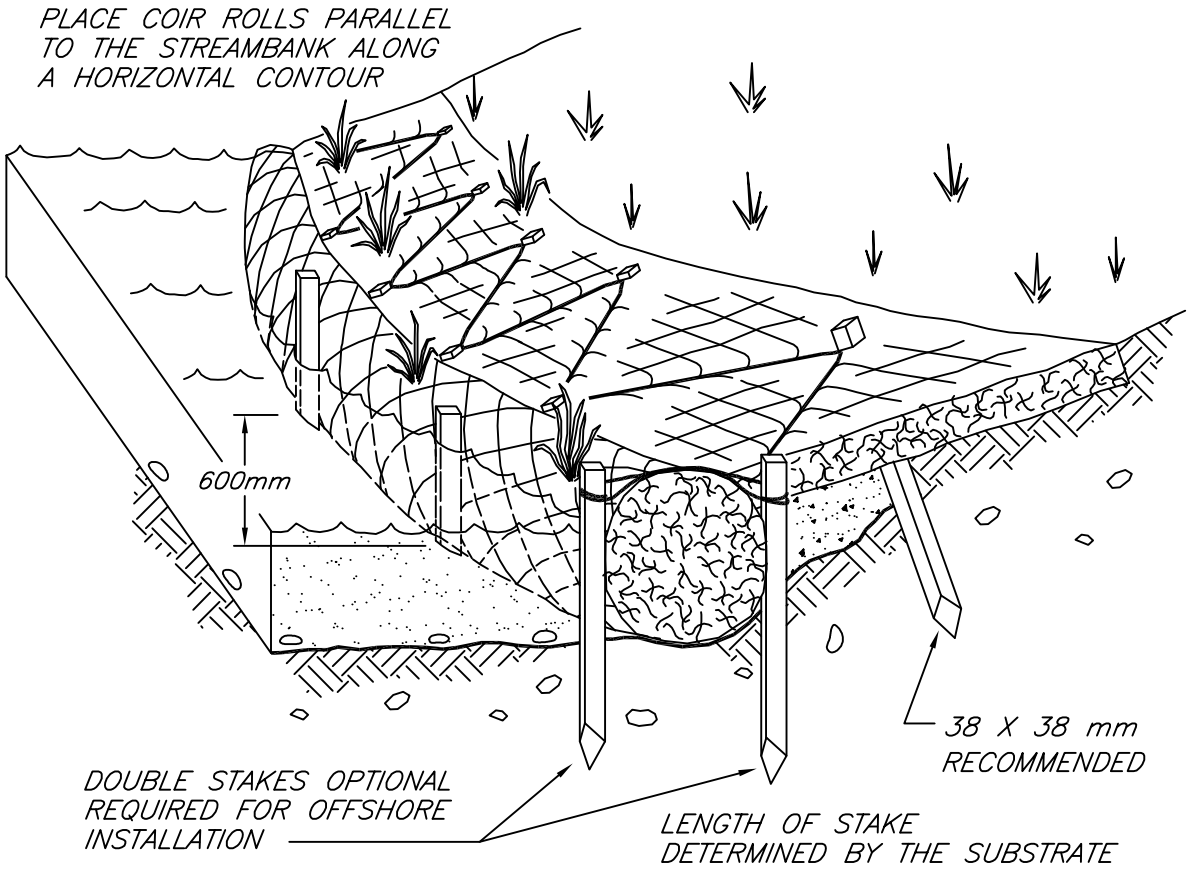
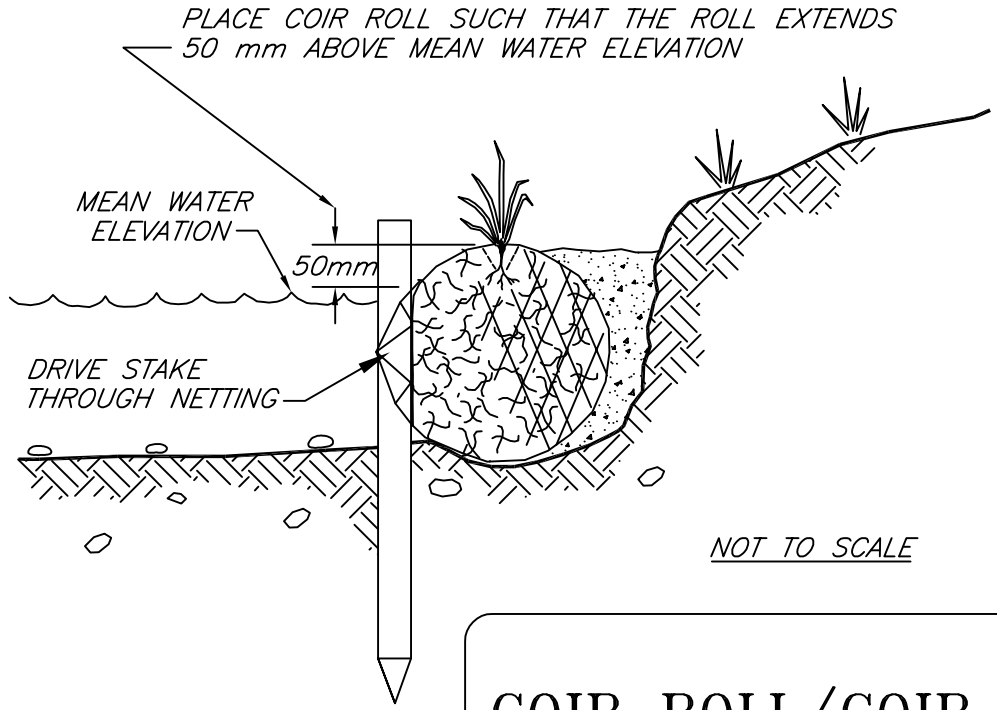
B.M.P. #38a
Typical Section

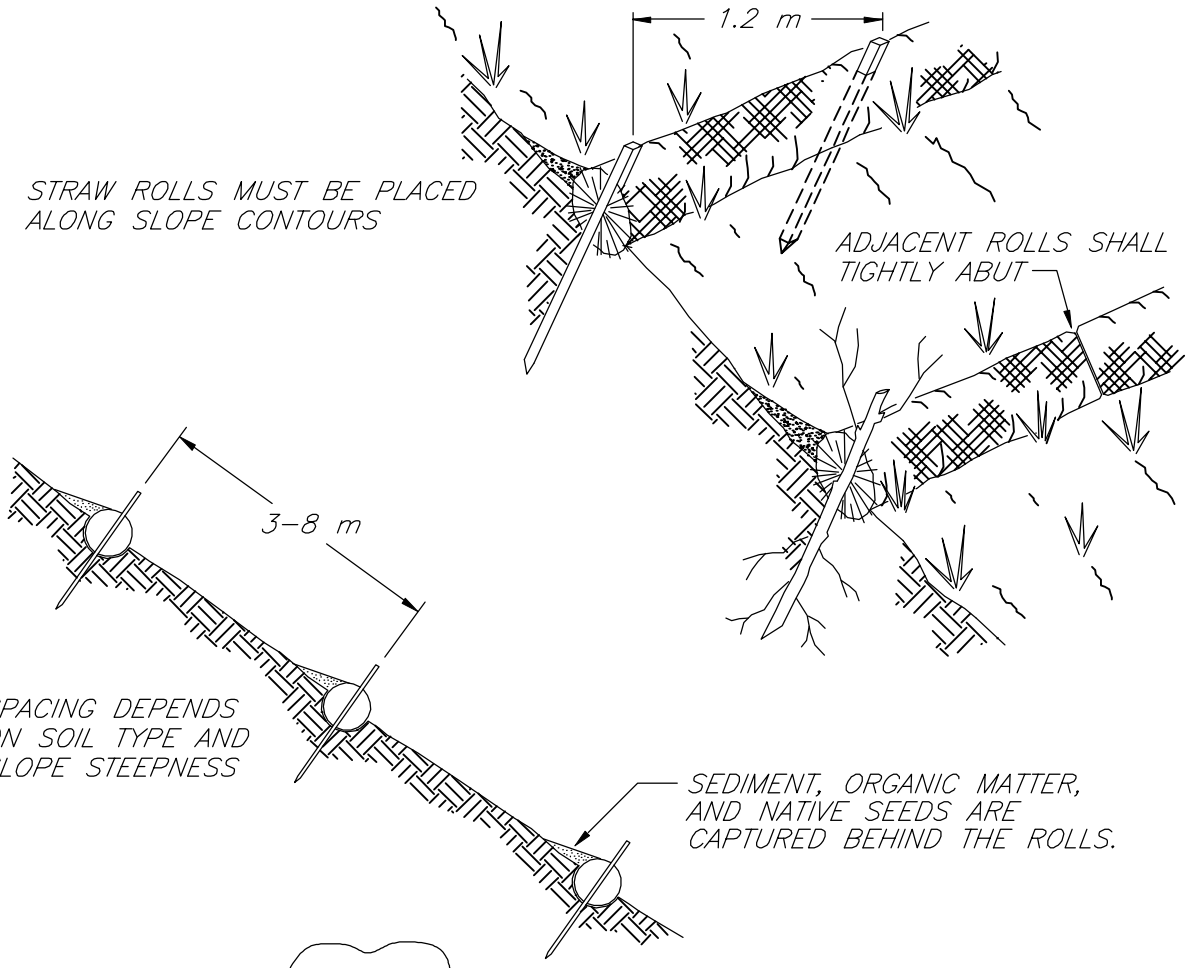


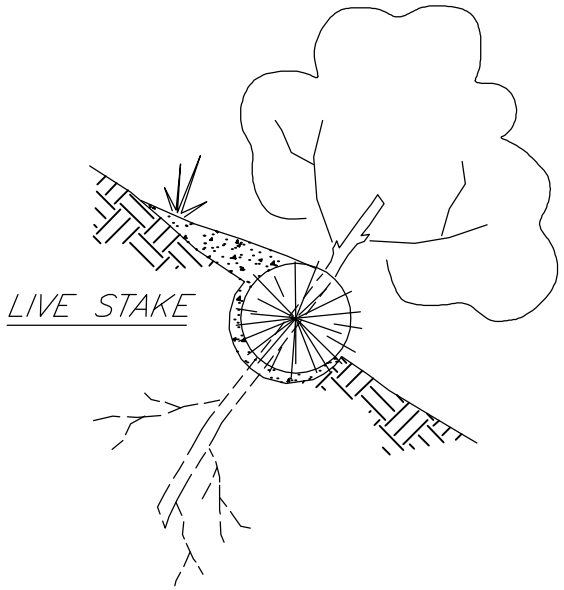


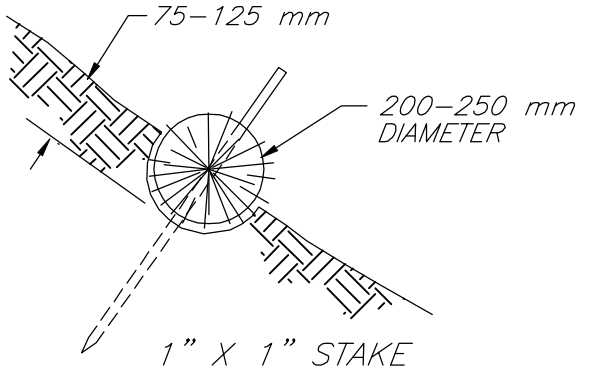
NOT TO SCALE

COIR ROLL/COIR MATS

FILE: COIRRM







NOT TO SCALE

NOTE:

1. STRAW ROLL INSTALLATION REQUIRES THE PLACEMENT AND SECURE STAKING OF THE ROLL IN A TRENCH, 75–125 mm DEEP, DUG ON CONTOUR. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND ROLL.
2. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

STRAW ROLLS

FILE: STRWROLL

Vegetated Riprap Streambank Stabilization Techniques	B.M.P. #45

Description and Purpose

- Vegetative Rip-Rap combines the widely-accepted, resistive, and continuous rock revetment techniques with vegetative techniques. It consists of a layer of stone and/or boulder armouring that is vegetated, optimally during construction, using pole planting, brushlayering and live staking techniques
- Continuous and resistive bank protection measures, such as riprap and longitudinal rock toes are primarily used to armour outer bends or areas with impinging flows
- The stream energy is resisted by the continuous protection, and is subsequently directed downward into the streambed
- The riprap will resist the hydraulic forces, while roots and branches increase geotechnical stability, prevent soil loss (or piping) from behind the structures, and increase pull-out resistance
- The roots, stems, and shoots will help anchor the rocks and resist 'plucking' and gouging by ice and debris

Applications

- Vegetated Rip-Rap is appropriate where infrastructure is at risk, and where redirective and discontinuous bank protection measures have been rejected or deemed inappropriate
- Vegetative Rip-Rap techniques are sometimes considered mitigation for some of the impacts caused by riprap
- Incorporating large and dense trees may be beneficial where thermal pollution is occurring, along north-facing banks (trees will cast shade) and where cover is necessary to protect fish (rearing habitat)

Advantages

- Correctly designed and installed, Vegetated Rip-Rap offers an opportunity for the designer to attain the immediate and long-term protection afforded by riprap with the habitat benefits inherent with the establishment of a healthy riparian buffer
- Above ground components of the plants will create habitat for both aquatic and terrestrial wildlife, provide shade (reducing thermal pollution), and improve aesthetic and recreational opportunities
- When graded or "self-launching" stone is used, riprap is self-adjusting to small amounts of substrate consolidation or movement
- The revetment can sustain minor damage and still continue to function adequately without further damage

- The rough surface of the riprap dissipates local currents and minimizes wave action more than a smooth revetment (like concrete blocks)
- Stones are readily available in most locations, and materials are less expensive than many other "hard armouring" techniques
- The rock provides a large amount of aquatic habitat
- Rip-Rap is easily repaired by placing more rock where needed
- The fibrous roots of the chosen vegetation prevents washout of fines, stabilizes the native soil, anchors armour stone to the bank, and increases the lift-off resistance
- The vegetation also improves drainage of the slope by removing soil moisture for its own use
- Vegetated Rip-Rap has a more natural appearance, and is therefore more aesthetically pleasing, which is frequently a matter of great importance in high-visibility areas
- In addition, environmental clearances are frequently easier to obtain if the project has biotechnical and habitat enhancement benefits incorporated into the design
- There are many environmental benefits offered by Vegetated Rip-Rap, most of which are derived from the planting of willows or other woody species in the installation
- The willow provides canopy cover to the stream, which gives fish and other aquatic fauna cool places to hide
- The vegetation also supplies the river with carbon-based debris, which is integral to many aquatic food webs, and birds that catch fish or aquatic insects will be attracted by the increased perching space next to the stream
- An additional environmental benefit is due to the use of rock, as the surface area of the rocks is substrate that is available for colonization by invertebrates
- The small spaces between the rocks also provide benthic habitat and hiding places for small fish and fry
- The brushlayering methods reach out over the water, and provide shade and organic debris to the aquatic system

Limitations

- Vegetated Rip-Rap may be inappropriate if flow capacity is an issue, as bank vegetation can reduce flow capacity, especially when in full leaf along a narrow channel
- In remote areas large rocks may be difficult to obtain and transport, which may greatly increase costs

- Riprap may present a barrier to animals trying to access the stream

Construction

The vegetation obtained should be poles of adventitiously-rooting native species (such as willow, cottonwood or dogwood), with a minimum diameter of 38 mm, and be sufficiently long to extend into the vadose zone below the riprap.

Vegetated Rip-Rap with Willow Bundles

- Grade the bank to the desired slope where the riprap will be placed, such that there is a smooth base
- Dig a toe trench for the keyway (if required) below where the riprap will be placed
- Place 10 to 15 cm (5 to 8 stem) bundles on the slope, with the butt ends placed at least 30 cm in the low water table
- This will probably involve placing the poles in the toe trench before the rock is placed, if standard riprap rock is being used
- Digging shallow trenches for the willows prior to placing them on the slope will decrease damage to the cuttings from the rocks, and may increase rooting success because more of the cuttings will be in contact with soil
- The bundles should be placed every 1.8 m along the bank, and be pointed straight up the slope
- Once the bundles are in position, place the rock on top of it to the top of the slope
- The bundles should extend 0.3 m above the top of the rock
- If the bundles are not sufficiently long, they will probably show decreased sprouting success, and therefore, a different technique should be chosen

Vegetated Rip-Rap with Bent Poles

- Grade back the slope where the riprap will be placed, such that there is a smooth base
- Dig a toe trench for the keyway (if required) below where the riprap will be placed
- If non-woven geotextile is being used, lay the fabric down on the slope, all the way into the toe trench, and cut holes in the fabric about 0.6 to 0.9 m above the annual low water level
- Slip the butt ends of the willow poles through the fabric and slide them down until the bases are at least 15 cm into the perennial water table, or at the bottom of the toe trench, whichever is deepest

- If using filter gravel, lay it down on the slope, and place a layer of willow poles on top of the gravel, with the bases of the cuttings at least 15 cm into the perennial water table, or at the bottom of the toe trench, whichever is deepest
- Place the largest rocks in the toe trench
- Ensure that they lock together tightly, as they are the foundation for the structure
- Place the next layer of boulders such that it tapers back slightly toward the streambank
- Bend several willow poles up, such that they are perpendicular to the slope, and tight against the first layer of rocks
- Now place the next layer of rocks behind these poles
- Placement will require an excavator with a thumb, as someone will have to hold the poles while the rocks are placed
- As the poles are released, they should be trimmed to 30 cm above the riprap
- This last step should be repeated until all the poles have been pulled up, and the entire slope has been covered

<u>Vegetated Rip-Rap with Brushlayering and Pole Planting</u>

There are two methods of constructing brushlayered riprap; one involves building up a slope, and the other works with a pre-graded slope – neither method can be used with non-woven geotextile

Method 1 (building up a slope):

- Lay the bank slope back to somewhat less than the desired finished slope
- Dig a toe trench, if needed, and lay the key rocks into the trench. Pack soil behind these rocks, with filter gravel in between the soil and rocks
- Continue installing riprap 0.9 to 1.2 m up the bank
- Slope the soil back into the bank at a 45° angle, such that the bottom of the soil slope is in the vadose zone
- Place a layer of willow cuttings on top of the soil, with the butt ends extending into the vadose zone, and the tips of the branches sticking out 30 to 60 cm
- Place the next layer of stones on top of the initial rocks, but graded slightly back, and repeat the soil and brush layering process
- When finished, trim the ends of the willow branches back to 30 cm
- Do not cut shorter than 30 cm, as the plant will have difficulty sprouting

Method 2 (pre-graded slope):

- Lay the bank slope back to the desired finished grade, and dig a toe trench if self-launching stone is not being used
- Place the largest rocks in the key-way, and fill in behind with filter gravel and soil
- Continue installing riprap 0.9 to 1.2 m up the bank
- Place the bucket of an excavator just above the layer of rocks at a 45° angle
- Pull the bucket down, still at a 45° angle, until the water table is reached, or the stream is dry, to the elevation at the bottom of the key trench
- Pull up and back on the bucket; this will provide a slot in the bank into which willow poles can be placed
- Throw in some willow poles (about 18 poles per linear m), ensuring that the butt ends are at the bottom of the trench
- Release the scoop of earth, and allow it to fall back in place on the slope
- Then place the next layer of rock on top of the branches, flush with the slope
- If self-filtering stone is not being used, filter gravel should be placed behind the rocks
- Repeat the process, beginning again with pulling back a scoop of soil
- Continue this process to the top of the slope, or if preferred, use joint-planted riprap on the upper slope, where it is difficult to reach the perennial water table with the excavator bucket
- When finished, trim the ends of the branches back such that only 30 cm extends beyond the revetment

Construction Considerations

- The technique can also be used in conjunction with other techniques, particularly resistive techniques, designed primarily to protect the bank toe (Vegetated Rip-Rap and Rootwad Revetments) and redirective techniques (Bendway Weirs, Spur Dikes, and Vanes)
- While riprap is very effective at arresting bank erosion and providing relatively permanent bank protection the environmental consequences can be less than desirable and should, therefore always be taken into account when selecting an environmentally-sensitive streambank stabilization treatment
- Scour counter-measures are sometimes required for continuous and resistive rock bank protection
- One alternative is a rock-filled key trench, designed with appropriate scour analysis

- Another counter-measure that may be employed is the use of graded, self-launching stone

Filter Material:

- Some sort of filter material is typically used to prevent piping of fine soils from below the riprap, if self-launching stone is not used
- There are two choices: non-woven geotextile fabric or graded filter gravel
- Non-woven geotextile fabrics are not recommended for use in Vegetated Rip-Rap, as roots have difficulty penetrating the fabric
- If non-woven geotextile fabric is required, one can cut holes in the fabric where the vegetation is placed
- Small slits in the fabric are especially appropriate with the bent pole method
- Filter gravel is the preferred filter media for Vegetated Rip-Rap

Rock Size:

- There are two options for rocks – self-launching/self-filtering rock or standard riprap
- The advantage of self-launching/self-filtering rock is that the revetment will build its own toe, by self-launching, in any scour hole that forms
- The different sizes of rock act as their own filter medium, so no geotextile fabric or filter gravel is needed
- This decreases cost, and also makes installation less labour-intensive for two of the three methods of installation
- Using self-launching stone is dependent on a source of graded rock, which is not always available

Inspection and Maintenance

- Riprap should be visually inspected as frequently as outlined in the PESC and TESC Plans, with focus on potential weak points, such as transitions between undisturbed and treated areas
- Soil above and behind riprap may show collapse or sinking, or loss of rock may be observed
- Inspect riprap during low flows annually, to ensure continued stability of the toe of the structure
- Treat bank or replace rock as necessary

Vegetated Riprap Streambank Stabilization Techniques	B.M.P. #45

Design Considerations

- It often takes many years for riprap to become vegetated if vegetation is not integrated into its design and construction at the outset
- Flanking, overtopping or undermining of the revetment due to improperly installed or insufficient keyways is one of the biggest reasons for failure of riprap
- Improperly designed or installed filter material can also cause undermining and failure of the installation
- Undersized stones can be carried away by strong currents, and sections of the revetment may settle due to poorly consolidated substrate
- Vegetation may require irrigation if planted in a nondormant state, or in extremely droughty soils

Vegetated Rip-Rap with Willow Bundles

Is the simplest to install, but it has a few drawbacks:

- This technique typically requires very long (3 to 7m) poles and branches, as the cuttings should reach from 15 cm below the low water table to 30 cm above the top of the rock
- Only those cuttings that are in contact with the soil will take root, and therefore, the geotechnical benefits of the roots from those cuttings on the top of the bundle may not be realized

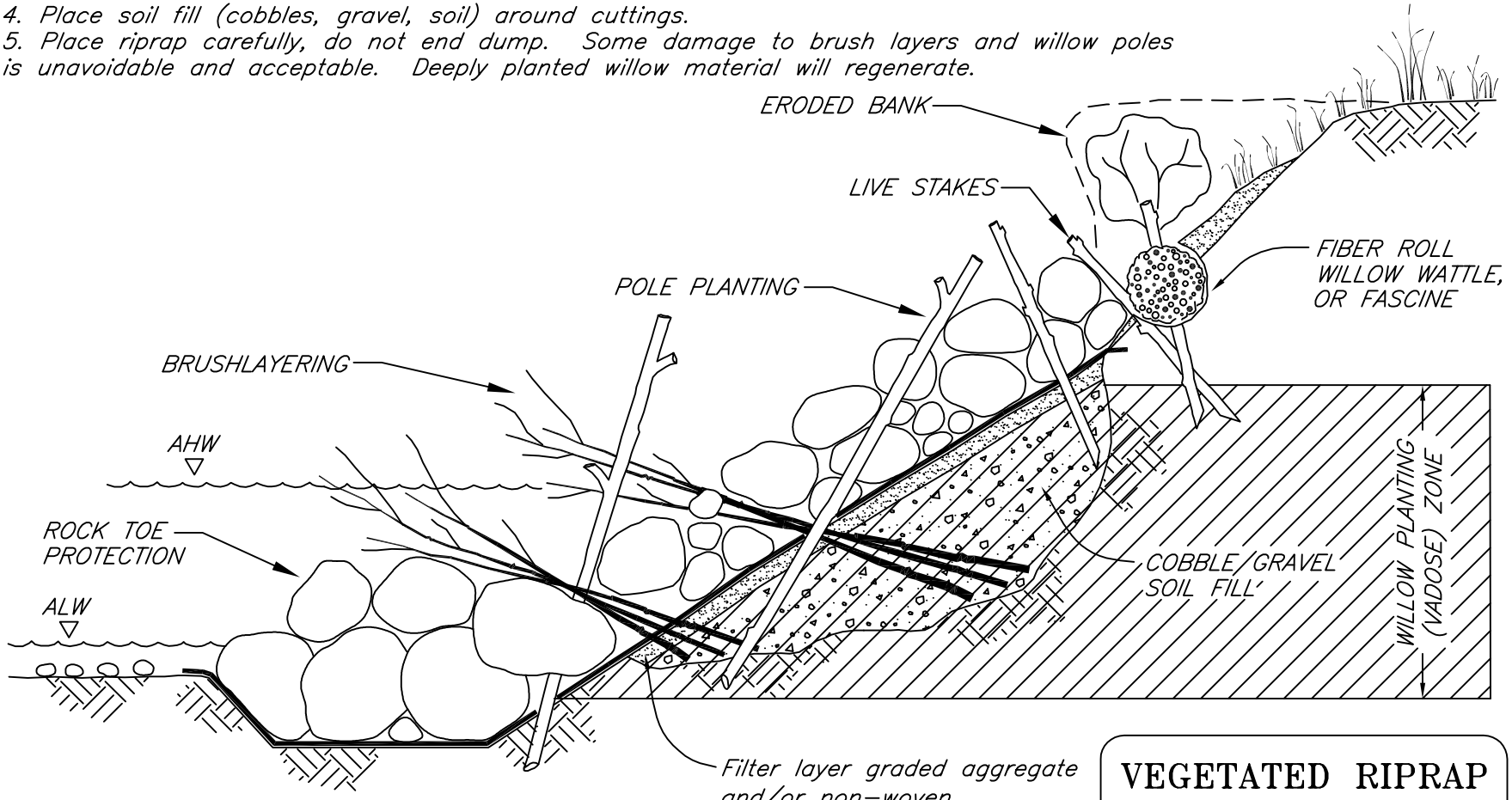
Vegetated Rip-Rap with Bent Poles

- Is slightly more complex to install
- A variety of different lengths of willow cuttings can be used, because they will protrude from the rock at different elevations
- The angle can be three to one, or forty-five degrees
- A tree and root growth will develop the entire length of each pole planted

Vegetated Rip-Rap with Brushlayering and Pole Planting

- Is the most complex type of riprap to install, but also provides the most immediate habitat benefits
- The installation of this technique is separated into 2 methods; one method describes installation when building a bank back up, while the other is for a well-established bank
- If immediate aquatic habitat benefits are desired, this technique should be used
- May not provide the greatest amount of root reinforcement, as the stem-contact with soil does not extend up the entire slope

NOTES:
1. Install willow pole planting and brushlayering during bank grading and riprap placement to ensure good contact with 'native ground' and/or soil fill.
2. Willow poles and brush layers shall extend down into expected soil moisture zones (vadose).
3. Cut small holes or slits in geotextile fabric as necessary.
4. Place soil fill (cobbles, gravel, soil) around cuttings.
5. Place riprap carefully, do not end dump. Some damage to brush layers and willow poles is unavoidable and acceptable. Deeply planted willow material will regenerate.



VEGETATED RIPRAP
W/ BRUSHLAYERING & POLE PLANTING

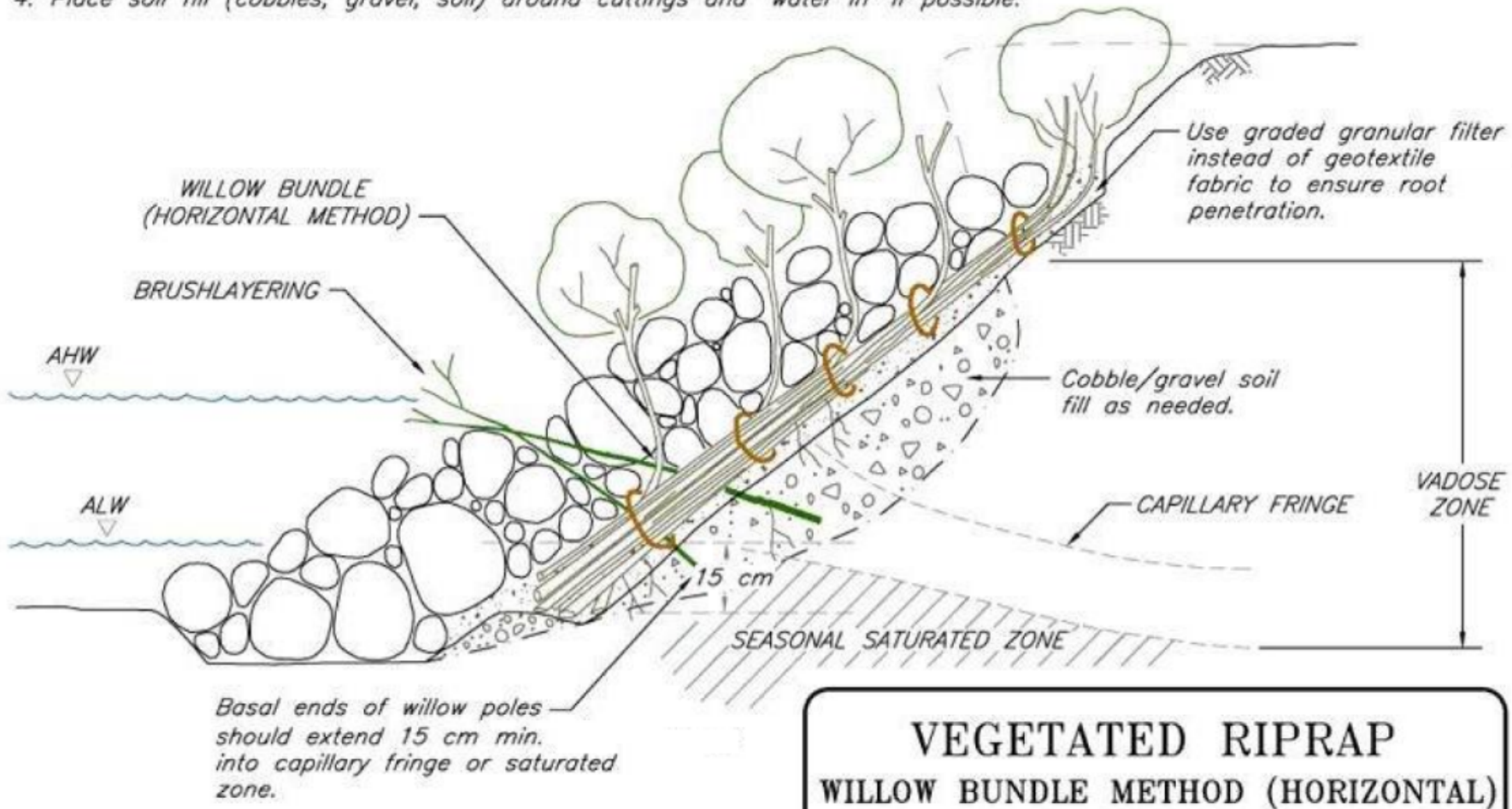
VGRIPRAP

Government of Alberta ■
Transportation

B.M.P. #45a
Typical Section

NOTES:

1. As a general rule, place basal ends of the cuttings 15 cm into the capillary fringe or seasonal saturated zone.
2. Bend individual poles up through the riprap during placement while ensuring contact of the stem with native ground. Laying poles 'horizontally" is an efficient and cost–effective way to maximize rooting.
3. Graded, granular filter is preferable to geotextile fabric to improve root penetration or slip poles through slits cut into fabric.
4. Place soil fill (cobbles, gravel, soil) around cuttings and 'water in' if possible.



VEGETATED RIPRAP
WILLOW BUNDLE METHOD (HORIZONTAL)

FILE: VRBND

COFFERDAMS

Instream Sediment Control

M 3

FACTSHEET

DESCRIPTION AND PURPOSE

- Consists of a permeable or impermeable physical barrier
- Used to temporarily enclose an instream work area to contain sediment or turbidity
- May be dewatered to allow work in the dry or left wet to isolate area

APPLICABILITY

- Instream areas shallow enough to accommodate a cofferdam
- Useful when excavation of the streambed is necessary
- Situations where a dry streambed is necessary for construction

ADVANTAGES

- Dry working area facilitates equipment access to streambed
- Allows sediment disturbance in the wet inside the cofferdam
- Usable in higher velocity flows than staked or floating sediment barriers

LIMITATIONS

- High permeability underlying soils may preclude dewatering without sheet piling
- Susceptible to overtopping due to flooding or ice cover
- No more than 1/3 of the channel width should be blocked by the cofferdam
- Installation and removal can be expensive

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COFFERDAMS

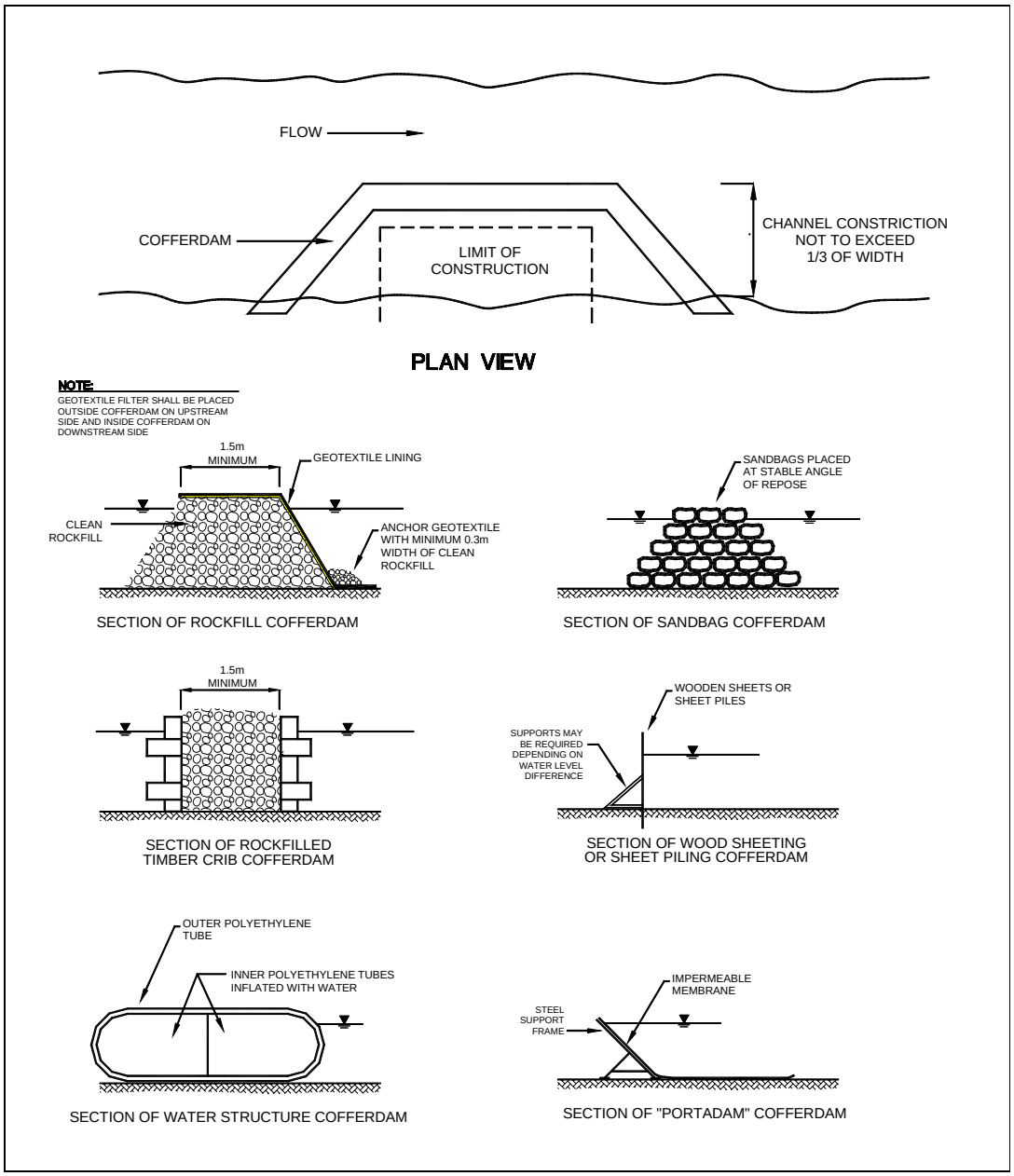
Instream Sediment Control

M 3

FACTSHEET

2 of 3

DESIGN AND IMPLEMENTATION (REFER TO FIGURE)



Government of Alberta
Transportation

COFFERDAMS

Instream Sediment Control

M 3

FACTSHEET

3 of 3

DESIGN AND IMPLEMENTATION (CONT'D)

EARTHFILL STRUCTURES

- Cofferdams may be constructed of granular fill, sandbags or rockfilled timber cribs
- Highly permeable materials may require a geotextile liner to properly contain sediment
- The geotextile liner should be placed outside the cofferdam on the upstream side and inside the cofferdam on the downstream side, with a connection at the transition, to prevent disturbance by streamflow
- If dewatering is required, an impermeable clay core or synthetic liner may be required

SHEET BARRIERS

- Cofferdams may be constructed of steel sheet piles or wooden sheeting
- Depending on water depth and how deep piles or sheets are driven, internal support of the barrier may be required

PROPRIETARY METHODS

- Proprietary methods for cofferdam construction include structural frames (e.g., Portadam) and water structures (e.g., Aquabarrier or Aquadam)
- Structural frame directs hydrostatic forces downwards and requires an impermeable liner to reduce water inflow. Usable in depths up to 2.7 m
- Water structures are double-walled, inflatable PVC or polyethylene tubes that seal against the streambed. Usable in depths up to 2.7 m. Their use is not recommended in streams with angular rock or materials with high puncture potential

MAINTENANCE

- If dewatering is necessary, this may need to be performed continuously by excavating and pumping from a sump, large enough to prevent seepage water from ponding in working areas. The pumping discharge should be located in a well-vegetated area at least 50 m from the stream to prevent sediment from entering the stream. Other methods (e.g. pumped filter, sediment trap, etc.) may be used to treat sediment-laden discharges
- Frequent inspections of cofferdam condition, seepage and streambed scour are recommended
- Reusable methods (e.g., Portadam or Aquabarrier) should be inspected thoroughly before and after use

REFERENCES AND FURTHER READING

Portadam Incorporated, Laurel Springs, New Jersey. Corporate Brochures.

Trow Consulting Engineers Ltd., 1997. Instream Sediment Control Techniques - Field Implementation Manual, Ontario Ministry of Natural Resources, 93 p.

Water Structures Unlimited, Carlotta, California. Corporate Brochures.

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INSTREAM SILT BARRIERS

Instream Sediment Control

M 4

FACTSHEET

DESCRIPTION AND PURPOSE

- Consists of geotextile suspended in the water by stakes or anchored buoys
- Isolates disturbed, turbid areas from clean, instream water
- Allows silt to settle out of suspension inside construction area

APPLICABILITY

- Used in low velocity streams
- Not intended to filter turbid water
- Not to be placed completely across channel unless flows are negligible

ADVANTAGES

- Easy to place and remove
- Cheaper than cofferdams

LIMITATIONS

- Susceptible to damage by fast flowing water, ice, floating debris and boats
- May result in scour in flowing areas outside the barrier
- Construction must proceed in the wet
- Some turbid water may escape the barrier

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INSTREAM SILT BARRIERS

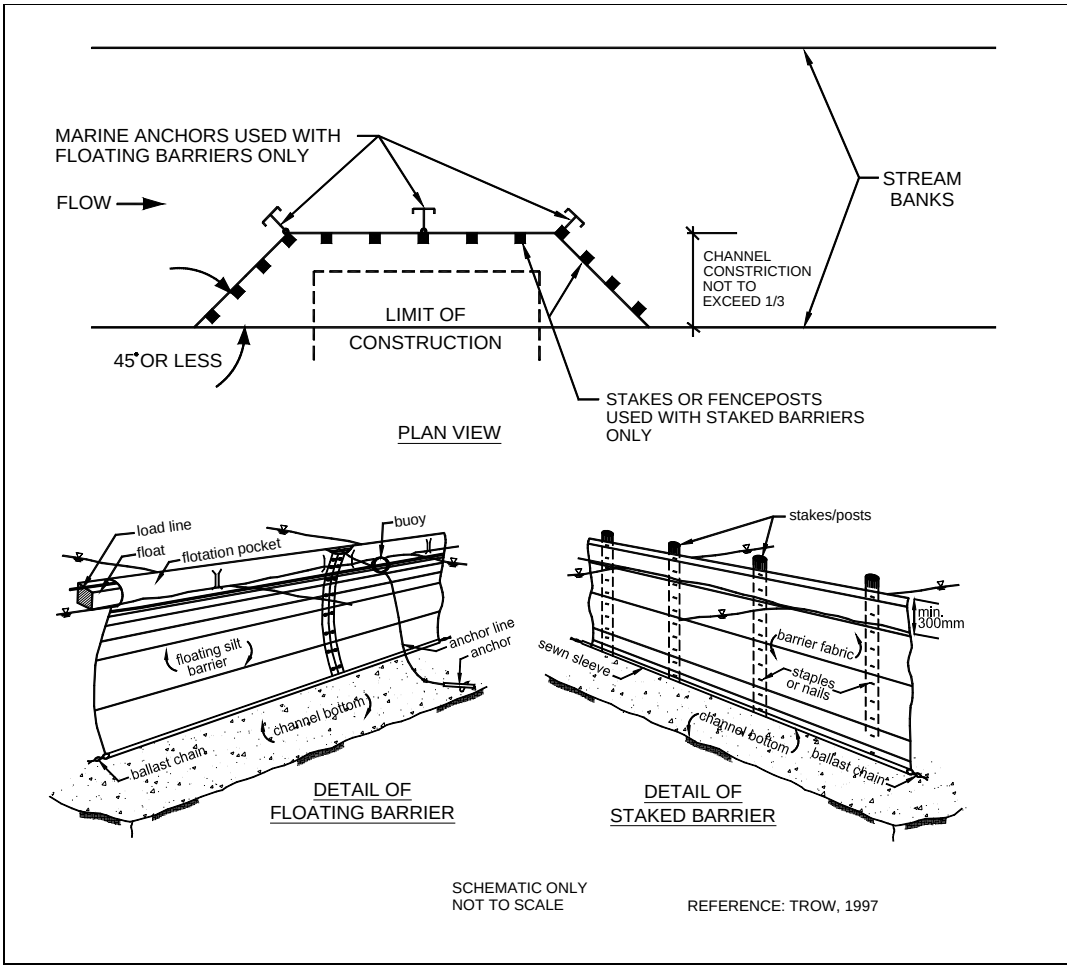
Instream Sediment Control

M 4

FACTSHEET

2 of 4

DESIGN AND IMPLEMENTATION (REFER TO FIGURE)



STAKED SILT BARRIERS

- Consist of geotextile fabric attached to stakes or posts, with a weighted sleeve at the bottom of the fabric to seal against the streambed
- Use of staked barriers is not recommended for flow velocities in excess of 0.25 m/s
- Fisheries regulations require that the total channel constriction not exceed 1/3 of the natural channel width
- Impermeable or permeable fabric may be used, with woven fabrics recommended to reduce sag and sink due to sediment trapping or stretching. Woven fabrics also absorb less water and are easier to handle when wet
- The barrier should not be used in water more than 1.2 m deep, as staking is generally done by wading
- The barrier should extend at least 0.30 m above the water level

- 150 mm wire mesh may be used to support the geotextile fabric

DESIGN AND IMPLEMENTATION (CONT'D)

- Stakes should be placed a maximum of 1.5 m (no wire mesh reinforcement) or 3.0 m apart (with wire mesh reinforcement). Stakes may be braced to resist current forces or a partial cofferdam may be used upstream to deflect current
- Fabric should be secured to the stakes with heavy duty staples or nails with washers. Tie wires should be used to attach the wire mesh (if used) to the fabric. A continuous roll of fabric should be used wherever possible
- The bottom 0.30 m of the fabric should be sewn into a sleeve and weighted with a chain. This sleeve should rest on the channel bottom and clean rockfill may be placed on top of it to ensure a good seal
- Before removing the barrier, time should be allowed for settling of sediment

FLOATING SILT BARRIERS

- Consist of geotextile hung from anchored flotation segments, with a weighted sleeve at the bottom to seal against the streambed
- Use of floating silt barriers is not recommended for flow velocities in excess of 0.15 m/s
- Fisheries regulations require that the total channel constriction not exceed 1/3 of the natural channel width
- The maximum depth for use of floating barriers varies with flow velocity and availability of anchorage, but depths in excess of 4 m are possible
- Flotation segments should be sewn or heat welded into a sleeve at the top of the barrier. Expanded polystyrene, ethafoam or closed cell plastic foam floats are recommended. Log booms are generally unsuitable. A load line may also be placed in the sleeve to assist in anchoring
- Impermeable or permeable fabric may be used. Woven geotextile is recommended to reduce sag and sink due to sediment trapping or stretching. Woven geotextiles also absorb less water and are easier to handle when wet
- A ballast chain should be sewn into the bottom of the geotextile to ensure an adequate seal with the streambed
- Floating barriers should be anchored to posts or trees at the shoreline and to piles or marine anchors in the channel. Anchors should be equipped with buoys to mark the anchor line and anchor location in the channel. Care should be taken to avoid interfering with channel navigation
- Floating silt barriers may be used in ice-covered conditions by anchoring to the ice sheet

MAINTENANCE

- Silt barriers should be inspected daily, especially after significant rainfall events (greater than 25 mm in 24 hours)
- Particular attention should be given to holes in the barrier which might release turbid water
- Ensure that the entire top edge of the barrier is above the water's surface
- Ensure that all stakes or anchors are functioning as intended
- Torn geotextile should be replaced by adding a continuous piece of fabric extending from post to post or by replacing a complete section

REFERENCES AND FURTHER READING

INSTREAM SILT BARRIERS

Instream Sediment Control

M 4

FACTSHEET

4 of 4

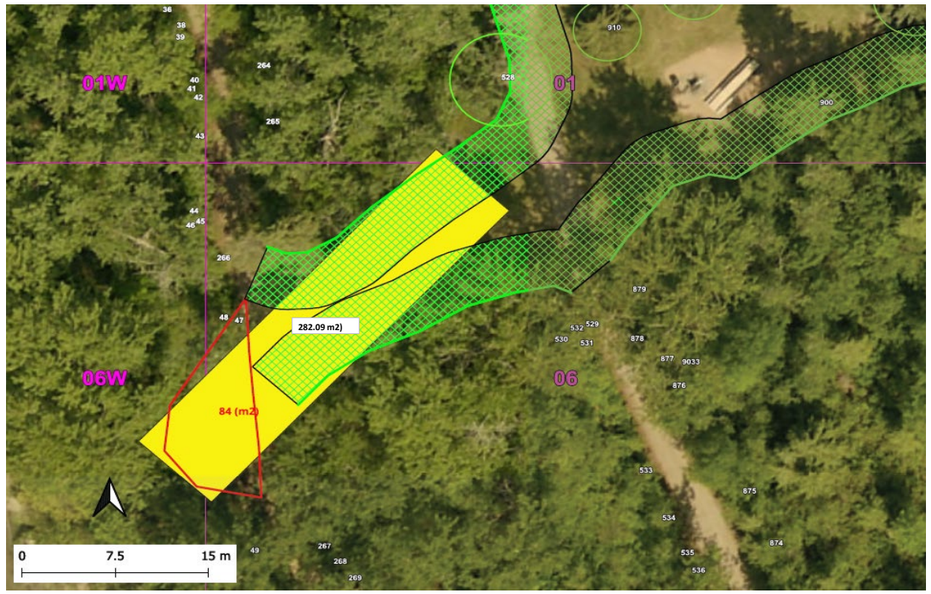
Trow Consulting Engineers Ltd., 1997. Instream Sediment Control Techniques - Field Implementation Manual, Ontario Ministry of Natural Resources, 93 p.

Government of Alberta
Transportation

Appendix 8. Natural Area Preservation Plan

Appendix 8. Natural Area Preservation Plan

AREA 1/ 6 - Natural Area Preservation Plan - Outfall #27 (NA Polygon 24)



GENERAL NOTES: i. CITY WILL REMOVE TREES & SHRUBS IN TREE REMOVAL AREAS AS INCIDATED IN DRAWINGS
ii. EROSION CONTROL MEASURES MUST BE IN PLACE AS NOTED BELOW
iii. ALL CITY TREES ARE PROTECTED BY CORPORATE TREE MANAGEMENT POLICY C456





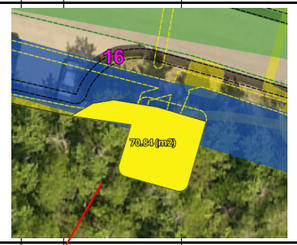
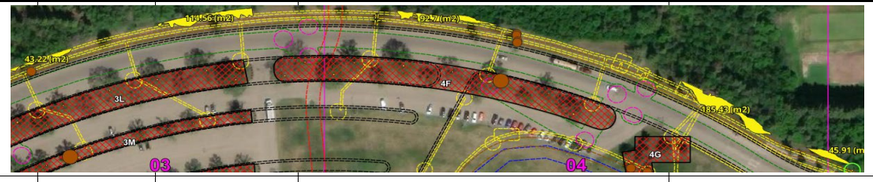
AREA 1	NA ID #	Disturbance Type/ Installation Method / Impact to Area	Drainage Impacts/ Proximity to water	Erosion & Sedimentation Control Measures	Environmental sensitivity & connectivity	Proposed tree removal/tree - vegetation m^2 loss	Propose Grade Changes	Soil Compaction / Root Damage Mitigation	Proposed Tree Care Treatments	Stand /Tree Spp. Condition
1,6	24	- New Storm; ST 750 HDPE; case bore under trees 911, 910, & 528 & existing storm	- 25% slope at 220 degrees; drainage is southwest to Saskatchewan River; distance from top of slope to water edge is ~ 65 meters - Ponding and pooling of water in excavated areas and compacted soils - Runoff (overland flow) on exposed sloped ground	- Erosion Potential identified as HIGH (Table 3.3, CoE 2015). Steep (over 15%) and long (65 m) slopes are present at site with high connectivity to watercourses and aquatic habitat. - Limit soil exposure and install continuous perimeter control structures around all soil stockpiles (as per AB transportation BMP #1, 4, 5, 22 and 23). Locate stockpiles away from watercourse (> 100m) in flat area. - Adhere to general BMPs Identified in ESCP and Section 6.1.1 Erosion and Sediment Control of the Tree Preservation Plan - Stabilize all cut and fill slopes temporarily by establishing cover. Vegetation is preferred, but short term measures such as mulch, geotextile fabrics or jute type mats/erosion control blankets have been shown effective. AB transportation BMPs # 27a, 30, 32, 33, 34, 37 and 38 apply. - Steeper cuts (> 3:1) should be hydroseeded (AB transportation BMP #24a) to provide temporary cover - Terrace and/or texture any disturbed or exposed slopes (AB transportation BMP # 34) to slow and dissipate or re-direct water into pre-determined catch basins/sediment traps. Any pumping should adhere to AB transportation BMP # 31. Terrace perpendicular to slope every 15 meters this could be done in unison with installation of silt fence rows perpendicular to slopes leading to SSR - Dust control might be needed in high traffic areas for safety and comfort. Regular watering during dry conditions or more longer term soil binders can be used - Install silt fences as per AB transportation erosion control manual BMP #1 - Silt fence installed 1) around perimeter to natural areas, 2) above high water mark of SSR surrounding immediate work area, and 3) perpendicular to 25 % slope and shaped upwards in a J-hook fashion into vegetation area to capture any runoff and water with suspended sediment. Objective is to have silt fence drain diffusely. Two rows evenly spaced 30 m apart will be required with an additional row above the anticipated high water mark. - Discharge any collected sediment from trench or case bore into stable (flat) vegetated areas or sediment trap. Dispose of according to ESCP and AB transportation BMP # 31 Outfall channel: - Heavy equipment should not be permitted within 8 meters of the high water mark. Long reach or lighter equipment should be used to reduce impacts and decrease risk of soil disturbance / mobilization of sediments in close proximity to SSR. - Long term measures should include live staking and bioengineering aspects to increase slope, stream bank and channel stability. AB transportation BMPs #27a, 27b, and 45 apply. - Outfall channel must be protected from anticipated storm drainage flow velocities and volumes using bank armouring or rip-wrap of suitable size and installed as per AB transportation BMP # 13. - Turbidity curtains or similar measures should be installed if there is instream work and sediment release has been authorized. AB transportation Fish Habitat Manual Instream Sediment Control factsheets M4 and M3 should be used as guidance. - Consultation with a Qualified Aquatic Specialist (QAES) is required for in-stream works.	- No unique or rare landforms noted; some immature balsam poplar with understory of Rose spp. - Riparian corridor will be compromised during construction and will likely impede wildlife movement during the construction period. Fencing of natural area will be required during works, recommend installation of wildlife suitable fencing (< 1.5 meters in height with 6 inches unobstructed bottom or with appropriately spaced breaks to allow for passage during non-active periods (evenings etc.)	- ~ 3 balsam poplar trees flagged at top of outfall; 84 m^2 impacted at outfall and 282 m^2 in remainder of natural area (see inset map) - Salvage and preserve all stripped organic matter and organic layers - Progressively strip soils to maintain horizons. If no distinct layers present then separation not required.	- No grade change anticipated	- Install TPZ fencing around trees 911, 910 & 528; no excavation within TPZ for manhole install - Designated corridors for heavy equipment moving down steep slopes or working near water will be required. - Rig mats required in any area used by equipment operating in/on unhardened infrastructure to protect root zone and minimize compaction. Rig mats will provide additional erosion protection due to cover and by minimizing rutting of soils in the immediate area.	- nstall TPZ fencing & signage on NW and SE edges of corridor. - No open trenching allowed within TPZ. - Trees and shrubs left on site during works to be monitored for decline and assessed prior to and after works are completed for condition and any post-work damage. - Trees in TPZ identified to be damaged or in a state of decline are to be addressed for failure risk by TRAQ, any recommendations must be approved by City of Edmonton (COE) Urban Foresters - Shrubs that are in decline or that become unstable during excavation are to be addressed for failure risk and any recommendations approved by COE Urban Foresters. - Viable shrubs not in immediate work areas but at risk of damage can be identified and marked (flagged) for removal and later transplanting post works. - Shrubs to be monitored over the spring and growing season for decline. Weekly deep watering is recommended or more often during periods of low soil moisture. - Once works are completed, viable shrubs will be transferred back to site and re-established. CoE landscape design and construction standards Section 02920 SEED AND SOD seed mixture (sec 2.1) and/or SOD (sec 2.2) provide guidance. - Revegetation will include application of native seed mix, live staking and topsoiling as per AB transportation BMP # 27a and 25 respectively. - Willdlife friendly fencing to prevent public damage and promote establishment is recommended until a minimum of 80 % cover is established on the site.	- Open immature balsam poplar; beaver activity evident; larger diameter willow on north west side of outfall - Stand in immediate area is a mix of age and condition. Heavy use by public in immediate area has resulted in high levels of compaction and disturbance/loss of organic matter. - Trees that are cut should be salvaged for future reclamation purposes

References / technical factsheet and BMP sources.
City of Edmonton Erosion and Sediment Control Guidelines (2005)
Alberta Transportation erosion and sediment control manual (2011)
City Design and Construction Standards: Vol 5 Landscape Design & Construction Standards (COI-IM-GUIDE-00010)

Drawn By: Andre Savaria

ISA Certified Arborist: PR-4880A
RPF #: 317

GENERAL NOTES: i. CITY WILL REMOVE TREES & SHRUBS IN TREE REMOVAL AREAS AS INCIDATED IN DRAWINGS
ii. EROSION CONTROL MEASURES MUST BE IN PLACE AS NOTED BELOW
iii. ALL CITY TREES ARE PROTECTED BY CORPORATE TREE MANAGEMENT POLICY C456

uPLVI Stand No	NA ID #	Disturbance Type/ Installation Method / Impact to Area	Drainage Impacts/ Proximity to water	Erosion & Sedimentation Control Measures	Environmental sensitivity & connectivity	Proposed tree removal/tree - vegetation m^2 loss	Propose Grade Changes	Soil Compaction / Root Damage Mitigation	Proposed Tree Care Treatments	Stand /Tree Spp. Condition
										
6834	21	New Electrical ; New electrical equipment	no drainage impacts; 37 meters to North Saskatchewan River	If directionally drilling, ensure that setup is outside of natural area boundary. Ensure soil disturbance is minimized. If soils are disturbed ensure they are properly stabilized as per ESCP and TPP Appendix 6 and Appendix 7.	No unique or rare landforms noted.	Total area for NA ID 21 = 80.8 m2 Some overhanging willow branches; otherwise grassed over pathway.	No grade change anticipated.	Directional drill new electrical.	Protect willow on north and south sides of corridor.	Mature willow with low shrubs beneath canopy.
										
6370	5	New Electrical ; New electrical equipment;	no drainage impacts; approx. 110 meters to North Saskatchewan	Ensure soil disturbance is minimized. If soils are disturbed ensure they are properly stabilized as per ESCP and TPP Appendix 6 and Appendix 7. Straw Logs, Silt fence, or a form of erosion control that fits the area will be installed on perimeter of work area/NA Boundary ifs drainage is sloped back into Natural Area.	No unique or rare landforms noted.	Total area for NA ID = 70.8 m2	- No grade change anticipated	Hydrovac to uncover roots, if large roots present Forestry to review. If roots are less than 2.5cm cut clean at work boundary. Alternative subgrade prep and material to be used to limit compaction including geocloth and a reduced base thickness base for SUP installation.	Air spade or hydrovac roots at time of construction; prune roots > 2.5 cms.	Mature 13 meter tall balsam poplar with shorter aspen
6370	19	Cut Fill, New_SUP	no drainage impacts; ~ 131 meters to North Saskatchewan River	no erosion control measures required if SUP is moved to the north to avoid impact to natural area	No unique or rare landforms noted.	Total area for NA ID = 28 m2	- No grade change anticipated	Hydrovac to uncover roots, if large roots present Forestry to review. If roots are less than 2.5cm cut clean at work boundary. Alternative subgrade prep and material to be used to limit compaction including geocloth and a reduced base thickness base for SUP installation.	Follow Forestry recommendations after site review. Monitor soil moisture and weather conditions. Cover exposed roots to prevent moisture loss. Water roots as required.	Mature 13 meter tall balsam poplar with shorter aspen
6370	20	New Electrical, New_CBAS_Manhole	no drainage impacts; ~ 127 meters to North Saskatchewan River	no erosion control measures required if CBAS/ Manhole is moved southeast outside of natural area	No unique or rare landforms noted.	Total area for NA ID = 20 m2	- No grade change anticipated	Hydrovac to uncover roots, if large roots present Forestry to review. If roots are less than 2.5cm cut clean at work boundary. Alternative subgrade prep and material to be used to limit compaction including geocloth and a reduced base thickness base for SUP installation.	Follow Forestry recommendations after site review. Monitor soil moisture and weather conditions. Cover exposed roots to prevent moisture loss. Water roots as required.	Mature 13 meter tall balsam poplar with shorter aspen
6503	6, 22	New Electrical , CUT Fill, New_Electrical, New SUP	no drainage concerns	Straw Logs, Silt fence, or a form of erosion control that fits the area will be installed on perimeter of work area/NA Boundary ifs drainage is sloped back into Natural Area	No unique or rare landforms noted.	Total area for NA ID 6 & 22 = 104 m2	- No grade change anticipated	Hydrovac to uncover roots, if large roots present Forestry to review. If roots are less than 2.5cm cut clean at work boundary. Alternative subgrade prep and material to be used to limit compaction including geocloth and a reduced base thickness base for SUP installation.	Follow Forestry recommendations after site review. Monitor soil moisture and weather conditions. Cover exposed roots to prevent moisture loss. Water roots as required.	Mature 20 meter tall balsam poplar white spruce mix
										
6608	8,9,10,11, 12,25	CUT_Fill, New_Electrical, New Electrical Equipment, New SUP	general slope is south to the ring road	Straw Logs, Silt fence, or a form of erosion control that fits the area will be installed on perimeter of work area/NA Boundary ifs drainage is sloped back into Natural Area	No unique or rare landforms noted.	Total area for NA ID's 8,9,10,11, 12 & 25 = 505 m2	- No grade change anticipated	Hydrovac to uncover roots, if large roots present Forestry to review. If roots are less than 2.5cm cut clean at work boundary. Alternative subgrade prep and material to be used to limit compaction including geocloth and a reduced base thickness base for SUP installation.	Follow Forestry recommendations after site review.	Mature 16 meter tall balsam poplar aspen mix.

City of Edmonton Erosion and Sediment Control Guidelines (2005)
Alberta Transportation erosion and sediment control manual (2011)
City Design and Construction Standards: Vol 5 Landscape Design & Construction Standards (COI-IM-GUIDE-00010)

Appendix 9. Tree Protection Designs

Appendix 9. Tree Protection Designs

Updated: April 17, 2023

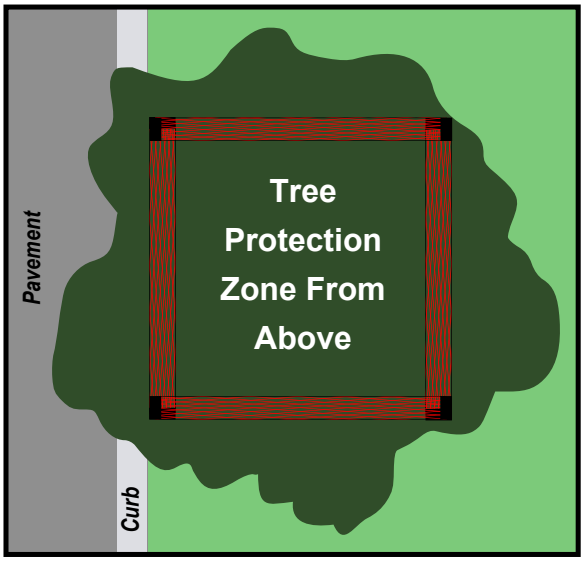
GUIDANCE NOTES:

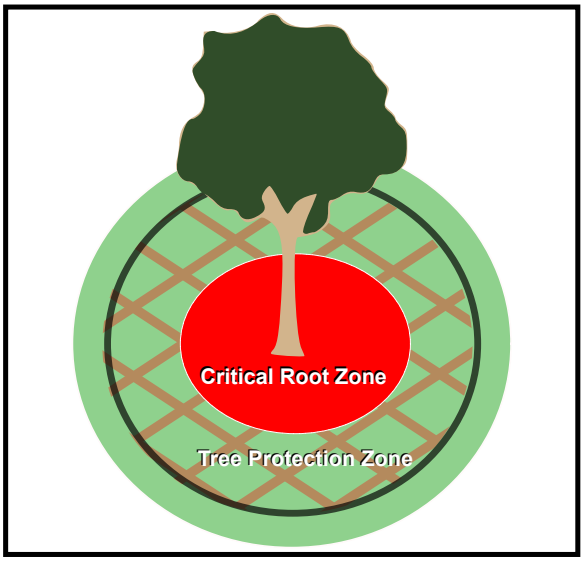
1. All work close to open space and natural area trees or within the Tree Protection Zone specified by the project arborist shall be reviewed and approved in writing by the project arborist as well as City of Edmonton Urban Forestry prior to commencement of said work.
2. All design changes affecting the tree considerations to be reviewed with project arborist before any changes take place in the field. If conflicts arise, please contact City of Edmonton Urban Forestry.
3. Any design change decisions made in the field or office shall be recorded in writing as sequentially numbered field reports issued by the project arborist and shall be seen as a matter of record unless amended in writing by City of Edmonton Urban Forestry.
4. Contractor shall ensure that project arborist is provided with a minimum of three business days notice for tree protection field work activity identified in the Tree Preservation Plan and additional areas where unplanned activities approach existing open space and natural areas trees.
5. Project arborist shall be on site to supervise all work within the TPZ of trees unless agreed otherwise in writing with CHANDOS Construction.
6. Any and all tree work including removals, pruning, stump grinding as well as possible cabling/ bracing will be coordinated by Urban Forestry at the cost of the project as per the Corporate Tree Management Policy C456C.
7. Contractor shall ensure that all arborist reports and arborist plans are readily available to site supervisors and site workers at all times.
8. Project arborist shall maintain a complete record of all site work, field reports, and any issues of concern and shall ensure that all records of activity, design changes, approvals are distributed to the project team in a timely manner.

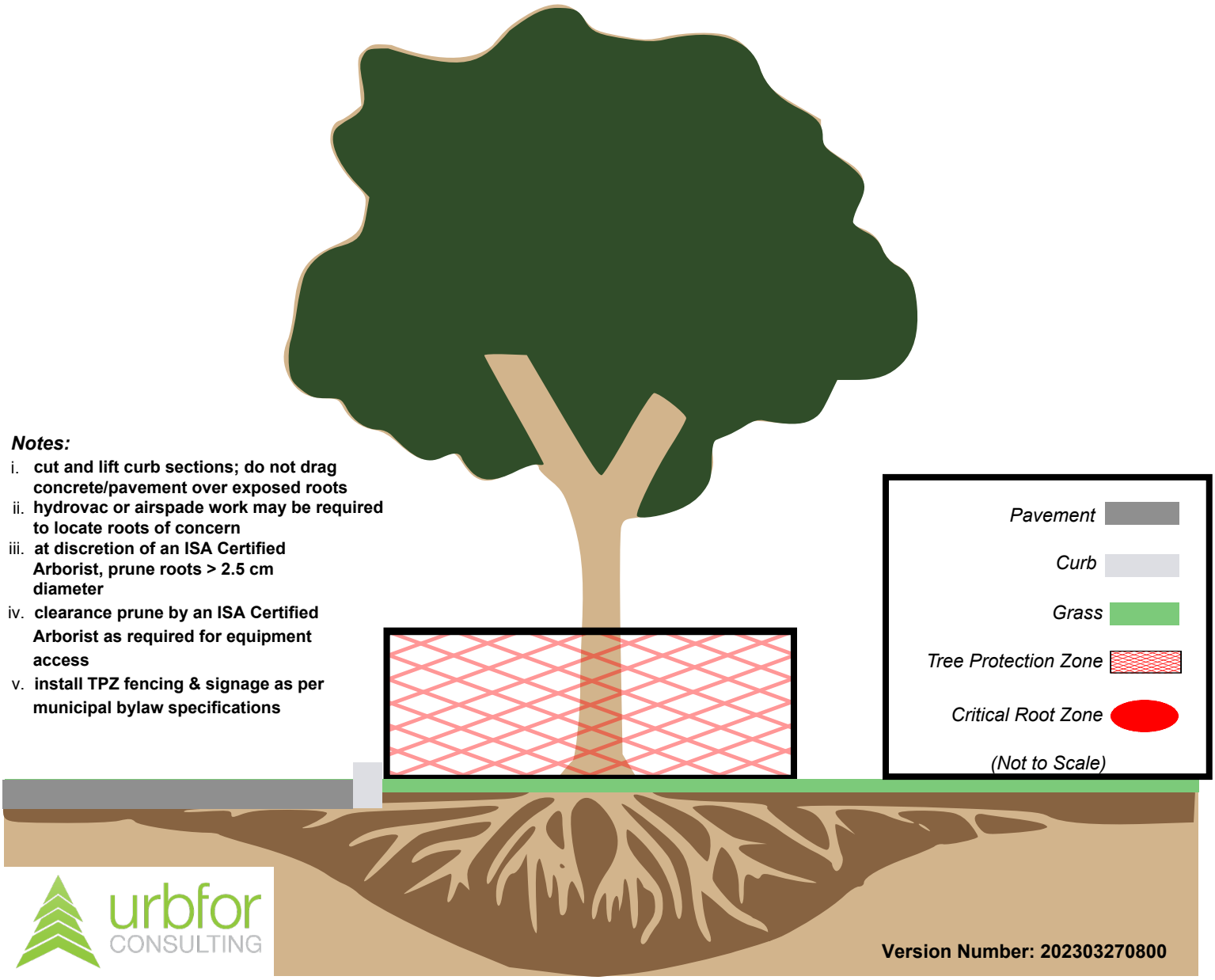
#	Title	Version (year/mm/dd)
T1	Pavement and Curb Replacement – One Side	20230327
T2	Pavement and Curb Replacement – Two Sides	20230327
T3	Shared Use Path (SUP) - Gravel	20230327
T4	Directional Drill/ Case Boring	20230327
T5	Open Cut	20230327
T6	Trench Box	20230327
T7	Air and Hand Tools (Path construction/Utility Installation	20230327
T8A	Light Standard - Existing	20230327
T8B	Light Standard – New Install	20230327
T9A	Catch Basin/Manhole – Abandon in Place or Remove	20230327
T10	Grading	20230327

T1. Pavement & Curb Replacement - One Side

Tree Protection Diagram







Notes:

i. **cut and lift curb sections; do not drag concrete/pavement over exposed roots**
ii. **hydrovac or airspade work may be required to locate roots of concern**
iii. **at discretion of an ISA Certified Arborist, prune roots > 2.5 cm diameter**
iv. **clearance prune by an ISA Certified Arborist as required for equipment access**
v. **install TPZ fencing & signage as per municipal bylaw specifications**

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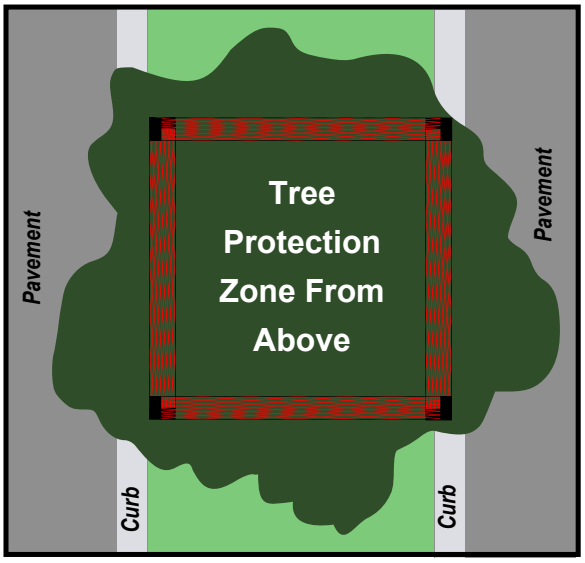
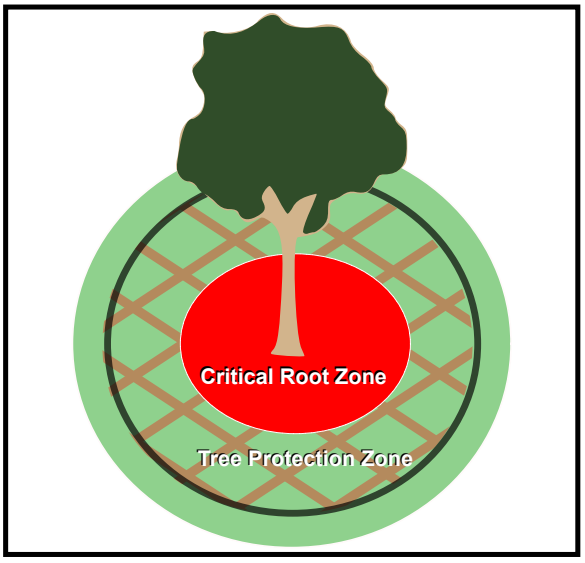
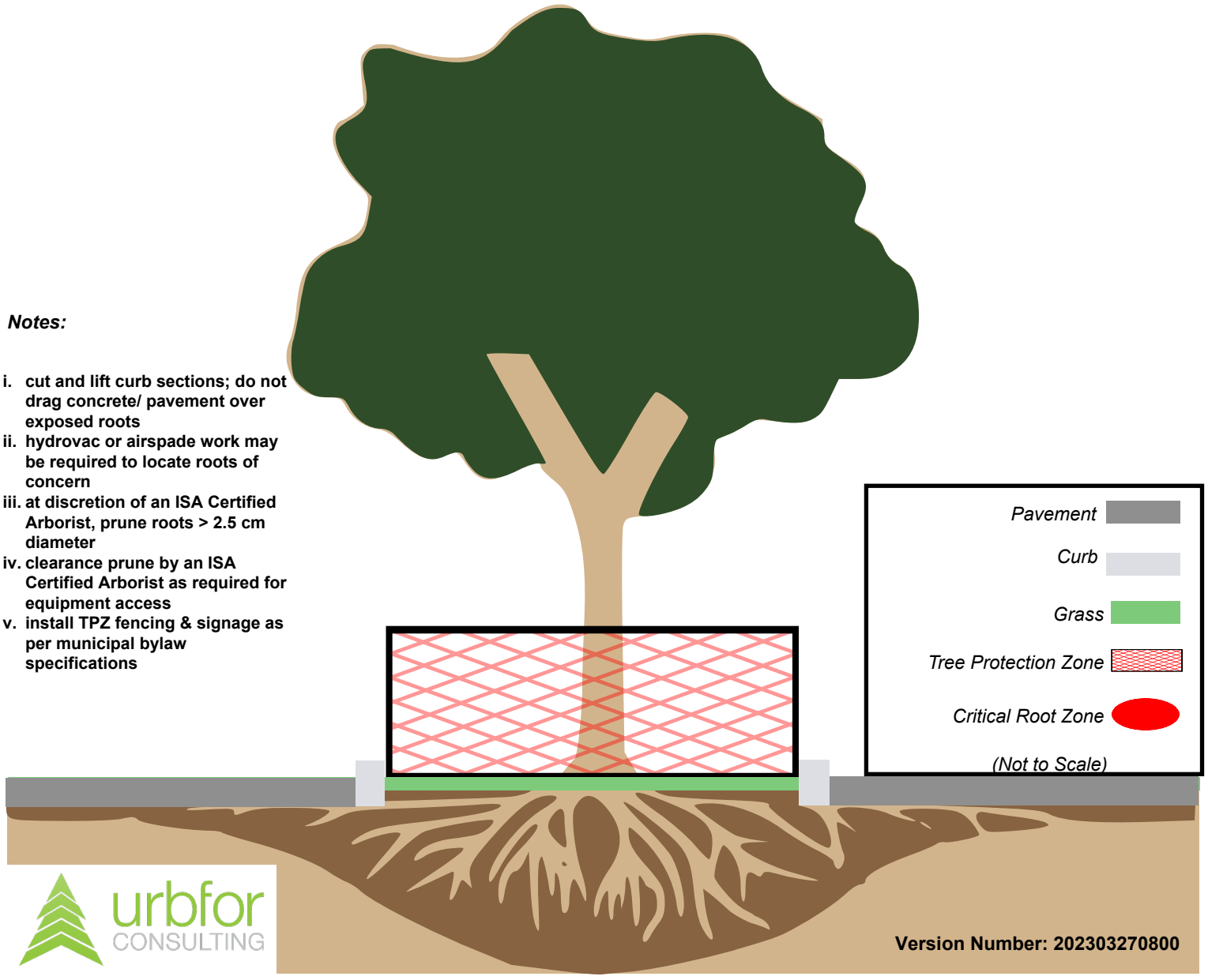
Version Number: 202303270800

T2. Pavement & Curb Replacement - Two Sides

Tree Protection Diagram







Notes:

i. cut and lift curb sections; do not drag concrete/ pavement over exposed roots
ii. hydrovac or airspade work may be required to locate roots of concern
iii. at discretion of an ISA Certified Arborist, prune roots > 2.5 cm diameter
iv. clearance prune by an ISA Certified Arborist as required for equipment access
v. install TPZ fencing & signage as per municipal bylaw specifications

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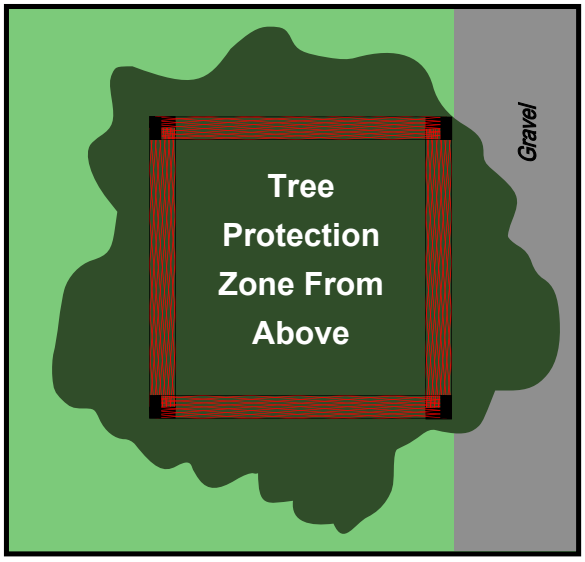
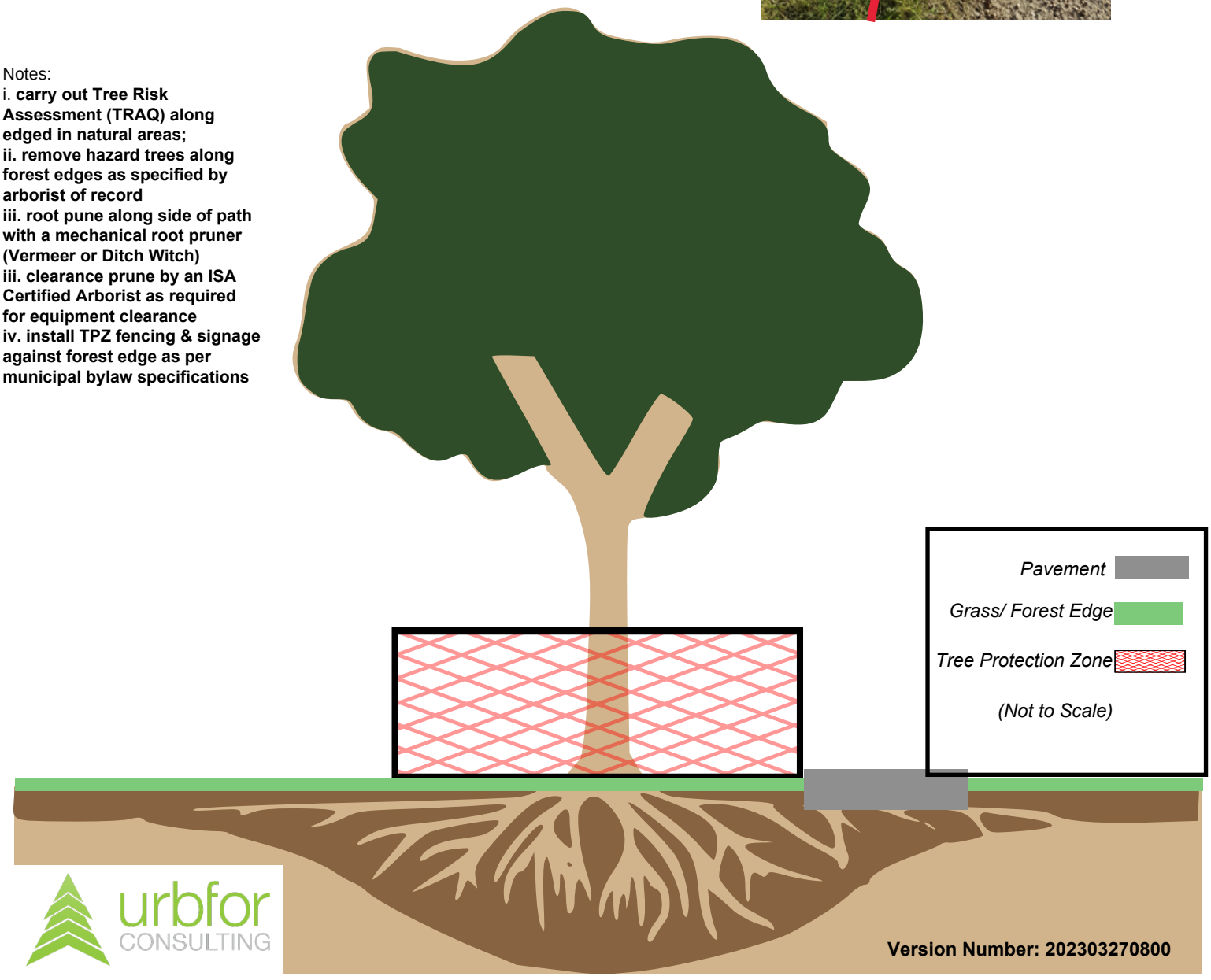
T3a. Shared Use Path(SUP) - Gravel

Tree Protection Diagram



Notes:
i. **carry out Tree Risk Assessment (TRAQ) along edged in natural areas;**
ii. remove hazard trees along forest edges as specified by arborist of record
iii. root pune along side of path with a mechanical root pruner (Vermeer or Ditch Witch)
iii. clearance prune by an ISA Certified Arborist as required for equipment clearance
iv. install TPZ fencing & signage against forest edge as per municipal bylaw specifications



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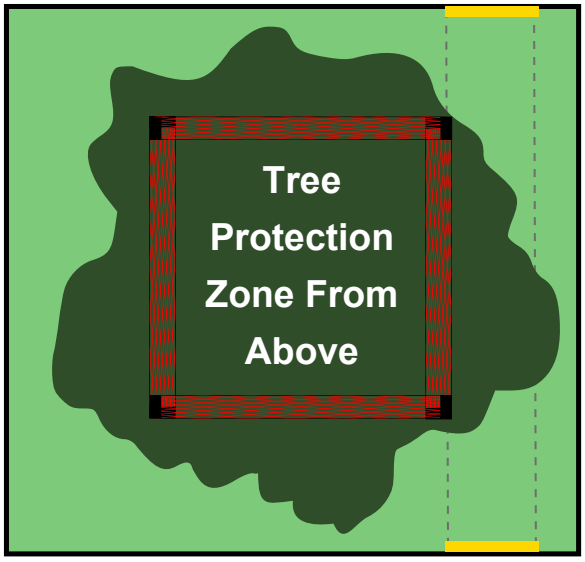
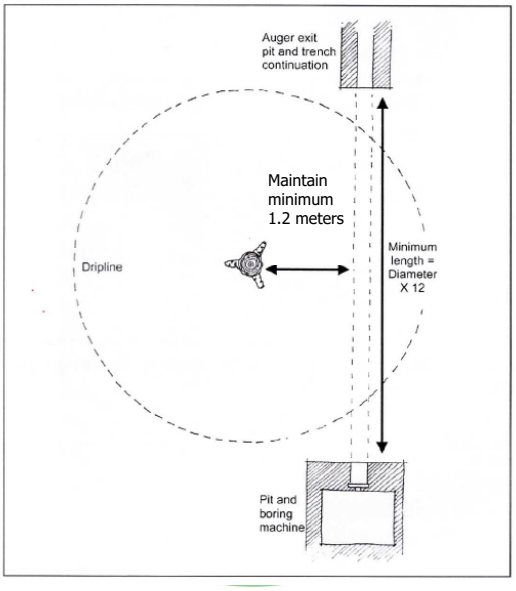
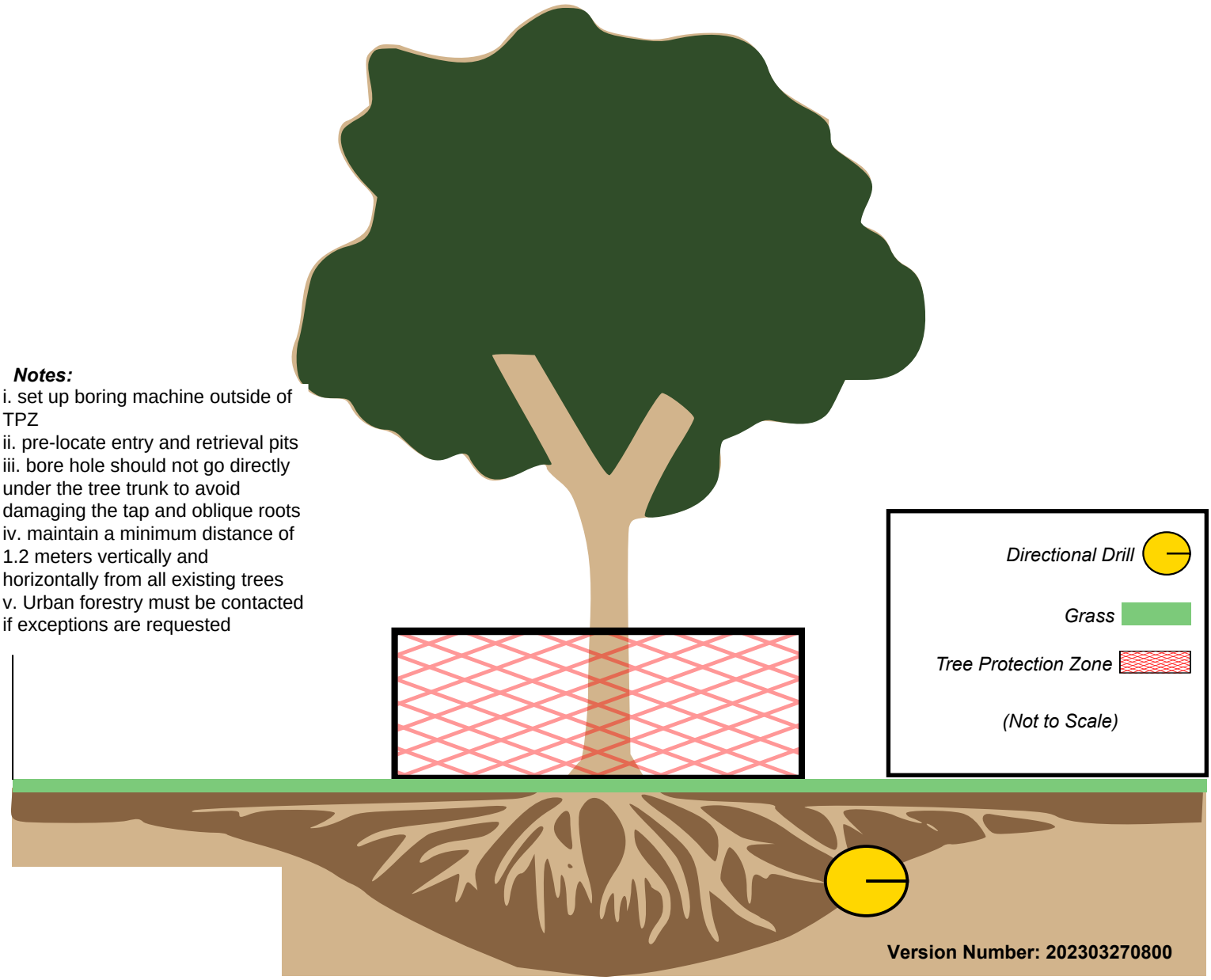
Version Number: 202303270800

T4. Directional Drill/ Case Boring

Tree Protection Diagram







Notes:

i. set up boring machine outside of TPZ

ii. pre-locate entry and retrieval pits

iii. bore hole should not go directly under the tree trunk to avoid damaging the tap and oblique roots

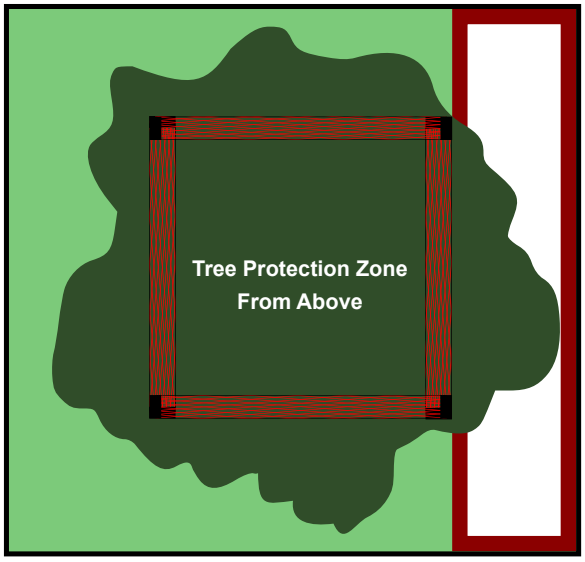
iv. maintain a minimum distance of 1.2 meters vertically and horizontally from all existing trees

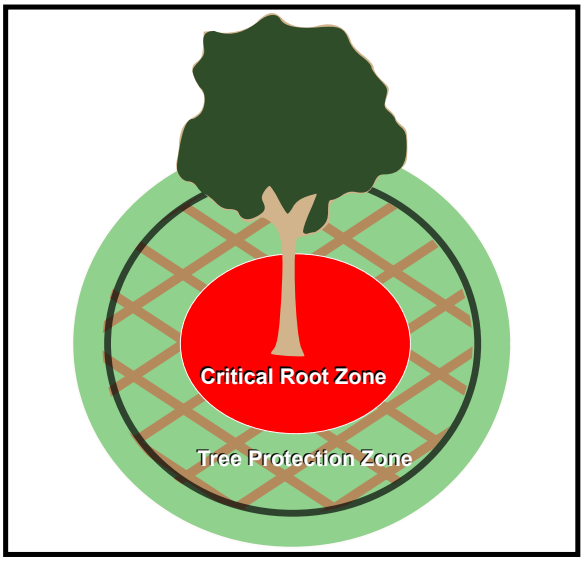
v. Urban forestry must be contacted if exceptions are requested

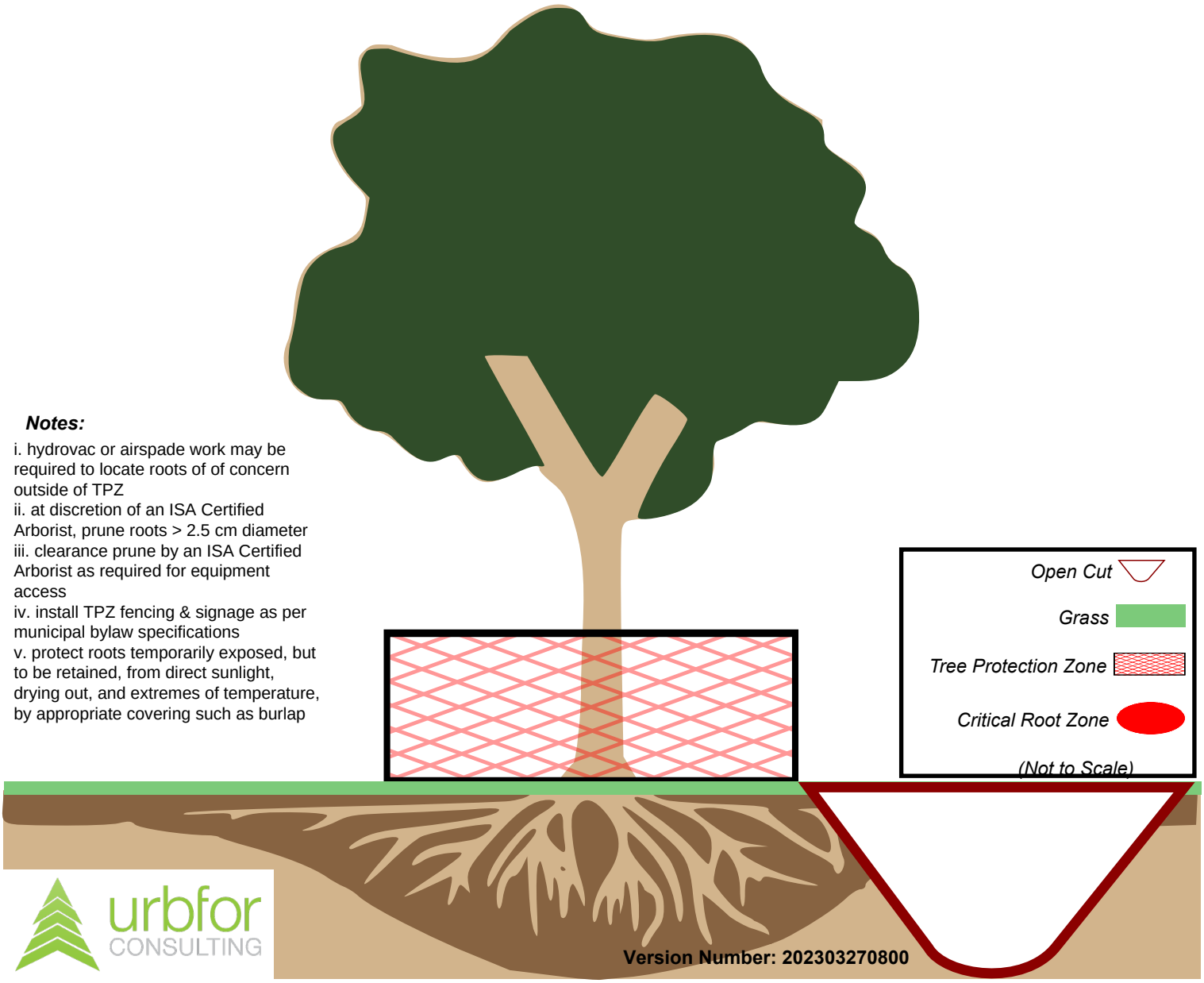
Version Number: 202303270800

T5. Open Cut

Tree Protection Diagram







Notes:

i. hydrovac or airspade work may be required to locate roots of of concern outside of TPZ
ii. at discretion of an ISA Certified Arborist, prune roots > 2.5 cm diameter
iii. clearance prune by an ISA Certified Arborist as required for equipment access
iv. install TPZ fencing & signage as per municipal bylaw specifications
v. protect roots temporarily exposed, but to be retained, from direct sunlight, drying out, and extremes of temperature, by appropriate covering such as burlap

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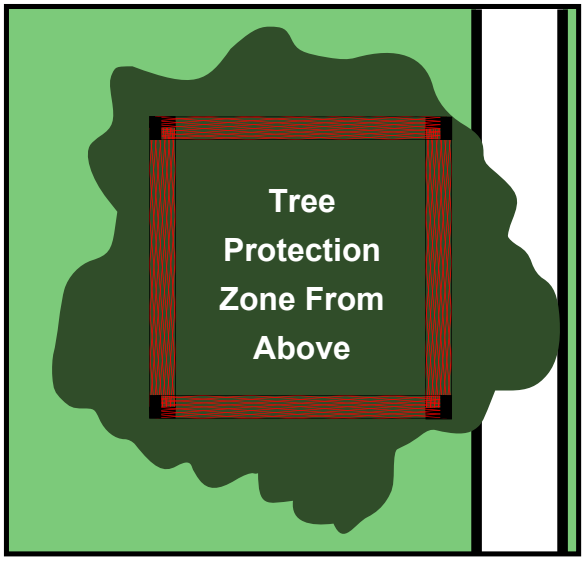
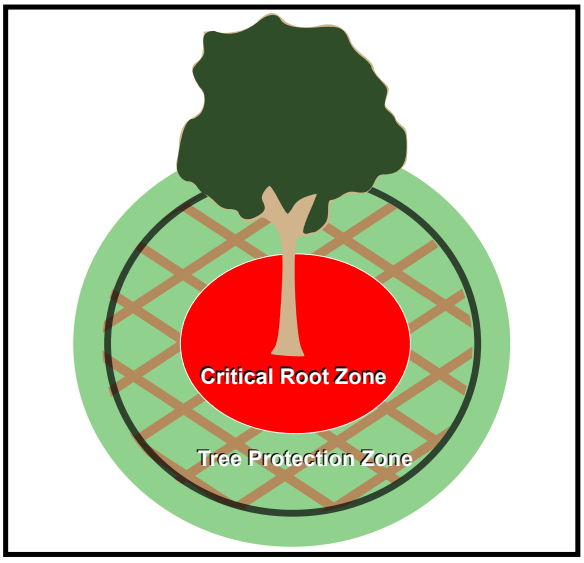
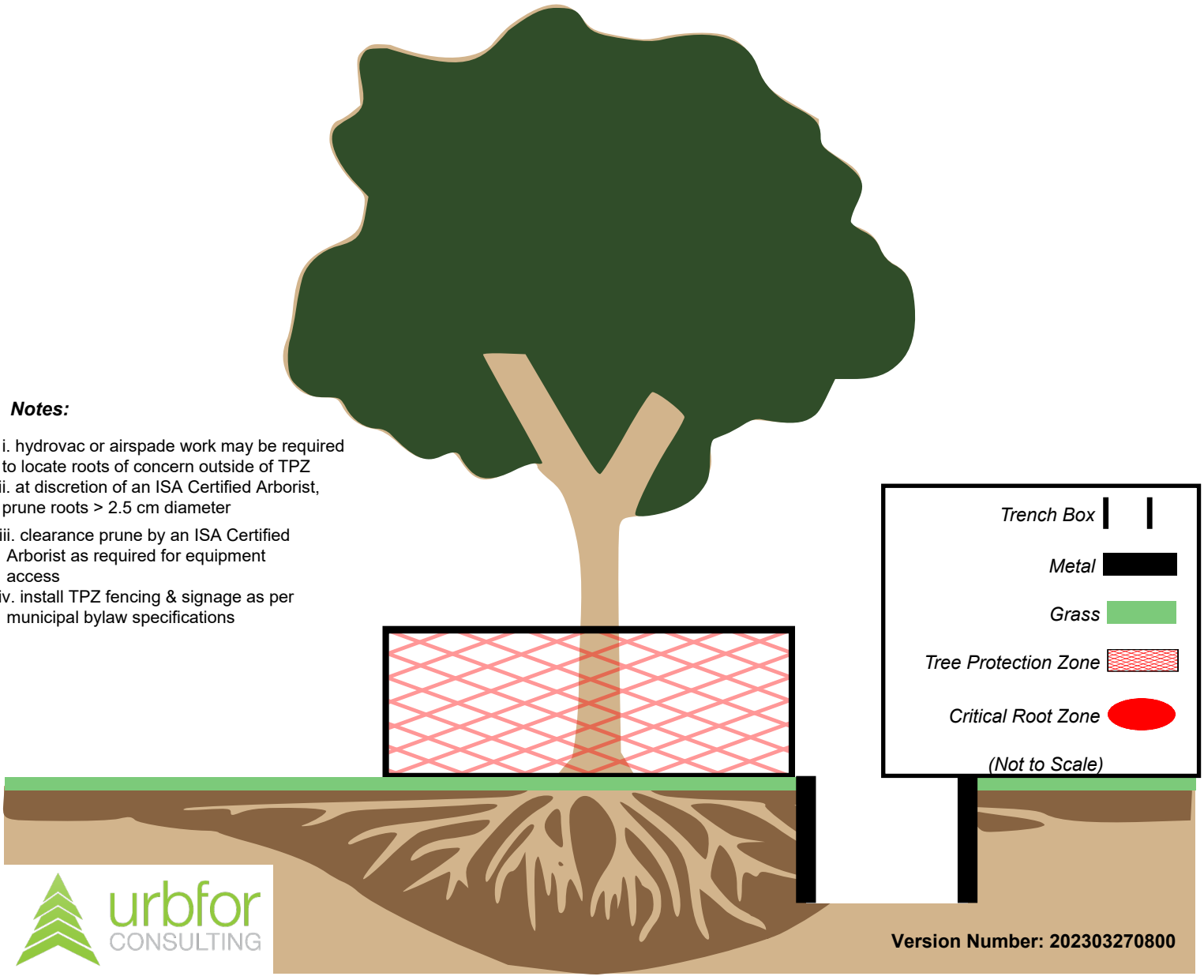
T6. Trench Box

Tree Protection Diagram







Notes:

i. hydrovac or airspade work may be required to locate roots of concern outside of TPZ
ii. at discretion of an ISA Certified Arborist, prune roots > 2.5 cm diameter
iii. clearance prune by an ISA Certified Arborist as required for equipment access
iv. install TPZ fencing & signage as per municipal bylaw specifications

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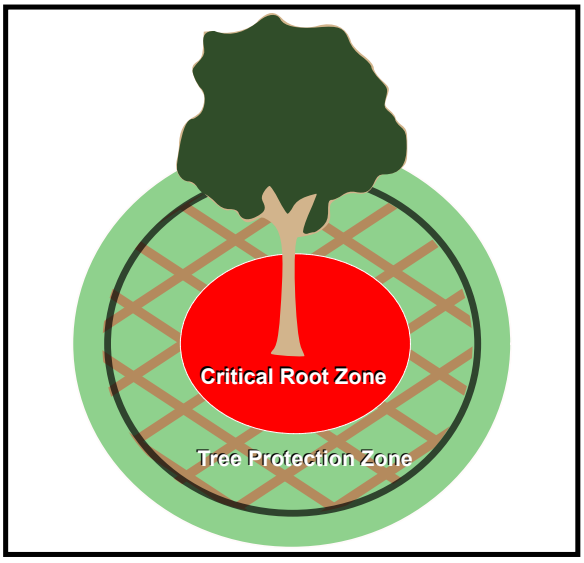
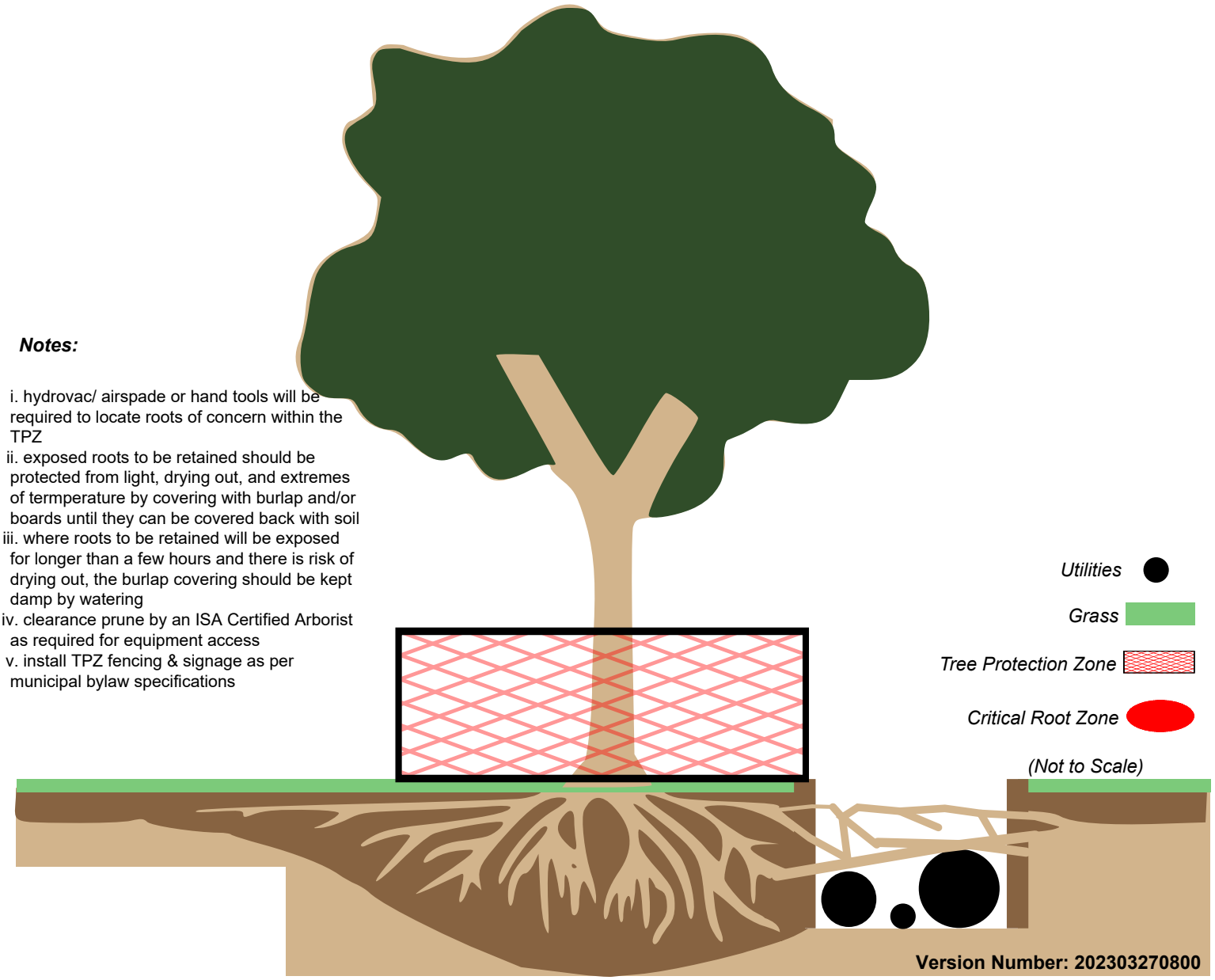
Version Number: 202303270800

T7. Air and Hand Tools
(Path Construction or Utility Installation)

Tree Protection Diagram





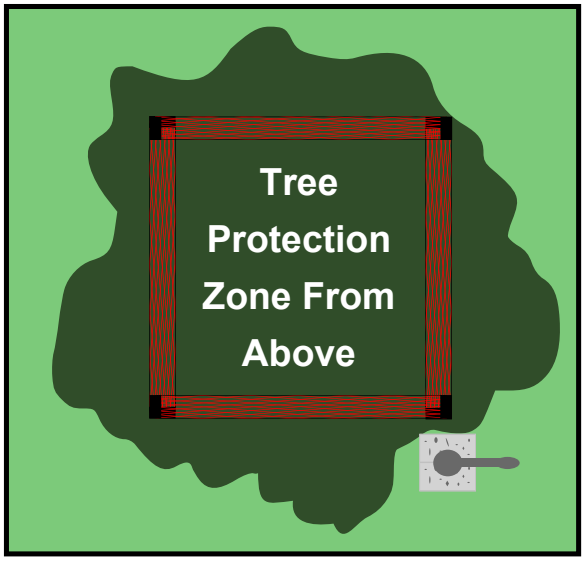
Notes:

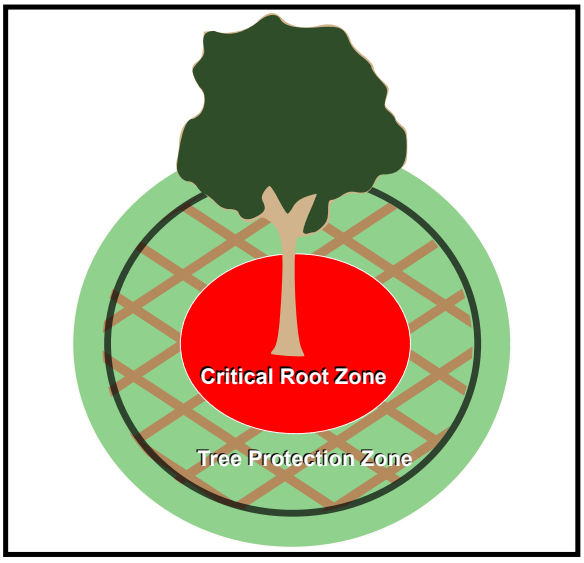
i. hydrovac/ airspade or hand tools will be required to locate roots of concern within the TPZ
ii. exposed roots to be retained should be protected from light, drying out, and extremes of termperature by covering with burlap and/or boards until they can be covered back with soil
iii. where roots to be retained will be exposed for longer than a few hours and there is risk of drying out, the burlap covering should be kept damp by watering
iv. clearance prune by an ISA Certified Arborist as required for equipment access
v. install TPZ fencing & signage as per municipal bylaw specifications

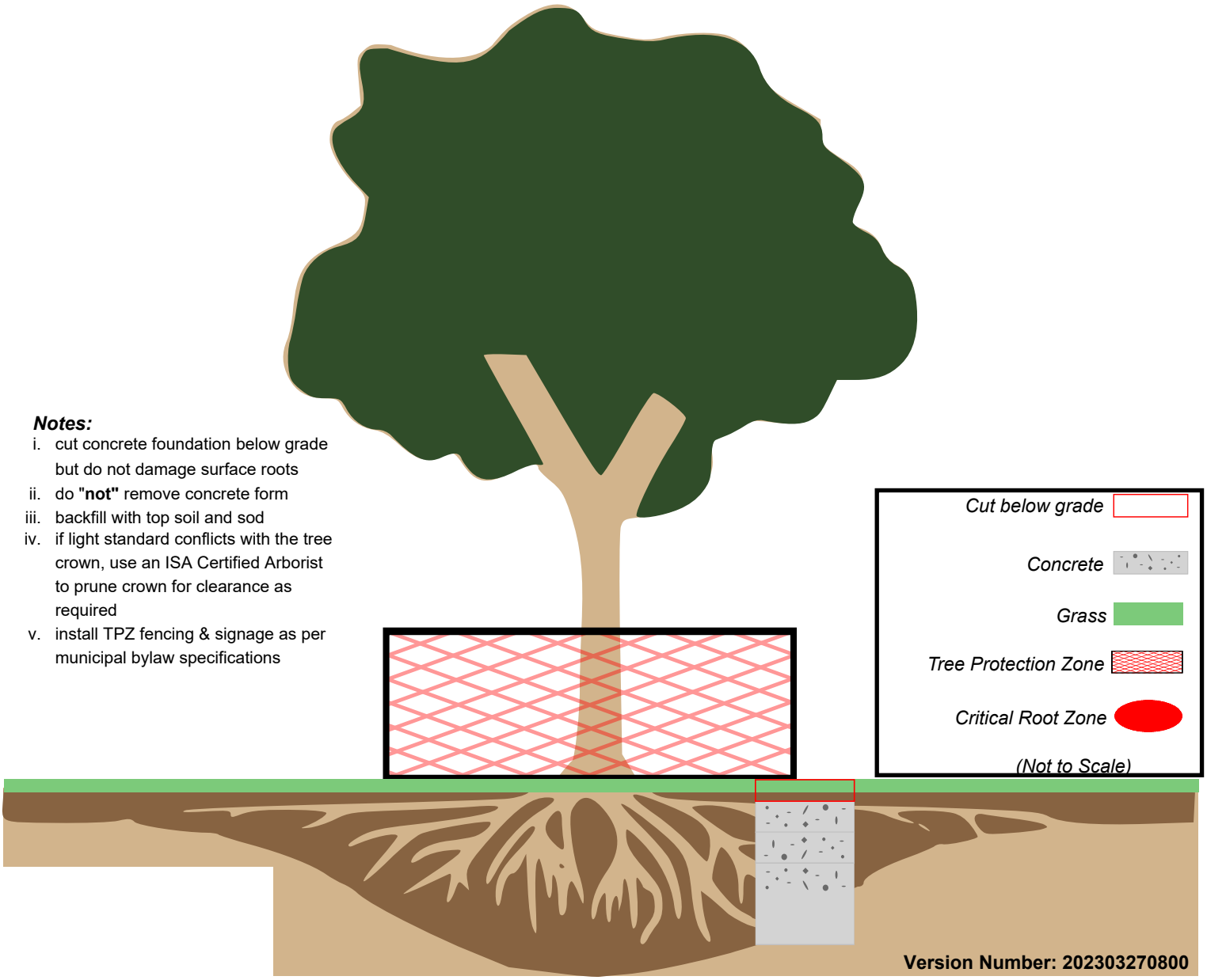
Version Number: 202303270800

T8a. Light Standard - Existing

Tree Protection Diagram







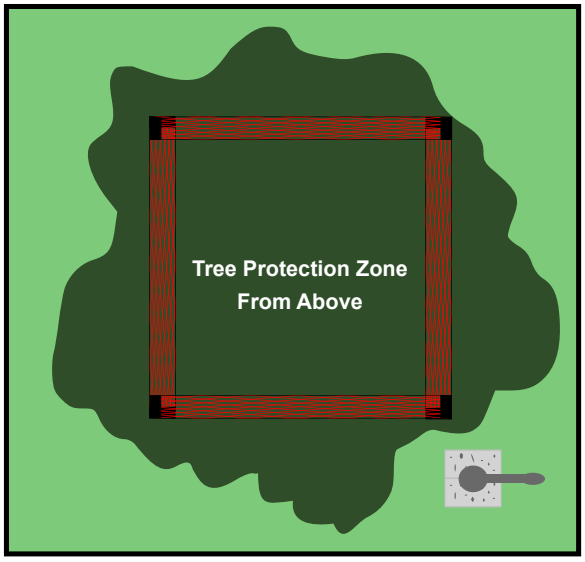
Notes:

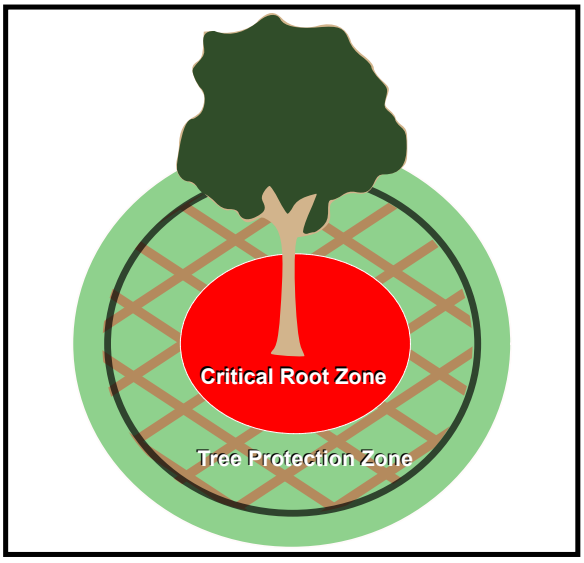
i. cut concrete foundation below grade but do not damage surface roots
ii. do "**not**" remove concrete form
iii. backfill with top soil and sod
iv. if light standard conflicts with the tree crown, use an ISA Certified Arborist to prune crown for clearance as required
v. install TPZ fencing & signage as per municipal bylaw specifications

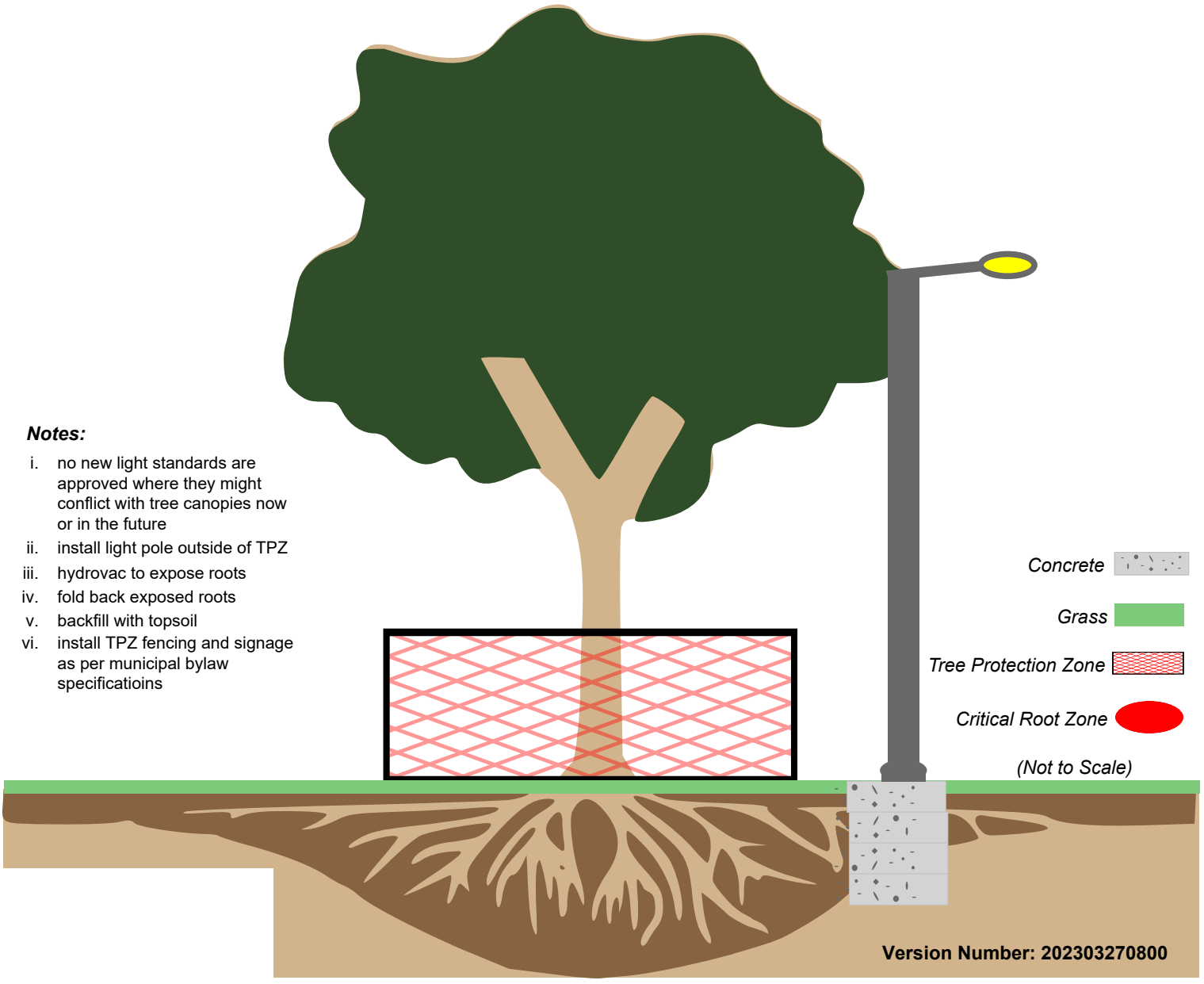
Version Number: 202303270800

T8b. Light Standard - New Install

Tree Protection Diagram







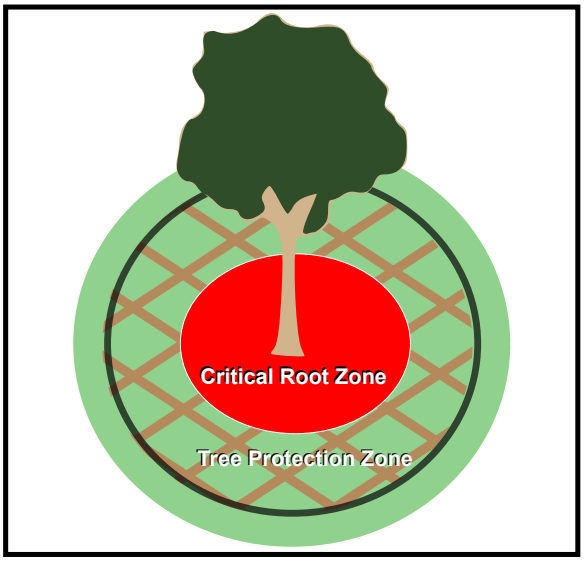
Notes:

i. no new light standards are approved where they might conflict with tree canopies now or in the future
ii. install light pole outside of TPZ
iii. hydrovac to expose roots
iv. fold back exposed roots
v. backfill with topsoil
vi. install TPZ fencing and signage as per municipal bylaw specificatioins

Version Number: 202303270800

T9a. Catch basin/manhole - Abandon in Place or Remove

Tree Protection Diagram



Notes:

i. carefully hydrovac around catch basin/man hole to locate roots of concern

ii. remove top 30 cm of the MH barrel; plug off the pipes & infill the barrel with fillcrete

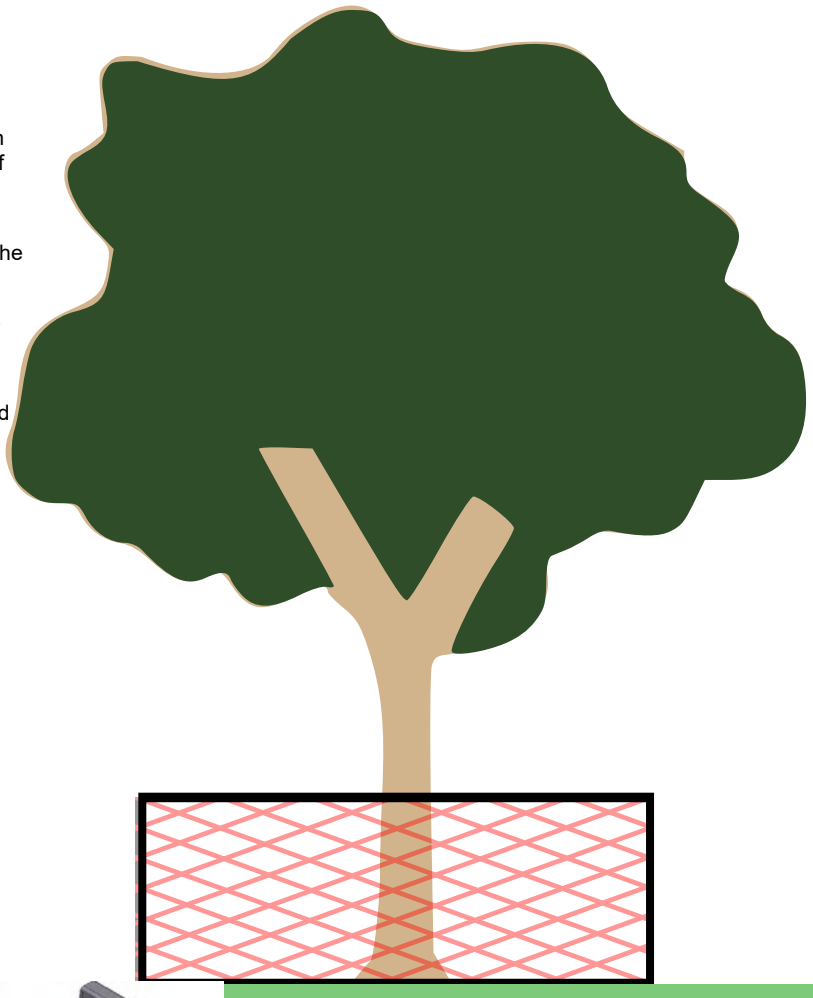
iii. place gravel on top of fillcrete & pour curb or pave

iv. if manhole is in grassed area, cover the fillcrete with topsoil and seed or place turf

v. concrete catch basin /manhole can be broken up inward and pieces be removed by hand or hydrovac and lift out

vi. backfill with topsoil
backfill with topsoil and level off

vii. install TPZ fencing and signage as per municipal bylaw specifications



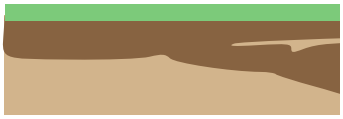
Concrete

Grass

Tree Protection Zone

Critical Root Zone

(Not to Scale)



Version Number: 202303270800

T10 . Grading

Notes:

i. avoid cuts and fills within the TPZ if possible

ii. follow specifications as per bar graph below

iii. use top soil high in organic matter for fills; this allows for water infiltration and gas exchange

iv. do not use clay soils for fill

v. older trees do not adapt to environmental changes as do younger trees;
consider grading impacts and protecting a 2 - 20 cm diameter tree than a larger mature tree

vi. preserve at least 70% of the root system to maintain a healthy tree

vii. If required, prune all roots > 2.5 cms

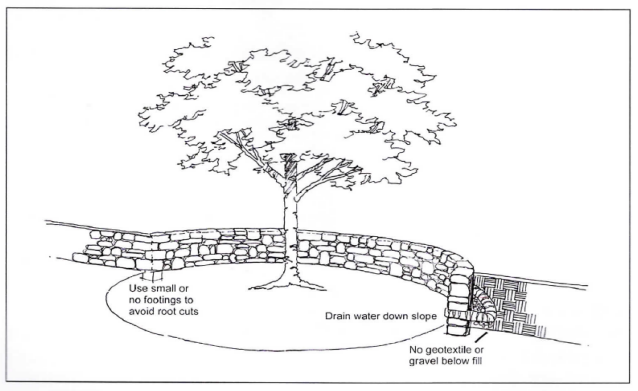
viii. avoid all soil compaction

ix. minor fills with topsoil less than 8 cm (3 inches) will not harm most trees

x. major changes in grading require an air supply to the roots - see Figure 1 Tree Well

xi. if a soil cut is required, terrace the grade or build a retaining wall;
walls should encompass an area extending at least to the dripline - see Figure 2

xii. when grade is lowered around the entire tree, consider building a tree island
see Figure 3



[2] **Figure 1. Tree well constructed to minimize soil fill over tree root systems**

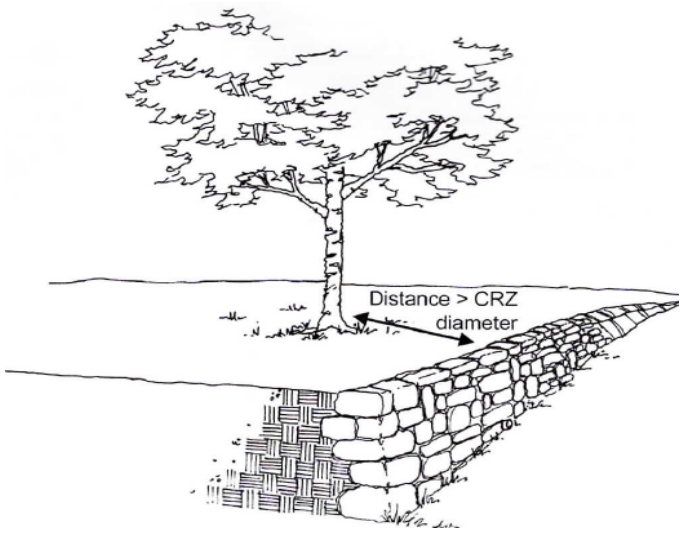
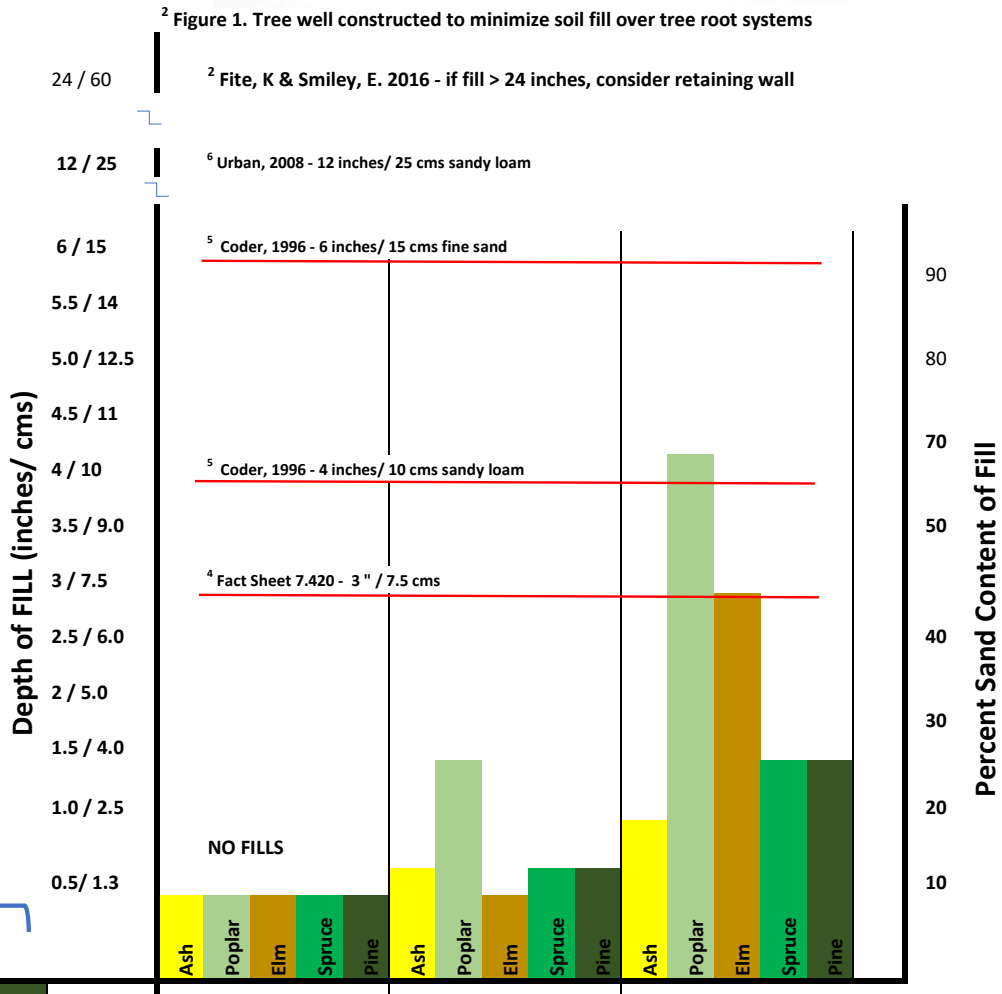
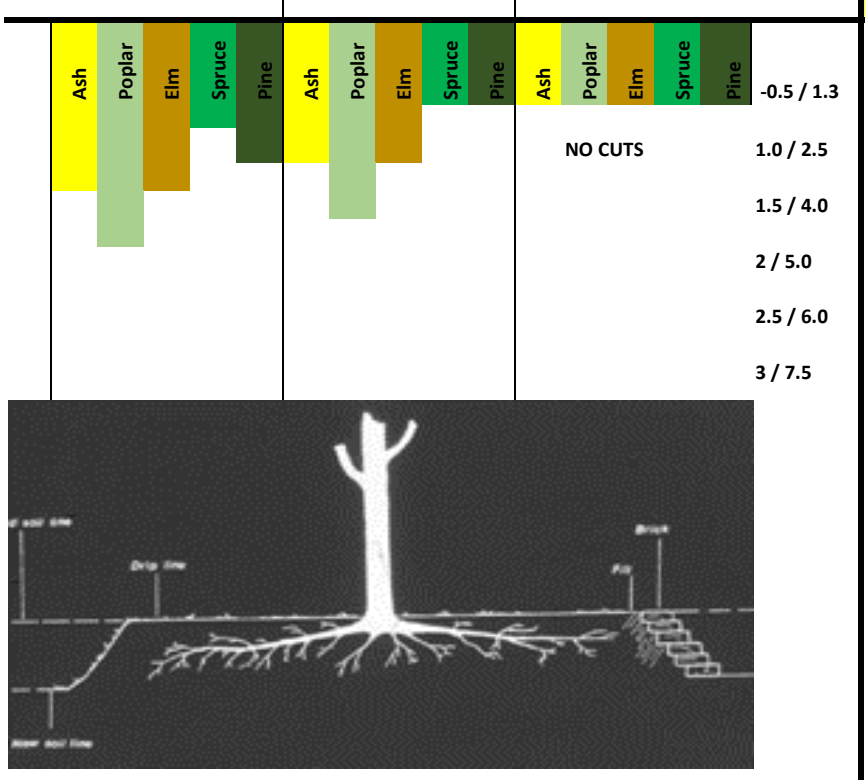


Figure 2. Grade elevation or reduction may be obtained by using retaining walls to minimize cutting and filling [2]





Lowering grade near trees [3]

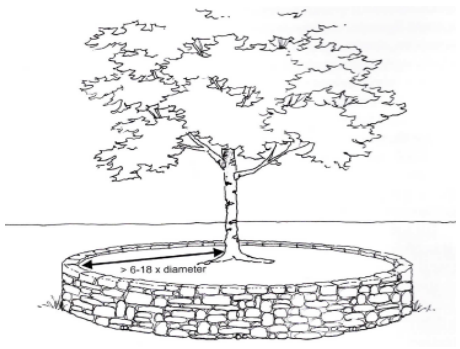


Figure 3. Consider building a tree island when grade is lowered around entire tree [2]

Depth of CUT (inches/ cms)

VIGOR

LOW MEDIUM HIGH

CONSIDERATIONS:			
Species	% Comp	Tolerance To Development [2]	Rooting Depth (m)[7]
Spruce	55%	Medium	< 1.0 m
Pine	27%	Medium	1.5 m
Poplar	56%	Good	< 2.5 m
Elm	14%	Medium	.09 - 3 m
Ash	4%	Medium	< 2.0 m
Tolerance to Development Impacts			
Rooting Patterns/ Depth			
Fill type / soil texture			
Tree vigor			
Depth of Fill			

[1] https://aggie-horticulture.tamu.edu/earthkind/landscape/protecting-trees/

[2] Managing During Construction.2016. Best Management Practices. ISA

[3] https://www.bartlett.com/resources/preventing-damage-to-trees-from-grade-changes.pdf

[4] https://extension.colostate.edu/topic-areas/yard-garden/protecting-trees-during-construction-7-420/

[5] https://urbanforestrysouth.org/resources/library/citations/construction-damage-assessments-trees-and-sites

[6] Urban, J. 2008. Up by Roots. P. 195

[7] https://www.rbkc.gov.uk/pdf/Document%2027%20-%20The%20Influence%20of%20Soils%20and%20Species.pdf

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"tree care is our passion!"

Appendix 10. Asphalt Milling, Curb Removal and Road Grading Procedures

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Asphalt Milling, Curb Removal, and Road Grading Procedures

Asphalt Milling

Before asphalt milling begins clearances will be checked along all curb lines. This includes distance to trees along curb as well as overhanging branches. Any potential intrusion into the tree protection zone (TPZ) will be noted on the pre work walk. Forestry will be notified to inspect on site and determine if pruning is necessary. All milling will be completed between curbs and not encroach past the curb line or below the bottom of asphalt. The only potential interaction with trees is assumed to be overhanging branches.

Curb Removal

The curb removal process will include an on site walk to make note of any roots that may protrude underneath or along the curb line. The locations will be noted and then hydrovac'd to confirm the root path and size. Once the hydrovac is complete Forestry will determine the process of tree/root protection during curb removal. Upon instruction to proceed any mitigation strategies will be implemented before the curb is removed. Curb removal in vicinity of trees will be done by saw cutting the curb at 10m increments and then using an excavator with a thumb on the bucket to grab the curb and lift vertically. This will negate the chance of the curb being dragged over the roots and causing damage. Once the curb is removed and there are roots exposed all mitigation measure shall be applied.

Road Grading

This will involve the removal of the granular underneath the asphalt as well as clay if in a cut situation. Road grading will start with a walk around to mark any spots for further investigation via hydro vac. If roots greater than 2.5cm are found within the work area an onsite visit with Forestry will be needed. Once Forestry decides the direction forward work will continue with mitigation strategies in effect.

Unearthed Roots Procedure

If a root is found while working the below steps will be followed.

1. Stop work immediately and determine the root size.
    a. If the root is smaller than 2.5cm cut the root cleanly at the work perimeter.
2. If the root is larger than 2.5cm continue to unearth the root by hand digging or hydrovacing.
3. Once the extent of the room is daylighted, mark a 2m boundary around the root with traffic barricades or survey stakes and flagging.
4. Notify the Superintendent Randy Dunne ph. 780-920-8520. He will then notify Forestry that an on-site consultation is required.
5. Continue working outside of the 2m boundary.

Appendix 11. CCL Construction Schedule

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Appendix 11. CCL Construction Schedule

Hawrelak 6 Week Lookahead Schedule

START DATE : 10/04/2023
Months : April/May

Task Description	Company	WEEK 1							WEEK 2							WEEK 3							WEEK 4							WEEK 5							WEEK 6						
		10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Site Services	Sureway																																										
Outfall 27 Excavation Back of Headwall to Receiving Pit																																											
Auger Pit Excavation			X	X	X	X																																					
Outfall 27 Case Bore									X	X	X	X	X			X	X	X																										
Storm Install STMH 6 to STMH4																X	X	X	X	X																								
Storm Install and Removal STMH4 to STMH22																		X	X	X			X	X	X																		
Storm Install and Removal STMH4 to STMH17																							X	X	X	X	X			X	X	X	X	X								
Storm Install and Removal STMH 17-21																														X	X	X	X	X			X	X	X	X	X		
Sanitary and Water Install, Lift Station Area																							X	X	X	X	X			X	X	X	X	X								
Topsoil Stripping for Sanitary			X	X	X	X																																					
Sanitary Install to Mayfair									X	X	X	X																															
Sanitary Install SM13 to SMH12				X	X	X																																					
Sanitary Install and Remvoal SMH13 to Maintenance Yard													X			X	X	X	X	x																							
Sanitary South Meadow																							X	X	X	X	X																
Outfall 25 Auger Pit Excavation																		X	X	X			X	X	X	X	X			X	X	X	X	X			X	X	X	X	X		
Paving	O'Hanlon																																										
Asphalt Milling			X	X	X	X			X	X	X	X	X			X	X	X																								
Curb Removal												X	X			X	X	X	X	X			X	X	X	X	X			X	X	X	X	X			X	X	X	X	X		
Hydrovac In Marked Areas			X	X																																						
Site Walks	COE/Forestry/CCL																																										
Tuesday-Tree Review, Pruning For SMH12, Thursday-Review Hyrdovac'd Curbs			X		X																																					
Tree Removal	Forestry		X	X	X	X																																					

Easter Monday	
Milestone	
Site Inspection	

Schedule subject to change as affected by site conditions.

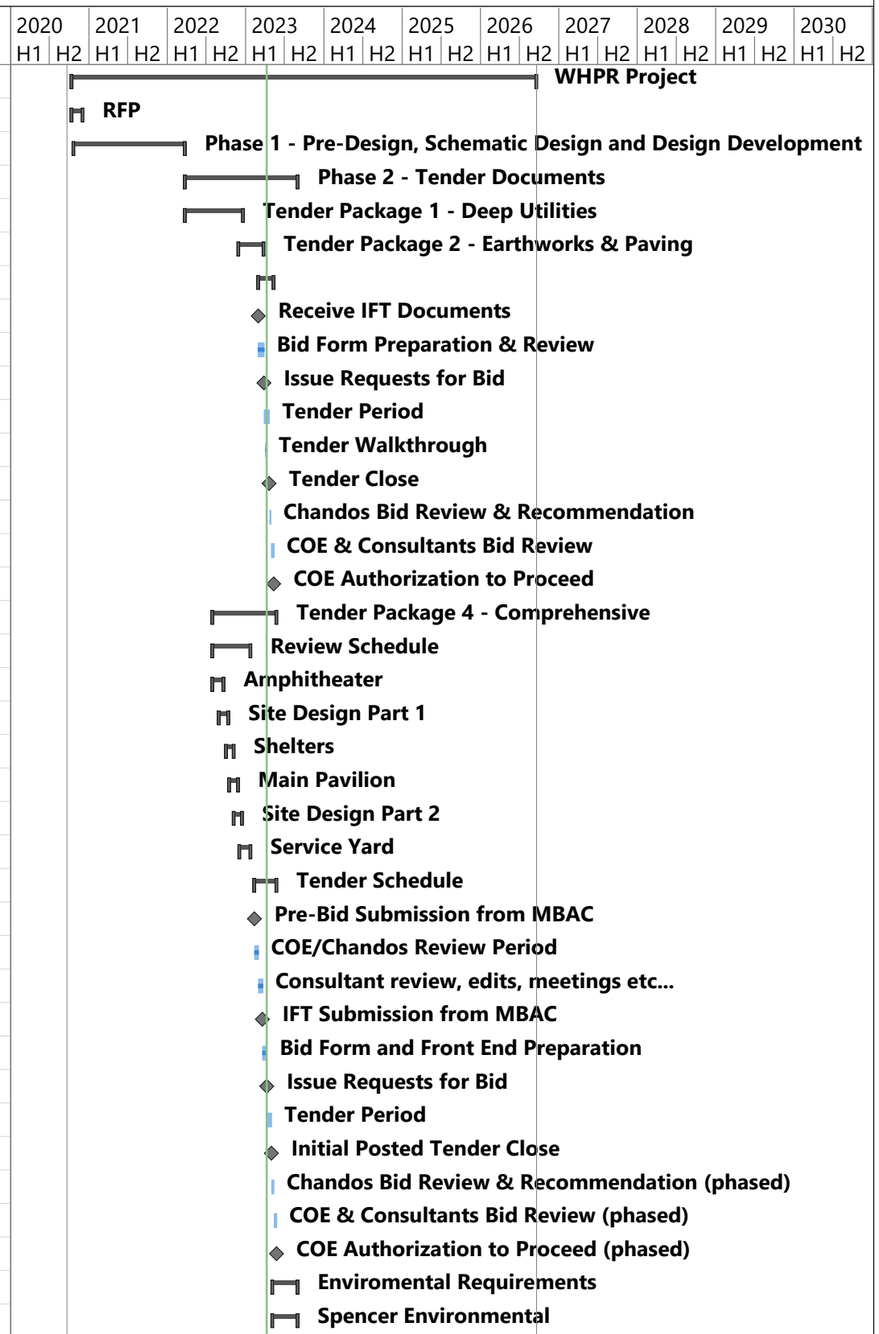
Notes: COE and MBAC are off Easter Monday, Chandos and Sureway will be on site.

CHANDOS

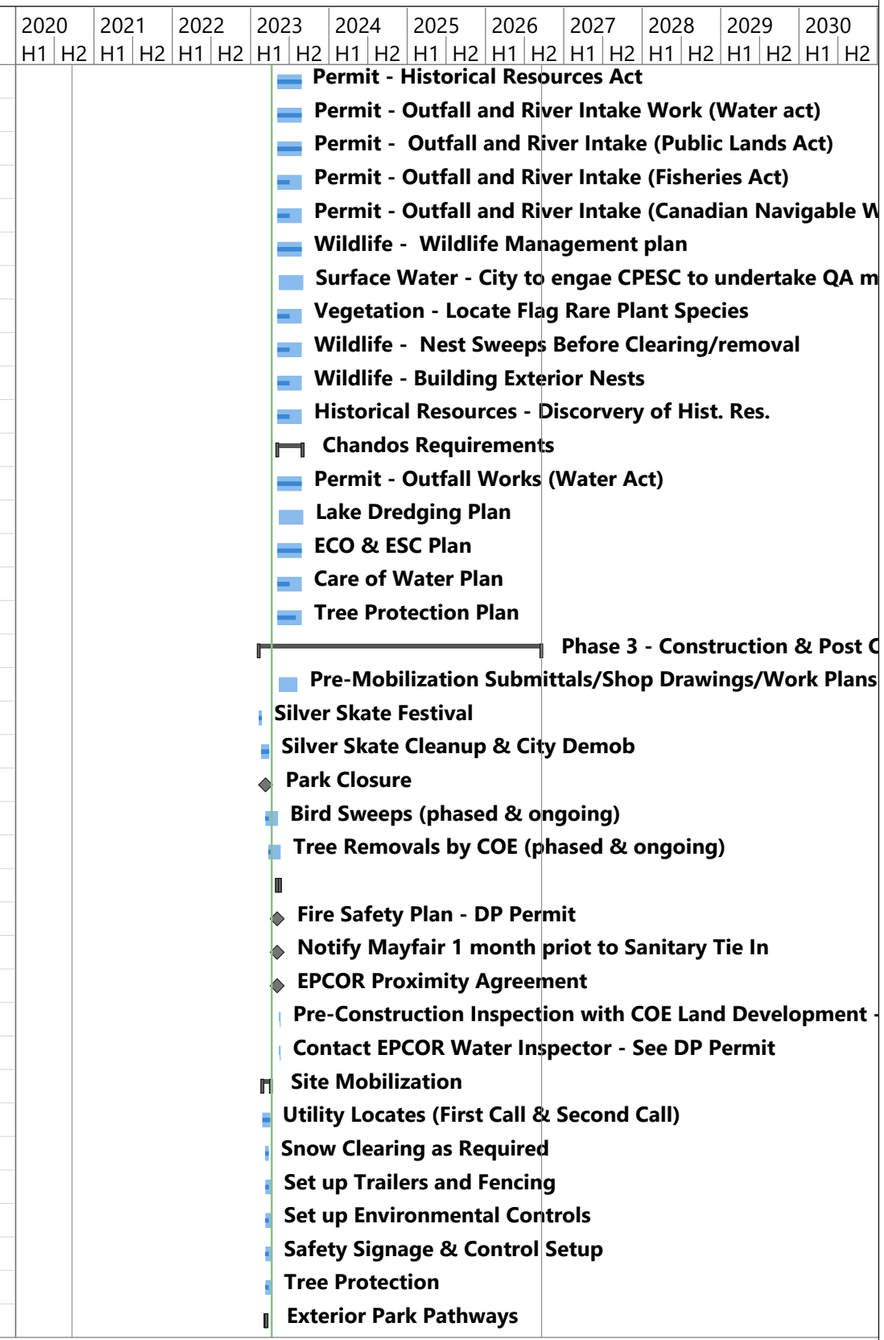
William Hawrelak Park Rehabilitation
Draft Construction Schedule

THE CITY OF Edmonton

ID	Task Name	Duration	Start	Finish	Predecessors	Successors	% Complete
1	**WHPR Project**	**1542 days**	**Tue 13/10/20**	**Fri 18/09/26**			**18%**
2	**RFP**	**37 days**	**Tue 13/10/20**	**Wed 02/12/20**			**0%**
6	**Phase 1 - Pre-Design, Schematic Design and Design Development**	**364 days**	**Thu 22/10/20**	**Fri 25/03/22**			**100%**
24	**Phase 2 - Tender Documents**	**376 days**	**Fri 25/03/22**	**Fri 01/09/23**			**72%**
25	**Tender Package 1 - Deep Utilities**	**193 days**	**Fri 25/03/22**	**Tue 20/12/22**			**100%**
39	**Tender Package 2 - Earthworks & Paving**	**84 days**	**Wed 30/11/22**	**Mon 27/03/23**			**100%**
50	**Tender Package 3 - Site Electrical & Gas**	**52 days**	**Thu 02/03/23**	**Fri 12/05/23**			**38%**
51	Receive IFT Documents	0 days	Thu 02/03/23	Thu 02/03/23		52	100%
52	Bid Form Preparation & Review	19 days	Thu 02/03/23	Tue 28/03/23	51	53	100%
53	**Issue Requests for Bid**	0 days	Tue 28/03/23	Tue 28/03/23	52	54,55FS+5 day	100%
54	Tender Period	18 days	Wed 29/03/23	Fri 21/04/23	53	56	0%
55	Tender Walkthrough	1 day	Wed 05/04/23	Wed 05/04/23	53FS+5 days		100%
56	Tender Close	0 days	Fri 21/04/23	Fri 21/04/23	54	57	0%
57	Chandos Bid Review & Recommendation	5 days	Mon 24/04/23	Fri 28/04/23	56	58	0%
58	COE & Consultants Bid Review	10 days	Mon 01/05/23	Fri 12/05/23	57	59	0%
59	COE Authorization to Proceed	0 days	Fri 12/05/23	Fri 12/05/23	58	125,107,108,1(	0%
60	**Tender Package 4 - Comprehensive**	**215 days**	**Mon 01/08/22**	**Fri 26/05/23**			**87%**
61	**Review Schedule**	**128 days**	**Mon 01/08/22**	**Wed 25/01/23**			**100%**
62	**Amphitheater**	**37 days**	**Mon 01/08/22**	**Tue 20/09/22**			**100%**
67	**Site Design Part 1**	**32 days**	**Wed 31/08/22**	**Thu 13/10/22**			**100%**
72	**Shelters**	**26 days**	**Mon 03/10/22**	**Mon 07/11/22**			**100%**
77	**Main Pavilion**	**30 days**	**Tue 18/10/22**	**Mon 28/11/22**			**100%**
82	**Site Design Part 2**	**29 days**	**Tue 08/11/22**	**Fri 16/12/22**			**100%**
87	**Service Yard**	**38 days**	**Mon 05/12/22**	**Wed 25/01/23**			**100%**
93	**Tender Schedule**	**75 days**	**Mon 13/02/23**	**Fri 26/05/23**			**55%**
94	Pre-Bid Submission from MBAC	0 days	Mon 13/02/23	Mon 13/02/23		95	100%
95	COE/Chandos Review Period	14 days	Mon 13/02/23	Thu 02/03/23	94	96	100%
96	Consultant review, edits, meetings etc...	13 days	Fri 03/03/23	Tue 21/03/23	95	97	100%
97	IFT Submission from MBAC	0 days	Tue 21/03/23	Tue 21/03/23	96	98	100%
98	Bid Form and Front End Preparation	14 days	Wed 22/03/23	Mon 10/04/23	97	99	100%
99	**Issue Requests for Bid**	0 days	Mon 10/04/23	Mon 10/04/23	98	100	0%
100	Tender Period	16 days	Tue 11/04/23	Tue 02/05/23	99	101	0%
101	Initial Posted Tender Close	0 days	Tue 02/05/23	Tue 02/05/23	100	102	0%
102	Chandos Bid Review & Recommendation (phased)	8 days	Wed 03/05/23	Fri 12/05/23	101	103	0%
103	COE & Consultants Bid Review (phased)	10 days	Mon 15/05/23	Fri 26/05/23	102	104	0%
104	COE Authorization to Proceed (phased)	0 days	Fri 26/05/23	Fri 26/05/23	103	276FS+3 wks,2	0%
105	**Enviromental Requirements**	**85 days**	**Mon 08/05/23**	**Fri 01/09/23**			**64%**
106	**Spencer Environmental**	**85 days**	**Mon 08/05/23**	**Fri 01/09/23**			**64%**



ID	Task Name	Duration	Start	Finish	Predecessors	Successors	% Complete
107	Permit - Historical Resources Act	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		100%
108	Permit - Outfall and River Intake Work (Water act)	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		100%
109	Permit - Outfall and River Intake (Public Lands Act)	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		100%
110	Permit - Outfall and River Intake (Fisheries Act)	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		50%
111	Permit - Outfall and River Intake (Canadian Navigable Waters Act)	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		50%
112	Wildlife - Wildlife Management plan	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		100%
113	Surface Water - City to engae CPESC to undertake QA monitoring	4 mons	Mon 15/05/23	Fri 01/09/23	38,59		0%
114	Vegetation - Locate Flag Rare Plant Species	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		50%
115	Wildlife - Nest Sweeps Before Clearing/removal	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		50%
116	Wildlife - Building Exterior Nests	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		50%
117	Historical Resources - Discorvery of Hist. Res.	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		50%
118	**Chandos Requirements**	**85 days**	**Mon 08/05/23**	**Fri 01/09/23**			**65%**
119	Permit - Outfall Works (Water Act)	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		100%
120	Lake Dredging Plan	4 mons	Mon 15/05/23	Fri 01/09/23	38,59		0%
121	ECO & ESC Plan	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		100%
122	Care of Water Plan	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		50%
123	Tree Protection Plan	4 mons	Mon 08/05/23	Fri 25/08/23	38,59		75%
124	**Phase 3 - Construction & Post Construction**	**941 days**	**Fri 10/02/23**	**Fri 18/09/26**			**3%**
125	Pre-Mobilization Submittals/Shop Drawings/Work Plans	3 mons	Mon 15/05/23	Fri 04/08/23	38,59		0%
126	Silver Skate Festival	7 days	Fri 10/02/23	Mon 20/02/23		127	100%
127	Silver Skate Cleanup & City Demob	5 wks	Tue 21/02/23	Mon 27/03/23	126	128FS-11 days	100%
128	Park Closure	0 days	Mon 13/03/23	Mon 13/03/23	127FS-11 days	130FS+2 wks,1	100%
129	Bird Sweeps (phased & ongoing)	2 mons	Mon 13/03/23	Fri 05/05/23	128		25%
130	Tree Removals by COE (phased & ongoing)	2 mons	Mon 27/03/23	Fri 19/05/23	128FS+2 wks		25%
131	**Reminders**	**9 days**	**Fri 05/05/23**	**Thu 18/05/23**			**0%**
132	Fire Safety Plan - DP Permit	0 days	Fri 05/05/23	Fri 05/05/23	38,59		100%
133	Notify Mayfair 1 month priot to Sanitary Tie In	0 days	Fri 05/05/23	Fri 05/05/23	38,59		100%
134	EPCOR Proximity Agreement	0 days	Fri 05/05/23	Fri 05/05/23	38,59		100%
135	Pre-Construction Inspection with COE Land Development - DP Permit	4 days	Fri 05/05/23	Thu 18/05/23	38,59		0%
136	Contact EPCOR Water Inspector - See DP Permit	4 days	Fri 05/05/23	Thu 18/05/23	38,59		0%
137	**Site Mobilization**	**30 days**	**Mon 27/02/23**	**Fri 07/04/23**		**251**	**68%**
138	Utility Locates (First Call & Second Call)	25 days	Mon 27/02/23	Fri 31/03/23	128FS-2 wks	159	100%
139	Snow Clearing as Required	2 wks	Mon 13/03/23	Fri 24/03/23	128		100%
140	Set up Trailers and Fencing	1 mon	Mon 13/03/23	Fri 07/04/23	128		50%
141	Set up Environmental Controls	1 mon	Mon 13/03/23	Fri 07/04/23	128		50%
142	Safety Signage & Control Setup	1 mon	Mon 13/03/23	Fri 07/04/23	128		50%
143	Tree Protection	1 mon	Mon 13/03/23	Fri 07/04/23	128		50%
144	**Exterior Park Pathways**	**5 days**	**Mon 13/03/23**	**Fri 17/03/23**			**100%**

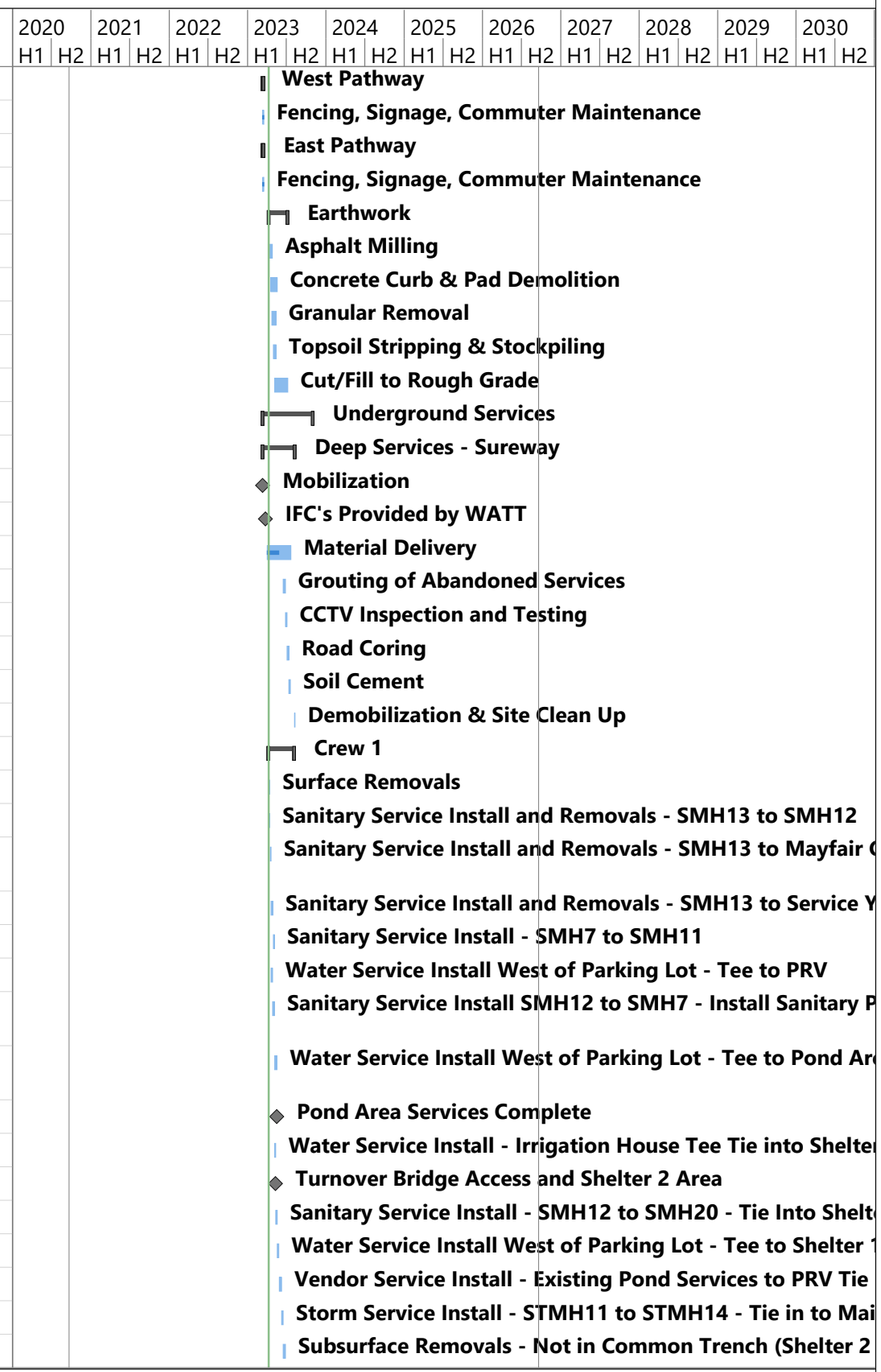


CHANDOS

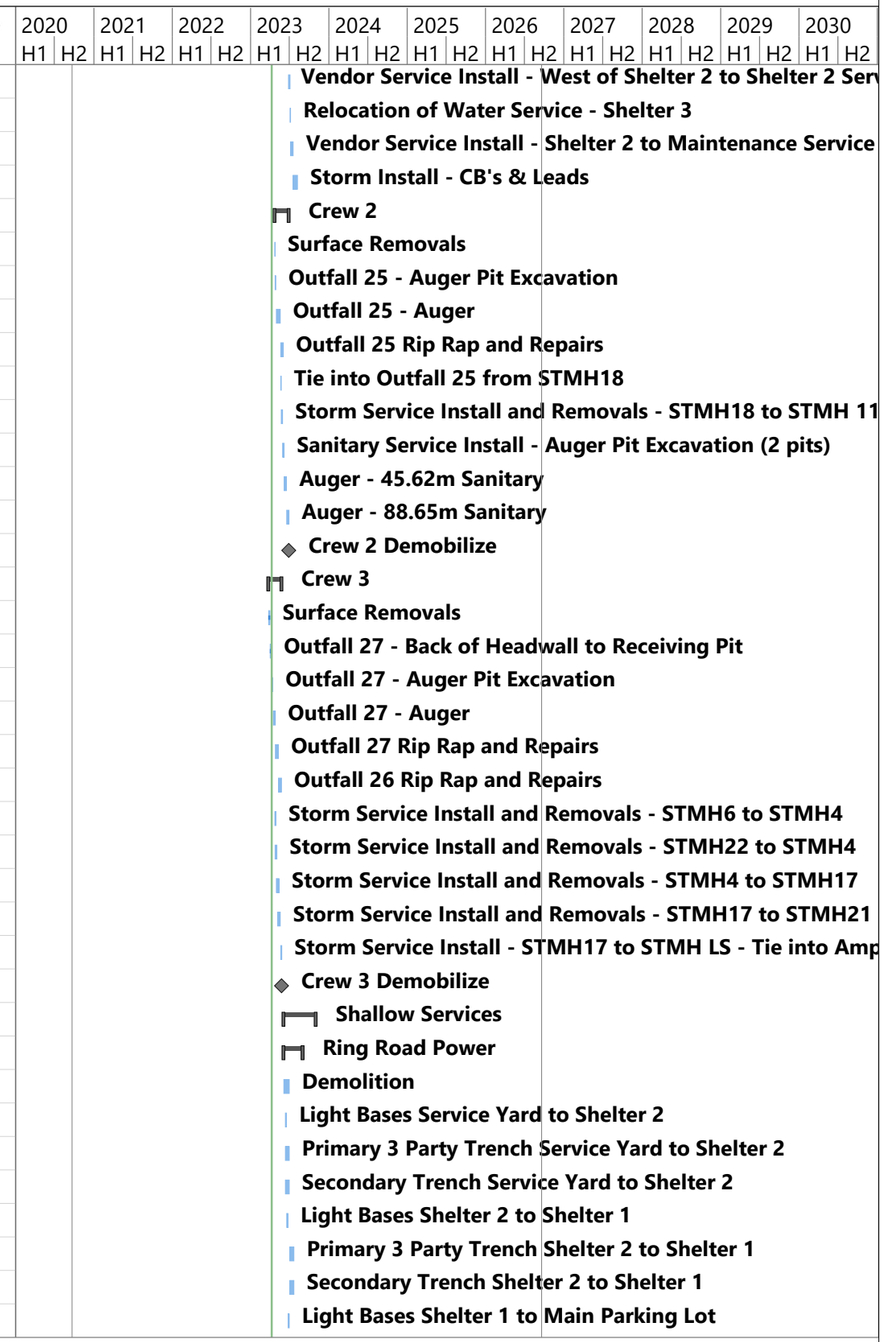
William Hawrelak Park Rehabilitation
Draft Construction Schedule

THE CITY OF Edmonton

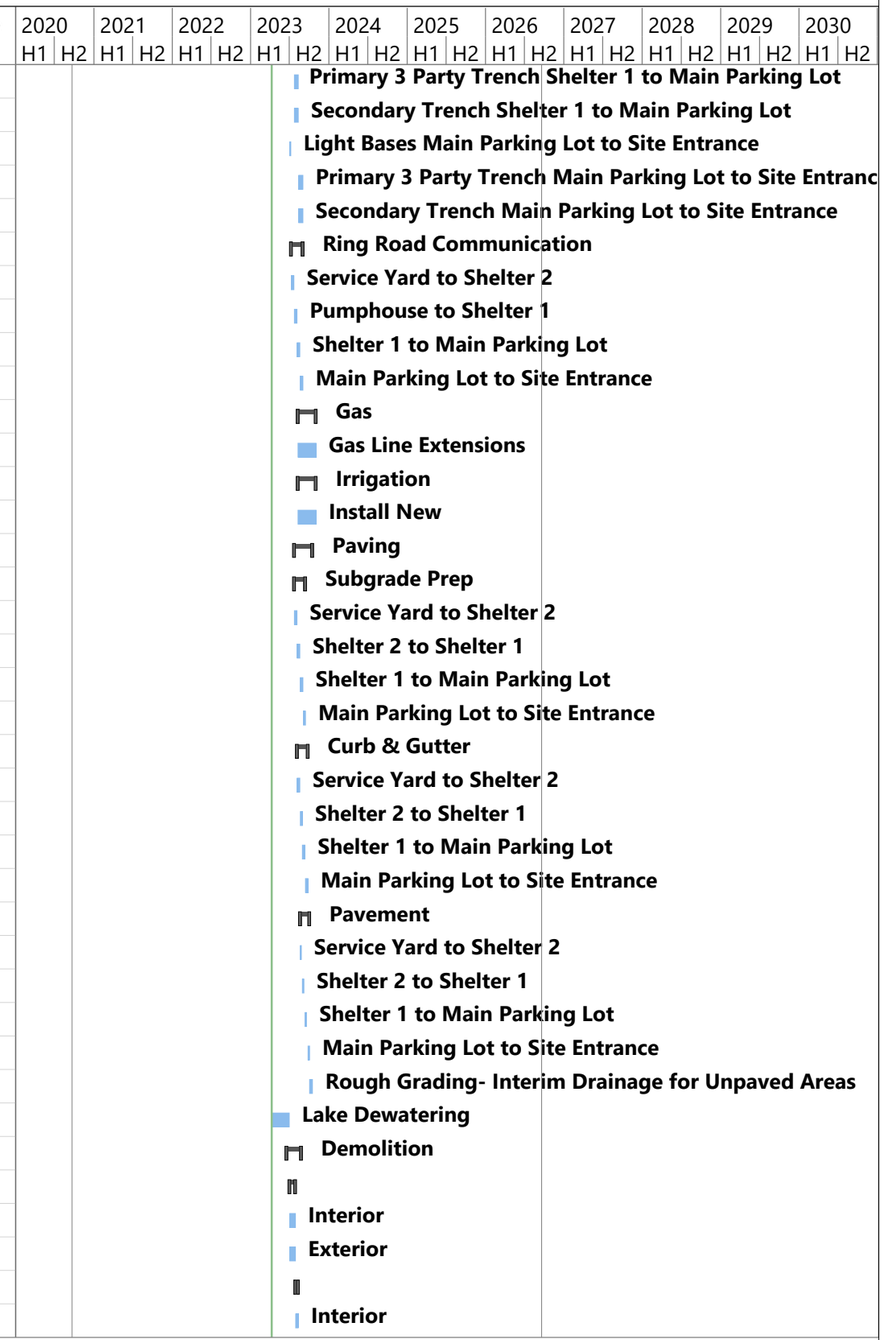
ID	Task Name	Duration	Start	Finish	Predecessors	Successors	% Complete
145	**West Pathway**	**5 days**	**Mon 13/03/23**	**Fri 17/03/23**			**100%**
146	Fencing, Signage, Commuter Maintenance	1 wk	Mon 13/03/23	Fri 17/03/23	128		100%
147	**East Pathway**	**5 days**	**Mon 13/03/23**	**Fri 17/03/23**			**100%**
148	Fencing, Signage, Commuter Maintenance	1 wk	Mon 13/03/23	Fri 17/03/23	128		100%
149	**Earthwork**	**64 days**	**Tue 11/04/23**	**Fri 07/07/23**		**480**	**0%**
150	Asphalt Milling	12 days	Tue 11/04/23	Wed 26/04/23	49FS+10 days	151FS-5 days	0%
151	Concrete Curb & Pad Demolition	22 days	Thu 20/04/23	Fri 19/05/23	150FS-5 days	152SS+2 days	0%
152	Granular Removal	15 days	Mon 24/04/23	Fri 12/05/23	151SS+2 days	153SS+5 days,1	0%
153	Topsoil Stripping & Stockpiling	10 days	Mon 01/05/23	Fri 12/05/23	152SS+5 days	154FS-5 days	0%
154	Cut/Fill to Rough Grade	45 days	Mon 08/05/23	Fri 07/07/23	153FS-5 days,152F		0%
155	**Underground Services**	**168 days**	**Mon 13/03/23**	**Wed 01/11/23**		**480**	**7%**
156	**Deep Services - Sureway**	**108 days**	**Mon 13/03/23**	**Wed 09/08/23**			**14%**
157	Mobilization	0 days	Mon 13/03/23	Mon 13/03/23	128		100%
158	IFC's Provided by WATT	0 days	Mon 27/03/23	Mon 27/03/23		166FS+2 wks,1	100%
159	Material Delivery	4 mons	Mon 03/04/23	Fri 21/07/23	138		50%
160	Grouting of Abandoned Services	7 days	Fri 16/06/23	Mon 26/06/23	181SS	161	0%
161	CCTV Inspection and Testing	5 days	Tue 27/06/23	Mon 03/07/23	160	162	0%
162	Road Coring	7 days	Tue 04/07/23	Wed 12/07/23	161	163	0%
163	Soil Cement	5 days	Thu 13/07/23	Wed 19/07/23	162	164	0%
164	Demobilization & Site Clean Up	2 days	Tue 08/08/23	Wed 09/08/23	163,196,209,185	231,233	0%
165	**Crew 1**	**86 days**	**Mon 10/04/23**	**Mon 07/08/23**			**0%**
166	Surface Removals	5 days	Mon 10/04/23	Fri 14/04/23	158FS+2 wks	168,167FS-3 da	0%
167	Sanitary Service Install and Removals - SMH13 to SMH12	3 days	Wed 12/04/23	Fri 14/04/23	166FS-3 days		0%
168	Sanitary Service Install and Removals - SMH13 to Mayfair GC Tie In	4 days	Mon 17/04/23	Thu 20/04/23	166	171,169	0%
169	Sanitary Service Install and Removals - SMH13 to Service Yard	6 days	Fri 21/04/23	Fri 28/04/23	168	170	0%
170	Sanitary Service Install - SMH7 to SMH11	5 days	Mon 01/05/23	Fri 05/05/23	169	175	0%
171	Water Service Install West of Parking Lot - Tee to PRV	5 days	Fri 21/04/23	Thu 27/04/23	168	172	0%
172	Sanitary Service Install SMH12 to SMH7 - Install Sanitary Pond Service Tie Ins	6 days	Fri 28/04/23	Fri 05/05/23	171	173	0%
173	Water Service Install West of Parking Lot - Tee to Pond Area Tie Ins - Irrigation House Tee	8 days	Mon 08/05/23	Wed 17/05/23	172	174	0%
174	Pond Area Services Complete	0 days	Wed 17/05/23	Wed 17/05/23	173		0%
175	Water Service Install - Irrigation House Tee Tie into Shelter 2	4 days	Mon 08/05/23	Thu 11/05/23	170	176	0%
176	Turnover Bridge Access and Shelter 2 Area	0 days	Thu 11/05/23	Thu 11/05/23	175	177	0%
177	Sanitary Service Install - SMH12 to SMH20 - Tie Into Shelter 1	5 days	Fri 12/05/23	Thu 18/05/23	176	178	0%
178	Water Service Install West of Parking Lot - Tee to Shelter 1 Tie In	6 days	Fri 19/05/23	Fri 26/05/23	177	179	0%
179	Vendor Service Install - Existing Pond Services to PRV Tie In	9 days	Mon 29/05/23	Thu 08/06/23	178	180	0%
180	Storm Service Install - STMH11 to STMH14 - Tie in to Maintenance	5 days	Fri 09/06/23	Thu 15/06/23	179	181	0%
181	Subsurface Removals - Not in Common Trench (Shelter 2 STM)	7 days	Fri 16/06/23	Mon 26/06/23	180	182,160SS	0%



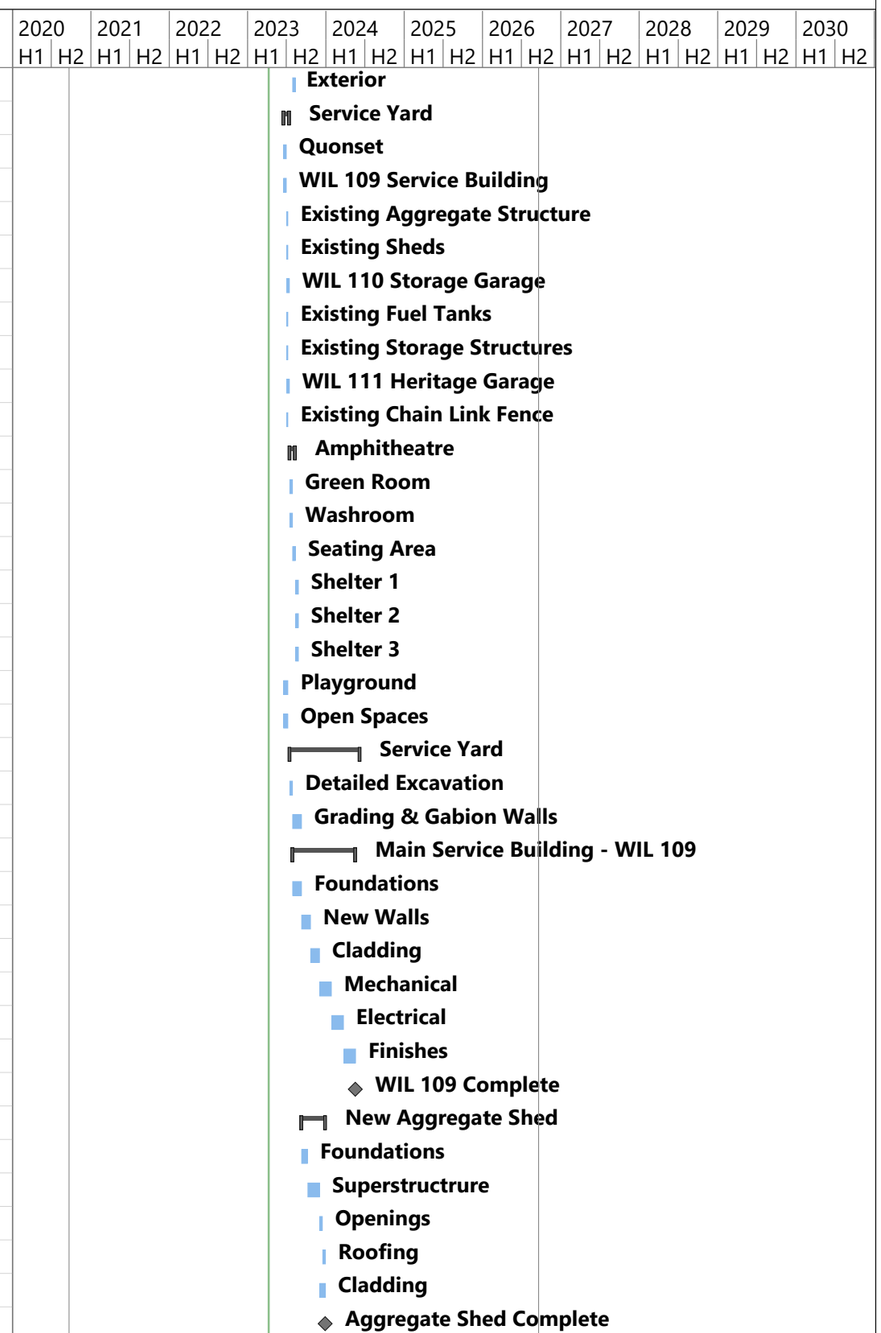
ID	Task Name	Duration	Start	Finish	Predecessors	Successors	% Complete
182	Vendor Service Install - West of Shelter 2 to Shelter 2 Service Line	5 days	Tue 27/06/23	Mon 03/07/23	181	183	0%
183	Relocation of Water Service - Shelter 3	2 days	Tue 04/07/23	Wed 05/07/23	182	184	0%
184	Vendor Service Install - Shelter 2 to Maintenance Service Line	9 days	Thu 06/07/23	Tue 18/07/23	183	185	0%
185	Storm Install - CB's & Leads	14 days	Wed 19/07/23	Mon 07/08/23	184	164	0%
186	**Crew 2**	**48 days**	**Mon 24/04/23**	**Wed 28/06/23**			**0%**
187	Surface Removals	2 days	Mon 24/04/23	Tue 25/04/23	158FS+4 wks	188	0%
188	Outfall 25 - Auger Pit Excavation	3 days	Wed 26/04/23	Fri 28/04/23	187	189	0%
189	Outfall 25 - Auger	15 days	Mon 01/05/23	Fri 19/05/23	188	190,191	0%
190	Outfall 25 Rip Rap and Repairs	10 days	Mon 22/05/23	Fri 02/06/23	189	196	0%
191	Tie into Outfall 25 from STMH18	2 days	Mon 22/05/23	Tue 23/05/23	189	192	0%
192	Storm Service Install and Removals - STMH18 to STMH 11	4 days	Wed 24/05/23	Mon 29/05/23	191	193	0%
193	Sanitary Service Install - Auger Pit Excavation (2 pits)	6 days	Tue 30/05/23	Tue 06/06/23	192	194	0%
194	Auger - 45.62m Sanitary	8 days	Wed 07/06/23	Fri 16/06/23	193	195	0%
195	Auger - 88.65m Sanitary	8 days	Mon 19/06/23	Wed 28/06/23	194	196	0%
196	Crew 2 Demobilize	0 days	Wed 28/06/23	Wed 28/06/23	195,190	164	0%
197	**Crew 3**	**45 days**	**Mon 27/03/23**	**Fri 26/05/23**			**13%**
198	Surface Removals	5 days	Mon 27/03/23	Fri 31/03/23	158	199	100%
199	Outfall 27 - Back of Headwall to Receiving Pit	5 days	Mon 03/04/23	Fri 07/04/23	198	200	100%
200	Outfall 27 - Auger Pit Excavation	5 days	Mon 10/04/23	Fri 14/04/23	199	201	0%
201	Outfall 27 - Auger	8 days	Mon 17/04/23	Wed 26/04/23	200	202,204FS-3 da	0%
202	Outfall 27 Rip Rap and Repairs	10 days	Thu 27/04/23	Wed 10/05/23	201	203	0%
203	Outfall 26 Rip Rap and Repairs	10 days	Thu 11/05/23	Wed 24/05/23	202	209	0%
204	Storm Service Install and Removals - STMH6 to STMH4	5 days	Mon 24/04/23	Fri 28/04/23	201FS-3 days	205FS-3 days	0%
205	Storm Service Install and Removals - STMH22 to STMH4	6 days	Wed 26/04/23	Wed 03/05/23	204FS-3 days	206FS-3 days	0%
206	Storm Service Install and Removals - STMH4 to STMH17	10 days	Mon 01/05/23	Fri 12/05/23	205FS-3 days	207FS-5 days	0%
207	Storm Service Install and Removals - STMH17 to STMH21	10 days	Mon 08/05/23	Fri 19/05/23	206FS-5 days	208	0%
208	Storm Service Install - STMH17 to STMH LS - Tie into Amphitheater	5 days	Mon 22/05/23	Fri 26/05/23	207	209	0%
209	Crew 3 Demobilize	0 days	Fri 26/05/23	Fri 26/05/23	208,203	164	0%
210	**Shallow Services**	**108 days**	**Mon 05/06/23**	**Wed 01/11/23**		**480**	**0%**
211	**Ring Road Power**	**65 days**	**Mon 05/06/23**	**Fri 01/09/23**			**0%**
212	Demolition	4 wks	Mon 05/06/23	Fri 30/06/23	59FS+3 wks	213FS-3 wks	0%
213	Light Bases Service Yard to Shelter 2	5 days	Mon 12/06/23	Fri 16/06/23	212FS-3 wks	214SS,216	0%
214	Primary 3 Party Trench Service Yard to Shelter 2	15 days	Mon 12/06/23	Fri 30/06/23	213SS	215FF,217	0%
215	Secondary Trench Service Yard to Shelter 2	15 days	Mon 12/06/23	Fri 30/06/23	214FF	218	0%
216	Light Bases Shelter 2 to Shelter 1	5 days	Mon 19/06/23	Fri 23/06/23	213	219	0%
217	Primary 3 Party Trench Shelter 2 to Shelter 1	15 days	Mon 03/07/23	Fri 21/07/23	214	220	0%
218	Secondary Trench Shelter 2 to Shelter 1	15 days	Mon 03/07/23	Fri 21/07/23	215	221,226FS-10 d	0%
219	Light Bases Shelter 1 to Main Parking Lot	5 days	Mon 26/06/23	Fri 30/06/23	216	222	0%



ID	Task Name	Duration	Start	Finish	Predecessors	Successors	% Complete
220	Primary 3 Party Trench Shelter 1 to Main Parking Lot	15 days	Mon 24/07/23	Fri 11/08/23	217	223	0%
221	Secondary Trench Shelter 1 to Main Parking Lot	15 days	Mon 24/07/23	Fri 11/08/23	218	224	0%
222	Light Bases Main Parking Lot to Site Entrance	5 days	Mon 03/07/23	Fri 07/07/23	219		0%
223	Primary 3 Party Trench Main Parking Lot to Site Entrance	15 days	Mon 14/08/23	Fri 01/09/23	220		0%
224	Secondary Trench Main Parking Lot to Site Entrance	15 days	Mon 14/08/23	Fri 01/09/23	221		0%
225	**Ring Road Communication**	**40 days**	**Mon 10/07/23**	**Fri 01/09/23**			**0%**
226	Service Yard to Shelter 2	10 days	Mon 10/07/23	Fri 21/07/23	218FS-10 days	227,236	0%
227	Pumphouse to Shelter 1	10 days	Mon 24/07/23	Fri 04/08/23	226	228,237	0%
228	Shelter 1 to Main Parking Lot	10 days	Mon 07/08/23	Fri 18/08/23	227	229,238	0%
229	Main Parking Lot to Site Entrance	10 days	Mon 21/08/23	Fri 01/09/23	228	239	0%
230	**Gas**	**60 days**	**Thu 10/08/23**	**Wed 01/11/23**			**0%**
231	Gas Line Extensions	3 mons	Thu 10/08/23	Wed 01/11/23	164		0%
232	**Irrigation**	**60 days**	**Thu 10/08/23**	**Wed 01/11/23**			**0%**
233	Install New	3 mons	Thu 10/08/23	Wed 01/11/23	164		0%
234	**Paving**	**61 days**	**Mon 24/07/23**	**Mon 16/10/23**			**0%**
235	**Subgrade Prep**	**38 days**	**Mon 24/07/23**	**Wed 13/09/23**			**0%**
236	Service Yard to Shelter 2	10 days	Mon 24/07/23	Fri 04/08/23	226	237,241	0%
237	Shelter 2 to Shelter 1	10 days	Mon 07/08/23	Fri 18/08/23	236,227	238	0%
238	Shelter 1 to Main Parking Lot	10 days	Mon 21/08/23	Fri 01/09/23	237,228	239	0%
239	Main Parking Lot to Site Entrance	8 days	Mon 04/09/23	Wed 13/09/23	238,229	244	0%
240	**Curb & Gutter**	**36 days**	**Mon 07/08/23**	**Mon 25/09/23**			**0%**
241	Service Yard to Shelter 2	10 days	Mon 07/08/23	Fri 18/08/23	236	242,246	0%
242	Shelter 2 to Shelter 1	8 days	Mon 21/08/23	Wed 30/08/23	241	243,247	0%
243	Shelter 1 to Main Parking Lot	8 days	Thu 31/08/23	Mon 11/09/23	242	244,248	0%
244	Main Parking Lot to Site Entrance	8 days	Thu 14/09/23	Mon 25/09/23	243,239	249	0%
245	**Pavement**	**31 days**	**Mon 21/08/23**	**Mon 02/10/23**			**0%**
246	Service Yard to Shelter 2	5 days	Mon 21/08/23	Fri 25/08/23	241	247	0%
247	Shelter 2 to Shelter 1	5 days	Thu 31/08/23	Wed 06/09/23	246,242	248	0%
248	Shelter 1 to Main Parking Lot	5 days	Tue 12/09/23	Mon 18/09/23	247,243	249	0%
249	Main Parking Lot to Site Entrance	5 days	Tue 26/09/23	Mon 02/10/23	248,244	250	0%
250	Rough Grading- Interim Drainage for Unpaved Areas	10 days	Tue 03/10/23	Mon 16/10/23	249		0%
251	Lake Dewatering	3 mons	Mon 10/04/23	Fri 30/06/23	137	313,254,255	0%
252	**Demolition**	**50 days**	**Mon 19/06/23**	**Fri 25/08/23**			**0%**
253	**Main Pavilion**	**20 days**	**Mon 03/07/23**	**Fri 28/07/23**			**0%**
254	Interior	20 days	Mon 03/07/23	Fri 28/07/23	104FS+3 wks,251	257,258,334	0%
255	Exterior	20 days	Mon 03/07/23	Fri 28/07/23	104FS+3 wks,251	257,258,313	0%
256	**Boathouse**	**10 days**	**Mon 31/07/23**	**Fri 11/08/23**		**273,274,275**	**0%**
257	Interior	10 days	Mon 31/07/23	Fri 11/08/23	254,255	351	0%



ID	Task Name	Duration	Start	Finish	Predecessors	Successors	% Complete
258	Exterior	10 days	Mon 31/07/23	Fri 11/08/23	254,255		0%
259	**Service Yard**	**20 days**	**Mon 19/06/23**	**Fri 14/07/23**		**270,271,279**	**0%**
260	Quonset	2 wks	Mon 19/06/23	Fri 30/06/23	104FS+3 wks	261SS,262,263	0%
261	WIL 109 Service Building	2 wks	Mon 19/06/23	Fri 30/06/23	260SS	262,263,264,2(	0%
262	Existing Aggregate Structure	5 days	Mon 03/07/23	Fri 07/07/23	260,261		0%
263	Existing Sheds	5 days	Mon 03/07/23	Fri 07/07/23	260,261		0%
264	WIL 110 Storage Garage	10 days	Mon 03/07/23	Fri 14/07/23	260,261		0%
265	Existing Fuel Tanks	5 days	Mon 03/07/23	Fri 07/07/23	260,261		0%
266	Existing Storage Structures	5 days	Mon 03/07/23	Fri 07/07/23	260,261		0%
267	WIL 111 Heritage Garage	10 days	Mon 03/07/23	Fri 14/07/23	260,261	297	0%
268	Existing Chain Link Fence	5 days	Mon 03/07/23	Fri 07/07/23	260,261		0%
269	**Amphitheatre**	**20 days**	**Mon 17/07/23**	**Fri 11/08/23**		**274,273,275**	**0%**
270	Green Room	10 days	Mon 17/07/23	Fri 28/07/23	259	272	0%
271	Washroom	10 days	Mon 17/07/23	Fri 28/07/23	259	272	0%
272	Seating Area	10 days	Mon 31/07/23	Fri 11/08/23	270,271		0%
273	Shelter 1	2 wks	Mon 14/08/23	Fri 25/08/23	256,269		0%
274	Shelter 2	2 wks	Mon 14/08/23	Fri 25/08/23	269,256		0%
275	Shelter 3	2 wks	Mon 14/08/23	Fri 25/08/23	256,269		0%
276	Playground	3 wks	Mon 19/06/23	Fri 07/07/23	104FS+3 wks	432SS	0%
277	Open Spaces	3 wks	Mon 19/06/23	Fri 07/07/23	104FS+3 wks	466,473	0%
278	**Service Yard**	**235 days**	**Mon 17/07/23**	**Fri 07/06/24**			**0%**
279	Detailed Excavation	10 days	Mon 17/07/23	Fri 28/07/23	259	280,282	0%
280	Grading & Gabion Walls	30 days	Mon 31/07/23	Fri 08/09/23	279		0%
281	**Main Service Building - WIL 109**	**210 days**	**Mon 31/07/23**	**Fri 17/05/24**		**361FS-2 mons**	**0%**
282	Foundations	6 wks	Mon 31/07/23	Fri 08/09/23	279	283,288,290	0%
283	New Walls	6 wks	Mon 11/09/23	Fri 20/10/23	282	284,288	0%
284	Cladding	6 wks	Mon 23/10/23	Fri 01/12/23	283	285,288	0%
285	Mechanical	8 wks	Mon 04/12/23	Fri 26/01/24	284	286,287,288	0%
286	Electrical	8 wks	Mon 29/01/24	Fri 22/03/24	285	287,288	0%
287	Finishes	8 wks	Mon 25/03/24	Fri 17/05/24	285,286	288	0%
288	WIL 109 Complete	0 days	Fri 17/05/24	Fri 17/05/24	282,283,284,285,2	310	0%
289	**New Aggregate Shed**	**80 days**	**Mon 11/09/23**	**Fri 29/12/23**			**0%**
290	Foundations	4 wks	Mon 11/09/23	Fri 06/10/23	282	291,295,303	0%
291	Superstructrure	8 wks	Mon 09/10/23	Fri 01/12/23	290	294,292,295	0%
292	Openings	2 wks	Mon 04/12/23	Fri 15/12/23	291	293,295	0%
293	Roofing	2 wks	Mon 18/12/23	Fri 29/12/23	292	295	0%
294	Cladding	4 wks	Mon 04/12/23	Fri 29/12/23	291	295	0%
295	Aggregate Shed Complete	0 days	Fri 29/12/23	Fri 29/12/23	290,291,292,293,2	310	0%

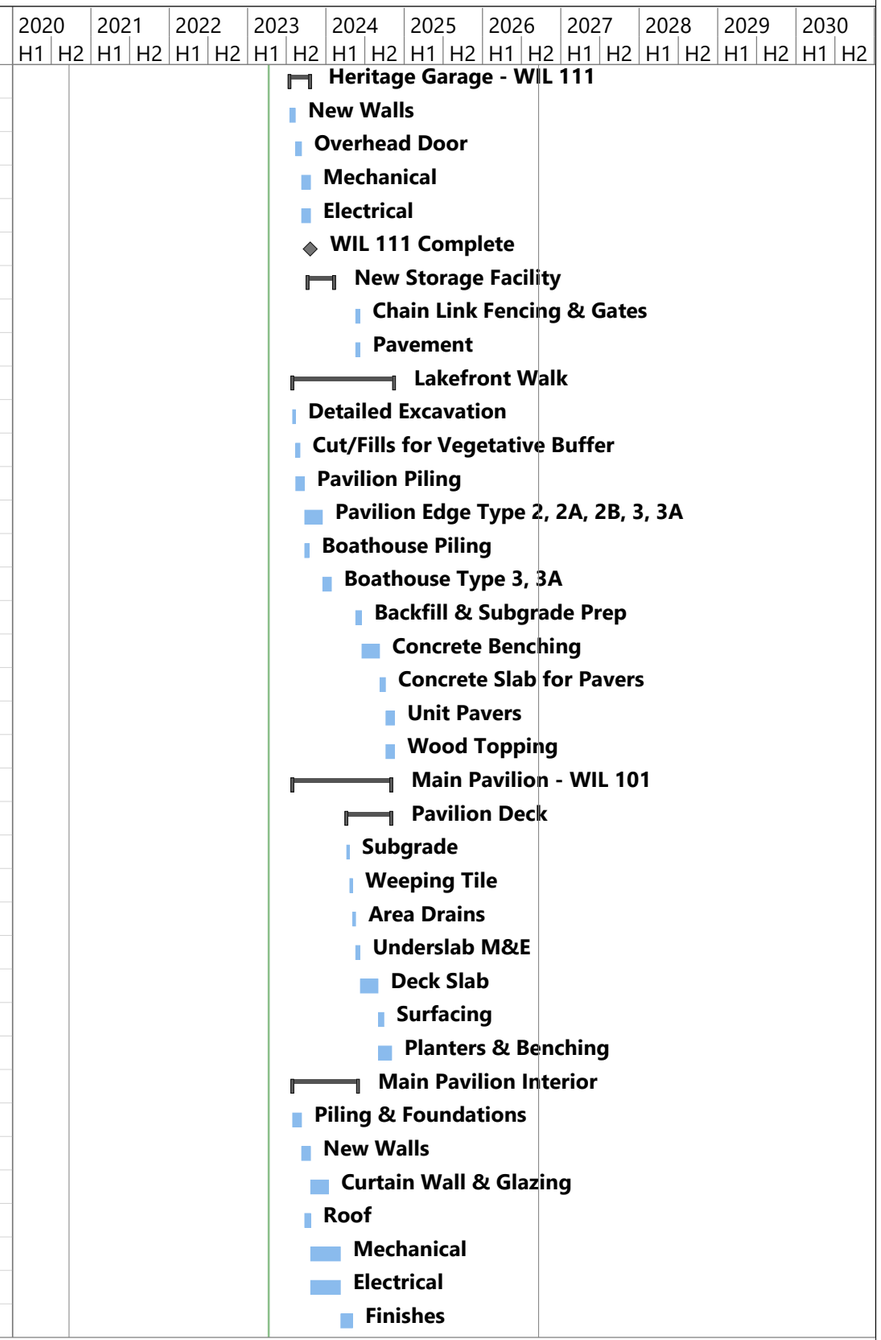


CHANDOS

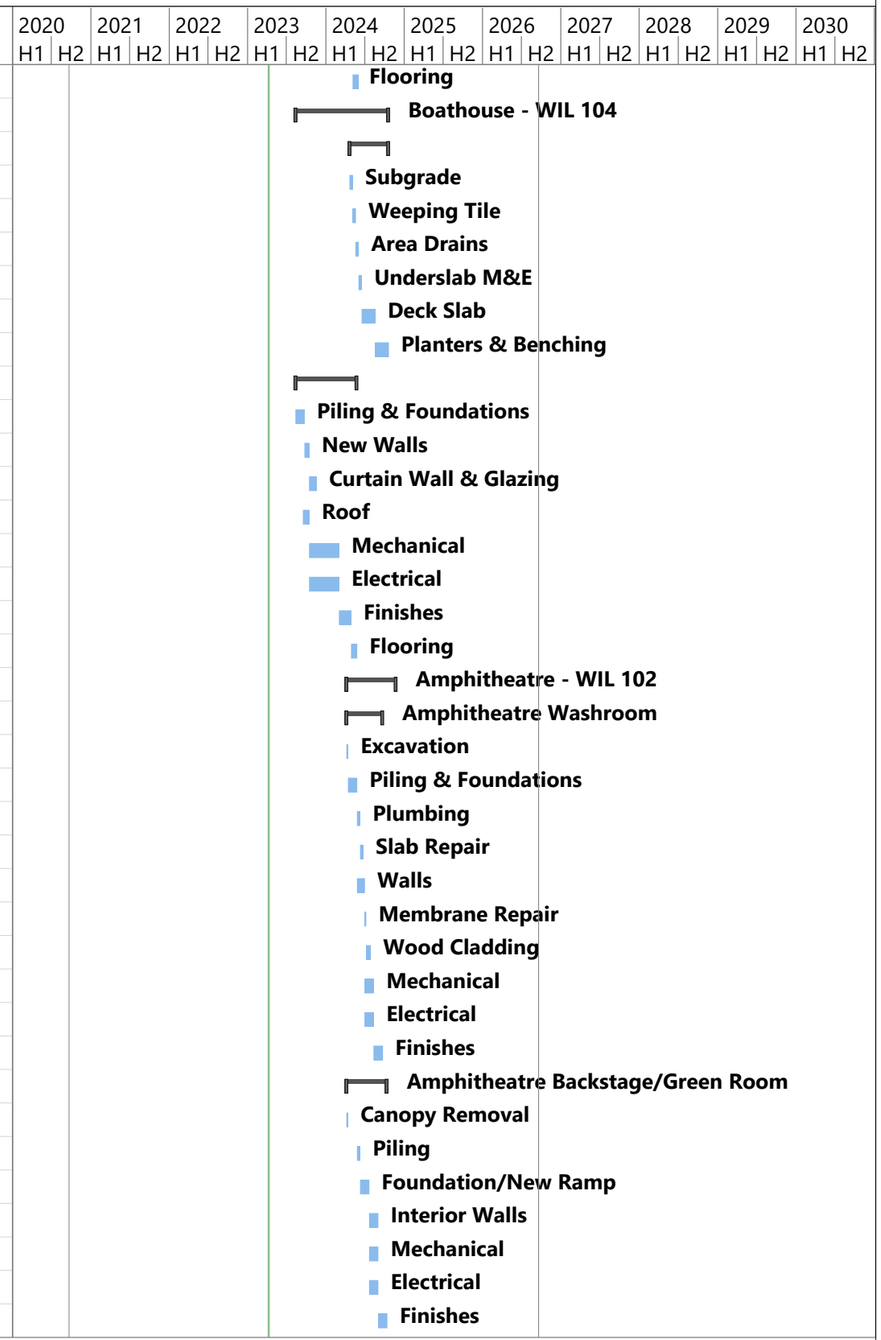
William Hawrelak Park Rehabilitation
Draft Construction Schedule

THE CITY OF Edmonton

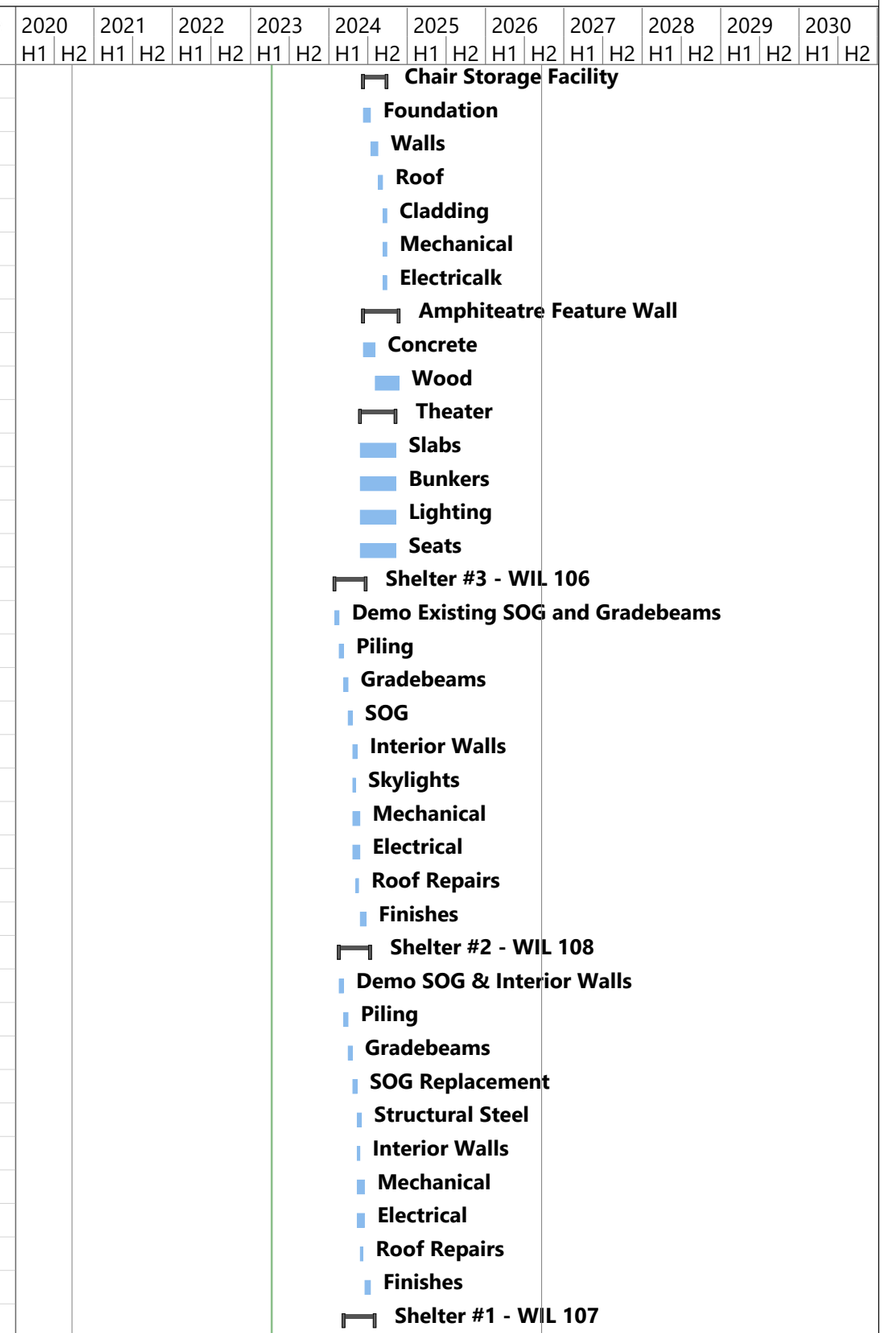
ID	Task Name	Duration	Start	Finish	Predecessors	Successors	% Complete
296	**Heritage Garage - WIL 111**	**70 days**	**Mon 17/07/23**	**Fri 20/10/23**			**0%**
297	New Walls	20 days	Mon 17/07/23	Fri 11/08/23	267	298,299,300,3(	0%
298	Overhead Door	20 days	Mon 14/08/23	Fri 08/09/23	297	299,300,301	0%
299	Mechanical	30 days	Mon 11/09/23	Fri 20/10/23	297,298	301	0%
300	Electrical	30 days	Mon 11/09/23	Fri 20/10/23	297,298	301	0%
301	WIL 111 Complete	0 days	Fri 20/10/23	Fri 20/10/23	297,298,299,300	310	0%
302	**New Storage Facility**	**90 days**	**Mon 09/10/23**	**Fri 09/02/24**			**0%**
310	Chain Link Fencing & Gates	15 days	Mon 20/05/24	Fri 07/06/24	288,295,301,309	311SS	0%
311	Pavement	15 days	Mon 20/05/24	Fri 07/06/24	310SS		0%
312	**Lakefront Walk**	**340 days**	**Mon 31/07/23**	**Fri 15/11/24**			**0%**
313	Detailed Excavation	10 days	Mon 31/07/23	Fri 11/08/23	251,255	315,314	0%
314	Cut/Fills for Vegetative Buffer	15 days	Mon 14/08/23	Fri 01/09/23	313	445	0%
315	Pavilion Piling	30 days	Mon 14/08/23	Fri 22/09/23	313	316,317	0%
316	Pavilion Edge Type 2, 2A, 2B, 3, 3A	60 days	Mon 25/09/23	Fri 15/12/23	315	318,326FS+4 m	0%
317	Boathouse Piling	15 days	Mon 25/09/23	Fri 13/10/23	315	459	0%
318	Boathouse Type 3, 3A	30 days	Mon 18/12/23	Fri 26/01/24	316	319FS+4 mons	0%
319	Backfill & Subgrade Prep	20 days	Mon 20/05/24	Fri 14/06/24	318FS+4 mons	320,450	0%
320	Concrete Benching	60 days	Mon 17/06/24	Fri 06/09/24	319	321	0%
321	Concrete Slab for Pavers	20 days	Mon 09/09/24	Fri 04/10/24	320	322,323	0%
322	Unit Pavers	30 days	Mon 07/10/24	Fri 15/11/24	321		0%
323	Wood Topping	30 days	Mon 07/10/24	Fri 15/11/24	321		0%
324	**Main Pavilion - WIL 101**	**330 days**	**Mon 31/07/23**	**Fri 01/11/24**			**0%**
325	**Pavilion Deck**	**150 days**	**Mon 08/04/24**	**Fri 01/11/24**			**0%**
326	Subgrade	10 days	Mon 08/04/24	Fri 19/04/24	316FS+4 mons	327,344	0%
327	Weeping Tile	10 days	Mon 22/04/24	Fri 03/05/24	326	328	0%
328	Area Drains	10 days	Mon 06/05/24	Fri 17/05/24	327	329	0%
329	Underslab M&E	15 days	Mon 20/05/24	Fri 07/06/24	328	330	0%
330	Deck Slab	60 days	Mon 10/06/24	Fri 30/08/24	329	332,331	0%
331	Surfacing	20 days	Mon 02/09/24	Fri 27/09/24	330		0%
332	Planters & Benching	45 days	Mon 02/09/24	Fri 01/11/24	330		0%
333	**Main Pavilion Interior**	**220 days**	**Mon 31/07/23**	**Fri 31/05/24**		**361FS-2 mons**	**0%**
334	Piling & Foundations	30 days	Mon 31/07/23	Fri 08/09/23	254	335	0%
335	New Walls	30 days	Mon 11/09/23	Fri 20/10/23	334	336,337FF,338	0%
336	Curtain Wall & Glazing	60 days	Mon 23/10/23	Fri 12/01/24	335		0%
337	Roof	20 days	Mon 25/09/23	Fri 20/10/23	335FF		0%
338	Mechanical	100 days	Mon 23/10/23	Fri 08/03/24	335	340	0%
339	Electrical	100 days	Mon 23/10/23	Fri 08/03/24	335	340	0%
340	Finishes	40 days	Mon 11/03/24	Fri 03/05/24	338,339	341	0%



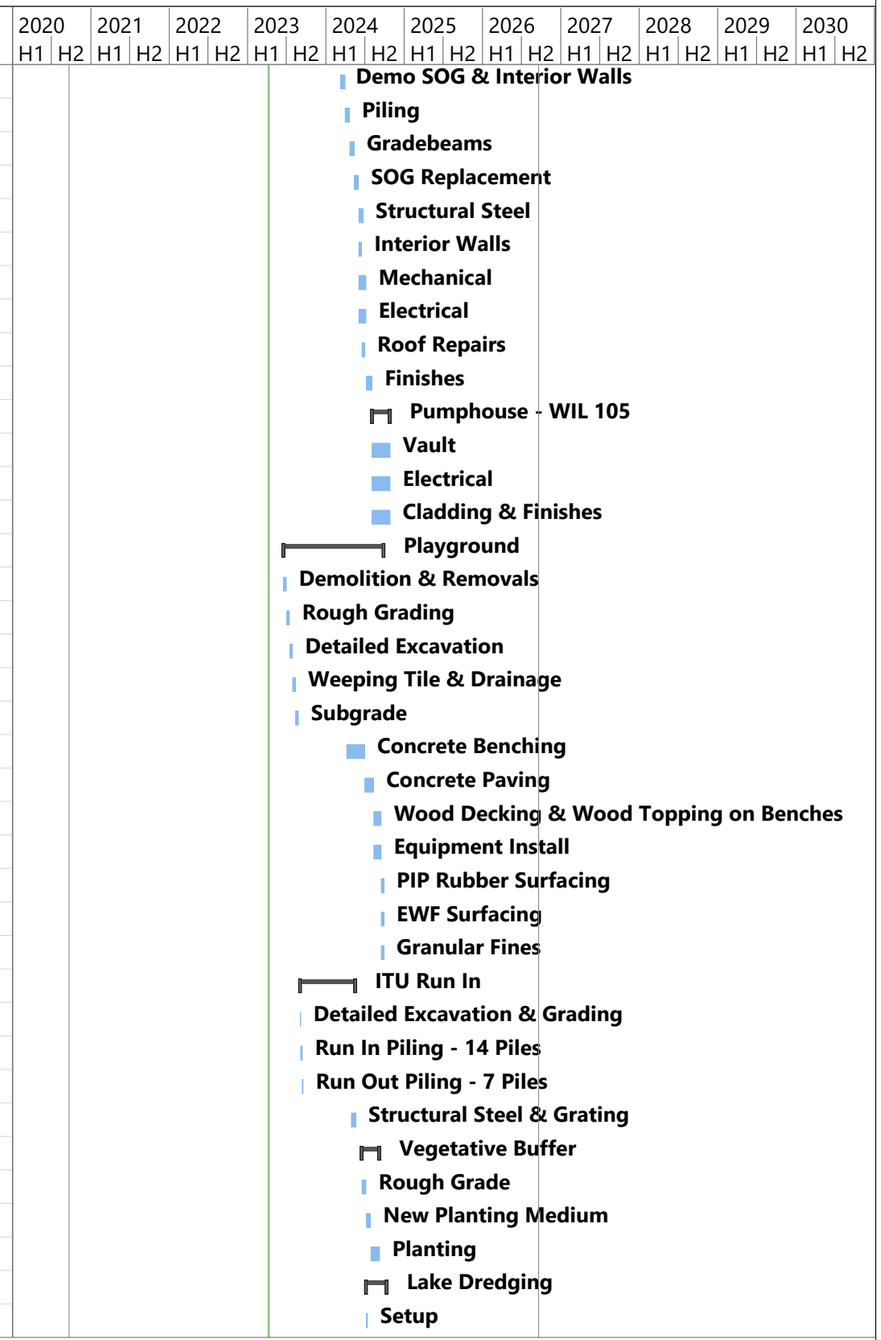
ID	Task Name	Duration	Start	Finish	Predecessors	Successors	% Complete
341	Flooring	20 days	Mon 06/05/24	Fri 31/05/24	340		0%
342	**Boathouse - WIL 104**	**310 days**	**Mon 14/08/23**	**Fri 18/10/24**			**0%**
343	**Boathouse Deck**	**130 days**	**Mon 22/04/24**	**Fri 18/10/24**			**0%**
344	Subgrade	10 days	Mon 22/04/24	Fri 03/05/24	326	345	0%
345	Weeping Tile	10 days	Mon 06/05/24	Fri 17/05/24	344	346	0%
346	Area Drains	10 days	Mon 20/05/24	Fri 31/05/24	345	347	0%
347	Underslab M&E	10 days	Mon 03/06/24	Fri 14/06/24	346	348	0%
348	Deck Slab	45 days	Mon 17/06/24	Fri 16/08/24	347	349	0%
349	Planters & Benching	45 days	Mon 19/08/24	Fri 18/10/24	348		0%
350	**Boathouse**	**205 days**	**Mon 14/08/23**	**Fri 24/05/24**			**0%**
351	Piling & Foundations	30 days	Mon 14/08/23	Fri 22/09/23	257	352	0%
352	New Walls	15 days	Mon 25/09/23	Fri 13/10/23	351	353,354FF,355	0%
353	Curtain Wall & Glazing	25 days	Mon 16/10/23	Fri 17/11/23	352		0%
354	Roof	20 days	Mon 18/09/23	Fri 13/10/23	352FF		0%
355	Mechanical	100 days	Mon 16/10/23	Fri 01/03/24	352	357	0%
356	Electrical	100 days	Mon 16/10/23	Fri 01/03/24	352	357	0%
357	Finishes	40 days	Mon 04/03/24	Fri 26/04/24	355,356	358	0%
358	Flooring	20 days	Mon 29/04/24	Fri 24/05/24	357		0%
359	**Amphitheatre - WIL 102**	**165 days**	**Mon 08/04/24**	**Fri 22/11/24**			**0%**
360	**Amphitheatre Washroom**	**120 days**	**Mon 08/04/24**	**Fri 20/09/24**			**0%**
361	Excavation	5 days	Mon 08/04/24	Fri 12/04/24	333FS-2 mons,281	362,372SS	0%
362	Piling & Foundations	30 days	Mon 15/04/24	Fri 24/05/24	361	365,363,373,3	0%
363	Plumbing	10 days	Mon 27/05/24	Fri 07/06/24	362	364	0%
364	Slab Repair	10 days	Mon 10/06/24	Fri 21/06/24	363	368,369	0%
365	Walls	25 days	Mon 27/05/24	Fri 28/06/24	362	366,367,368,3	0%
366	Membrane Repair	5 days	Mon 01/07/24	Fri 05/07/24	365	367	0%
367	Wood Cladding	15 days	Mon 08/07/24	Fri 26/07/24	365,366		0%
368	Mechanical	30 days	Mon 01/07/24	Fri 09/08/24	364,365	370	0%
369	Electrical	30 days	Mon 01/07/24	Fri 09/08/24	364,365	370	0%
370	Finishes	30 days	Mon 12/08/24	Fri 20/09/24	368,369		0%
371	**Amphitheatre Backstage/Green Room**	**135 days**	**Mon 08/04/24**	**Fri 11/10/24**			**0%**
372	Canopy Removal	5 days	Mon 08/04/24	Fri 12/04/24	361SS		0%
373	Piling	10 days	Mon 27/05/24	Fri 07/06/24	362	374,380,387	0%
374	Foundation/New Ramp	30 days	Mon 10/06/24	Fri 19/07/24	373	375,376,377	0%
375	Interior Walls	30 days	Mon 22/07/24	Fri 30/08/24	374	378	0%
376	Mechanical	30 days	Mon 22/07/24	Fri 30/08/24	374	378	0%
377	Electrical	30 days	Mon 22/07/24	Fri 30/08/24	374	378	0%
378	Finishes	30 days	Mon 02/09/24	Fri 11/10/24	375,376,377		0%



ID	Task Name	Duration	Start	Finish	Predecessors	Successors	% Complete
379	**Chair Storage Facility**	**80 days**	**Mon 10/06/24**	**Fri 27/09/24**			**0%**
380	Foundation	25 days	Mon 10/06/24	Fri 12/07/24	373	381	0%
381	Walls	25 days	Mon 15/07/24	Fri 16/08/24	380	382,383,384,3	0%
382	Roof	15 days	Mon 19/08/24	Fri 06/09/24	381	383,384,385	0%
383	Cladding	15 days	Mon 09/09/24	Fri 27/09/24	381,382		0%
384	Mechanical	15 days	Mon 09/09/24	Fri 27/09/24	381,382		0%
385	Electricalk	15 days	Mon 09/09/24	Fri 27/09/24	381,382		0%
386	**Amphiteatre Feature Wall**	**120 days**	**Mon 10/06/24**	**Fri 22/11/24**			**0%**
387	Concrete	40 days	Mon 10/06/24	Fri 02/08/24	373	388	0%
388	Wood	80 days	Mon 05/08/24	Fri 22/11/24	387		0%
389	**Theater**	**120 days**	**Mon 27/05/24**	**Fri 08/11/24**			**0%**
390	Slabs	120 days	Mon 27/05/24	Fri 08/11/24	362		0%
391	Bunkers	120 days	Mon 27/05/24	Fri 08/11/24	362		0%
392	Lighting	120 days	Mon 27/05/24	Fri 08/11/24	362		0%
393	Seats	120 days	Mon 27/05/24	Fri 08/11/24	362		0%
394	**Shelter #3 - WIL 106**	**105 days**	**Mon 29/01/24**	**Fri 21/06/24**			**0%**
395	Demo Existing SOG and Gradebeams	15 days	Mon 29/01/24	Fri 16/02/24	318	396,406	0%
396	Piling	15 days	Mon 19/02/24	Fri 08/03/24	395	397	0%
397	Gradebeams	15 days	Mon 11/03/24	Fri 29/03/24	396	398	0%
398	SOG	15 days	Mon 01/04/24	Fri 19/04/24	397	399,400,401,4	0%
399	Interior Walls	15 days	Mon 22/04/24	Fri 10/05/24	398	404	0%
400	Skylights	10 days	Mon 22/04/24	Fri 03/05/24	398	403	0%
401	Mechanical	25 days	Mon 22/04/24	Fri 24/05/24	398	404	0%
402	Electrical	25 days	Mon 22/04/24	Fri 24/05/24	398	404	0%
403	Roof Repairs	10 days	Mon 06/05/24	Fri 17/05/24	400		0%
404	Finishes	20 days	Mon 27/05/24	Fri 21/06/24	399,401,402		0%
405	**Shelter #2 - WIL 108**	**105 days**	**Mon 19/02/24**	**Fri 12/07/24**			**0%**
406	Demo SOG & Interior Walls	15 days	Mon 19/02/24	Fri 08/03/24	395	407,417	0%
407	Piling	15 days	Mon 11/03/24	Fri 29/03/24	406	408	0%
408	Gradebeams	15 days	Mon 01/04/24	Fri 19/04/24	407	409	0%
409	SOG Replacement	15 days	Mon 22/04/24	Fri 10/05/24	408	410,411,412,4	0%
410	Structural Steel	15 days	Mon 13/05/24	Fri 31/05/24	409	415	0%
411	Interior Walls	10 days	Mon 13/05/24	Fri 24/05/24	409	414	0%
412	Mechanical	25 days	Mon 13/05/24	Fri 14/06/24	409	415	0%
413	Electrical	25 days	Mon 13/05/24	Fri 14/06/24	409	415	0%
414	Roof Repairs	10 days	Mon 27/05/24	Fri 07/06/24	411		0%
415	Finishes	20 days	Mon 17/06/24	Fri 12/07/24	410,412,413		0%
416	**Shelter #1 - WIL 107**	**105 days**	**Mon 11/03/24**	**Fri 02/08/24**			**0%**



ID	Task Name	Duration	Start	Finish	Predecessors	Successors	% Complete
417	Demo SOG & Interior Walls	15 days	Mon 11/03/24	Fri 29/03/24	406	418	0%
418	Piling	15 days	Mon 01/04/24	Fri 19/04/24	417	419	0%
419	Gradebeams	15 days	Mon 22/04/24	Fri 10/05/24	418	420	0%
420	SOG Replacement	15 days	Mon 13/05/24	Fri 31/05/24	419	421,422,423,4	0%
421	Structural Steel	15 days	Mon 03/06/24	Fri 21/06/24	420	426	0%
422	Interior Walls	10 days	Mon 03/06/24	Fri 14/06/24	420	425	0%
423	Mechanical	25 days	Mon 03/06/24	Fri 05/07/24	420	426	0%
424	Electrical	25 days	Mon 03/06/24	Fri 05/07/24	420	426	0%
425	Roof Repairs	10 days	Mon 17/06/24	Fri 28/06/24	422		0%
426	Finishes	20 days	Mon 08/07/24	Fri 02/08/24	421,423,424	428	0%
427	**Pumphouse - WIL 105**	**60 days**	**Mon 05/08/24**	**Fri 25/10/24**			**0%**
428	Vault	3 mons	Mon 05/08/24	Fri 25/10/24	426	429SS,430SS	0%
429	Electrical	3 mons	Mon 05/08/24	Fri 25/10/24	428SS		0%
430	Cladding & Finishes	3 mons	Mon 05/08/24	Fri 25/10/24	428SS		0%
431	**Playground**	**335 days**	**Mon 19/06/23**	**Fri 27/09/24**			**0%**
432	Demolition & Removals	10 days	Mon 19/06/23	Fri 30/06/23	276SS	433	0%
433	Rough Grading	10 days	Mon 03/07/23	Fri 14/07/23	432	434	0%
434	Detailed Excavation	10 days	Mon 17/07/23	Fri 28/07/23	433	435	0%
435	Weeping Tile & Drainage	10 days	Mon 31/07/23	Fri 11/08/23	434	436	0%
436	Subgrade	10 days	Mon 14/08/23	Fri 25/08/23	435	437FS+8 mons	0%
437	Concrete Benching	60 days	Mon 08/04/24	Fri 28/06/24	436FS+8 mons	438,439,440	0%
438	Concrete Paving	30 days	Mon 01/07/24	Fri 09/08/24	437	439,440	0%
439	Wood Decking & Wood Topping on Benches	25 days	Mon 12/08/24	Fri 13/09/24	437,438		0%
440	Equipment Install	25 days	Mon 12/08/24	Fri 13/09/24	437,438	441,442,443	0%
441	PIP Rubber Surfacing	10 days	Mon 16/09/24	Fri 27/09/24	440		0%
442	EWF Surfacing	10 days	Mon 16/09/24	Fri 27/09/24	440		0%
443	Granular Fines	10 days	Mon 16/09/24	Fri 27/09/24	440		0%
444	**ITU Run In**	**185 days**	**Mon 04/09/23**	**Fri 17/05/24**			**0%**
445	Detailed Excavation & Grading	2 days	Mon 04/09/23	Tue 05/09/23	314	446	0%
446	Run In Piling - 14 Piles	5 days	Wed 06/09/23	Tue 12/09/23	445	447,448FS+8 m	0%
447	Run Out Piling - 7 Piles	3 days	Wed 13/09/23	Fri 15/09/23	446	448FS+8 mons	0%
448	Structural Steel & Grating	15 days	Mon 29/04/24	Fri 17/05/24	446FS+8 mons,447		0%
449	**Vegetative Buffer**	**60 days**	**Mon 17/06/24**	**Fri 06/09/24**			**0%**
450	Rough Grade	15 days	Mon 17/06/24	Fri 05/07/24	319	451,454	0%
451	New Planting Medium	15 days	Mon 08/07/24	Fri 26/07/24	450	452	0%
452	Planting	30 days	Mon 29/07/24	Fri 06/09/24	451		0%
453	**Lake Dredging**	**70 days**	**Mon 08/07/24**	**Fri 11/10/24**		**465,472**	**0%**
454	Setup	5 days	Mon 08/07/24	Fri 12/07/24	450	455	0%

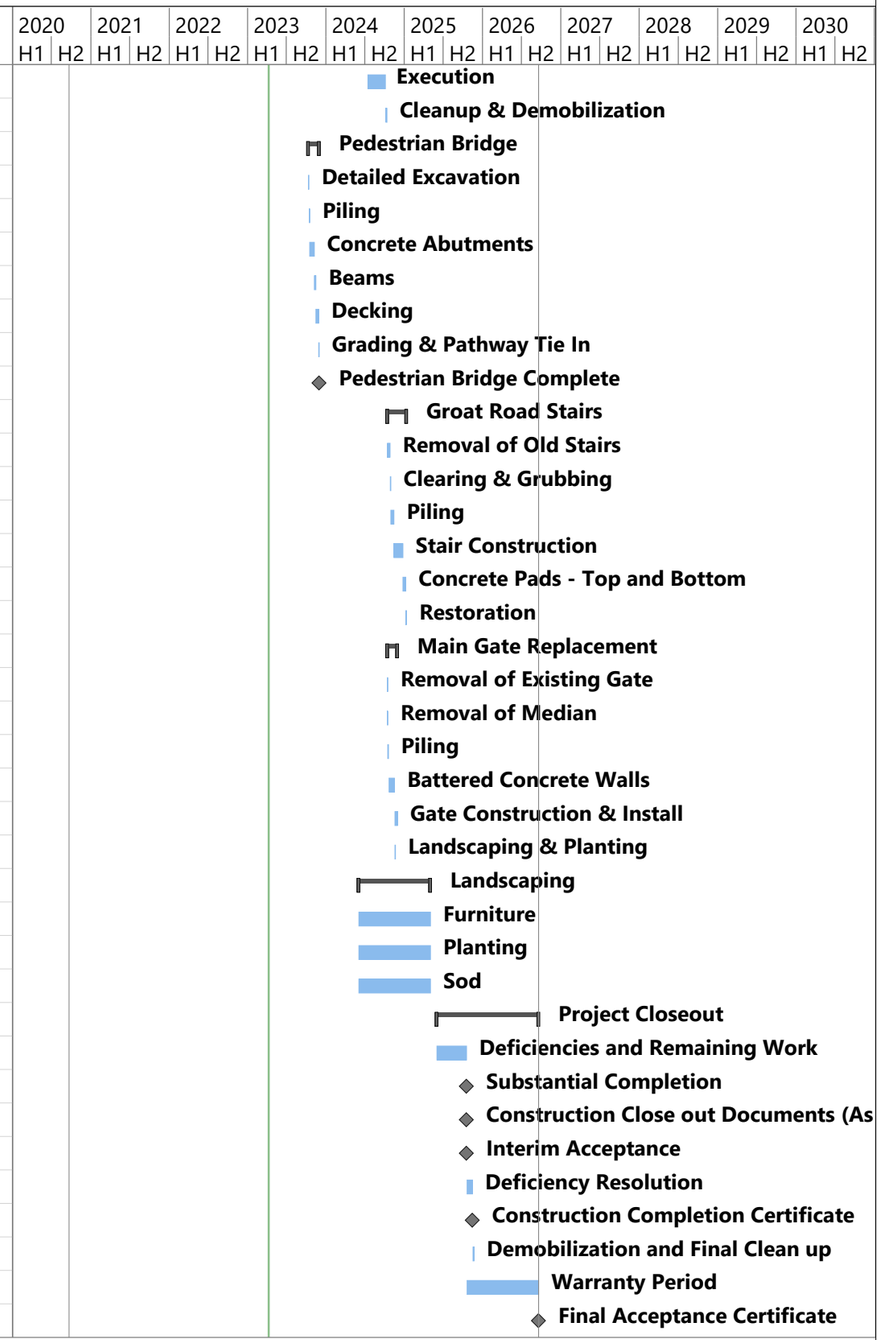


CHANDOS

William Hawrelak Park Rehabilitation
Draft Construction Schedule

THE CITY OF Edmonton

ID	Task Name	Duration	Start	Finish	Predecessors	Successors	% Complete
455	Execution	60 days	Mon 15/07/24	Fri 04/10/24	454	456	0%
456	Cleanup & Demobilization	5 days	Mon 07/10/24	Fri 11/10/24	455		0%
457	**Pedestrian Bridge**	**36 days**	**Thu 12/10/23**	**Thu 30/11/23**		**465,472**	**0%**
458	Detailed Excavation	2 days	Thu 12/10/23	Fri 13/10/23	459SS-2 days		0%
459	Piling	2 days	Mon 16/10/23	Tue 17/10/23	317	460,458SS-2 da	0%
460	Concrete Abutments	15 days	Wed 18/10/23	Tue 07/11/23	459	461	0%
461	Beams	5 days	Wed 08/11/23	Tue 14/11/23	460	462	0%
462	Decking	10 days	Wed 15/11/23	Tue 28/11/23	461	463	0%
463	Grading & Pathway Tie In	2 days	Wed 29/11/23	Thu 30/11/23	462	464	0%
464	Pedestrian Bridge Complete	0 days	Thu 30/11/23	Thu 30/11/23	463		0%
465	**Groat Road Stairs**	**65 days**	**Mon 14/10/24**	**Fri 10/01/25**	**453,457**		**0%**
466	Removal of Old Stairs	10 days	Mon 14/10/24	Fri 25/10/24	277	467	0%
467	Clearing & Grubbing	2 days	Mon 28/10/24	Tue 29/10/24	466	468	0%
468	Piling	10 days	Wed 30/10/24	Tue 12/11/24	467	469	0%
469	Stair Construction	30 days	Wed 13/11/24	Tue 24/12/24	468	470	0%
470	Concrete Pads - Top and Bottom	10 days	Wed 25/12/24	Tue 07/01/25	469	471	0%
471	Restoration	3 days	Wed 08/01/25	Fri 10/01/25	470		0%
472	**Main Gate Replacement**	**35 days**	**Mon 14/10/24**	**Fri 29/11/24**	**453,457**		**0%**
473	Removal of Existing Gate	2 days	Mon 14/10/24	Tue 15/10/24	277	474SS,475	0%
474	Removal of Median	2 days	Mon 14/10/24	Tue 15/10/24	473SS	475	0%
475	Piling	3 days	Wed 16/10/24	Fri 18/10/24	473,474	476	0%
476	Battered Concrete Walls	20 days	Mon 21/10/24	Fri 15/11/24	475	477,478	0%
477	Gate Construction & Install	10 days	Mon 18/11/24	Fri 29/11/24	476		0%
478	Landscaping & Planting	3 days	Mon 18/11/24	Wed 20/11/24	476		0%
479	**Landscaping**	**240 days**	**Mon 03/06/24**	**Fri 02/05/25**			**0%**
480	Furniture	12 mons	Mon 03/06/24	Fri 02/05/25	149,155,210	481SS,482SS,4	0%
481	Planting	12 mons	Mon 03/06/24	Fri 02/05/25	480SS	484	0%
482	Sod	12 mons	Mon 03/06/24	Fri 02/05/25	480SS	484	0%
483	**Project Closeout**	**340 days**	**Mon 02/06/25**	**Fri 18/09/26**			**0%**
484	Deficiencies and Remaining Work	5 mons	Mon 02/06/25	Fri 17/10/25	480,481,482	485,488,487,4	0%
485	Substantial Completion	0 days	Fri 17/10/25	Fri 17/10/25	484		0%
486	Construction Close out Documents (As builts, O&M Manual)	0 days	Fri 17/10/25	Fri 17/10/25	484FF		0%
487	Interim Acceptance	0 days	Fri 17/10/25	Fri 17/10/25	484	491	0%
488	Deficiency Resolution	1 mon	Mon 20/10/25	Fri 14/11/25	484	490,489	0%
489	Construction Completion Certificate	0 days	Fri 14/11/25	Fri 14/11/25	488		0%
490	Demobilization and Final Clean up	1 wk	Mon 17/11/25	Fri 21/11/25	488		0%
491	Warranty Period	12 mons	Mon 20/10/25	Fri 18/09/26	487	492	0%
492	Final Acceptance Certificate	0 days	Fri 18/09/26	Fri 18/09/26	491		0%



Appendix 12. Public Tree Permit 465610386-001

Public Tree Permit - Issued

This document is a record of a Public Tree Permit application, and a record of decision for the undertaking described below, subject to the limitations and conditions of this permit, in accordance with the Public Tree Bylaw 18825.

Applicant

CHANDOS CONSTRUCTION LTD
Care of: ANDREW MURPHY
9604 - 20 AVENUE NW
EDMONTON, ALBERTA CANADA T6N 1G1

Property Address(es) and Legal Description(s)

9330 - GROAT ROAD NW
Plan 6075AM Blk X

Location(s) of Work

Neighbourhood: RIVER VALLEY MAYFAIR

Scope of Permit

To conduct Above-ground & Below-ground Work work within 5 metres of a blvd/open-space tree & 10 metres of a natural stand, at the location specified in this permit, and according to the associated Tree Preservation Plan(s).

Permit Details

Blanket Permit: No
Project Type: Commercial/Residential Construction
Work Type: Above-ground & Below-ground Work

Plan Type: Tree Preservation
Related Permit #:
Working Within: 5 metres of a blvd/open-space tree & 10 metres of a natural stand

Public Tree Permit Decision

Issued

Issue Date:

Decision By: BAYUS, ERIN, LACEY, LAURIE

Start Date: Mar 13, 2023

Expiry Date: Nov 30, 2023

Public Tree Permit - Issued

Conditions of Approval

April 4, 2023 - Public Tree Permit Conditions.

1. The project EIA must be complete and have no conditions requiring tree removals to be postponed.

2. All mitigation measures and comments in the EIA must be followed.

3. This Permit applies to the first phase of work including deep utility work and work within the amphitheater, the maintenance yard, and ring road milling. A complete tree preservation plan that encompasses the entire work area and project impacts will need to be submitted for all other tree removal work.

4. Going forward, the Tree Preservation Plan will be the document that Urban Foresters will consult and it is expected to have most up to date information including all work expected within a 4-6 week (and beyond) window. It is expected that there is a high level of communication and transparency regarding work near trees.

5. Bird surveys must be completed and approved prior to all tree removals. These surveys shall be completed by certified biologists.

6. The Preservation Plan submitted for this permit speaks to a hired consulting arborist and is considered a fluid document, until it is all encompassing of all phases, and scopes of work including demolition, pre-construction, construction, restoration and landscaping, it is expected that the certified ISA arborist will consult with the project on a weekly or biweekly basis to make updates to the tree preservation plan as needed.

7. The consulting Arborist is expected to be most up to date with ongoing work and involved with weekly construction meetings to minimize communication breakdowns between groups.

8. Given that the Preservation Plan is guided more by frameworks, there is a zero tolerance for infractions that may cause damage to retained trees and Bylaw will be involved.

9. Additional tree protection may be required than what is shown on site plans. This will include trees that may be outside of 5/10m of work but that Urban Foresters require protection around in order to limit accidental access.

10. If an area is not fenced and vehicles or equipment encroach within 5/10 m of a tree, remediation may be required in accordance with C456C.

11. The Tree Protection Zone Table may be used in the place of Figure 1. Conceptual Tree Preservation Framework

12. Additional anticompaction measures may be required than what is listed in the Plan.

13. Fences shall not be moved for any reason without approved anticompaction and consultation with Urban Forester.

14. Further information is needed for restoration. Note: All trees planted as part of this project will have a 2 year maintenance period to allow for establishment. Even if the park is open, the maintenance (watering, weed control) of plantings is expected. Signage and Fencing may be used to educate the public on the restoration efforts and minimize human/dog trampling if necessary.

15. Natural Area information was largely compiled using available digital information and may not be accurate. Further consultation for any work within 10 m of natural stands is required.

16. Any updates throughout the length of the project will require to be uploaded to the Self-Serve System and may require redline recirculations in order for the Tree Permit to remain approved (once approved).

17. Conditions may be added to this permit as needed.

Public Tree Permit - Issued

Standard Permit Conditions

- All work will be in accordance with the approved Tree Protection Plan(s) or Tree Preservation Plan(s) (each or collectively, a "Plan") for the duration of the permit.
- Where the permit holder contracts with contractors/subcontractors to work on site, the permit holder is responsible for maintaining tree protection/preservation measures on site.
- Any changes to the approved Plan, permit dates or other conditions require approval by a City of Edmonton Urban Forester. For blanket permits, changes will not be approved within 60 days of permit expiry.
- Unless approved by an Urban Forester, any hoarding (tree or other) and scaffolding used in construction work must NOT be in physical contact with trees.
- No arboricultural work on City Trees is permitted without the authorization of a City of Edmonton Urban Forester. "Arboricultural work" includes, but is not limited to, maintenance of or treatments to the tree such as pruning, removal/clearing, watering, root exposure/cutting, or damage repair.
    - The permit holder must contact a City of Edmonton Urban Forester to request the City to complete any required clearance pruning or root pruning, prior to the permit holder commencing project work.
    - Any arboricultural work requested by the permit holder on City trees under the scope of this permit is subject to cost recovery.
- Any damages to City trees (above or below ground) under the scope of this permit are to be reported to 311 within 24 hours. This includes incidental exposure of structural roots (greater than 5cm diameter) through excavation activities.
- Any damages/loss to City trees under the scope of this permit are subject to recovery through a claim for equitable compensation as calculated under the *Guidelines for the Evaluation of Trees*, or the *Natural Stand Valuation Guidelines*, as applicable.
- A copy of the Public Tree Permit or the permit number must be produced upon request when work on site is occurring (digital versions acceptable).
- Backfill and topsoil must be level with the surrounding grade and otherwise comply with all soil specifications outlined in the current version of *Volume 5 - Landscape Design and Construction Standards*.
- Upon completion of the work, all tree protection measures are to be removed within two business days.
- For blanket permits only, the permit holder must update the list of work sites under this permit on a weekly basis, through the Self-Service Portal (https://selfserve.edmonton.ca).
    - For unplanned "emergency" work, the permit holder will report the work and location to 311 within 24 hours, and subsequently enter it into the Self-Service Portal (https://selfserve.edmonton.ca) at the next weekly update. ("Emergency" work is for situations that involve an immediate threat to human health and safety, risk of major property or environmental damage, or interruption of critical services.)
- For blanket permits only, planned excavations 0-3m from an open space/boulevard tree or 0-5m from a natural stand, are NOT covered under this permit. A separate Public Tree Permit application using a Tree Preservation Plan is required for each site where such work is planned.
- All work carried out at the work location(s) set out under this permit are subject to inspection by the City of Edmonton to assess compliance with the conditions of this permit.
- For additional information related to public tree permits and operational guidelines, visit https://www.edmonton.ca/TreePermit

Appendix 13. Technical References

Appendix 13. Technical References

1. ANSI A300 (Part 1) – 2008 American National Standard for Tree Care Operations – Tree, Shrub, and other Woody Plant Management – Standard Practices (Pruning).

2. City of Edmonton Corporate Tree Management Policy C456A. Adopted by City Council April 30, 2019.

3. Design and Construction Standards. Volume 5 Landscaping. June 2017 Edition.

4. Guidelines for Evaluation of Trees. City Operations Department. Updated March 2020.

5. Guide for Plant Appraisal. 9th Edition. Council of Tree Landscape Appraisers. International Society of Arboriculture.

6. Tree Preservation Guidelines – Open Space Operations – Last Update: October 2019.

7. Boulevard Tree Protection Zone. LA 101. June 2017.

8. Hiratsuka (1987), Forest Tree Diseases of the Prairie provinces, pp 88-89.

9. Temporary Erosion and Sediment Control Plan. March 2023. William Hawrelak Park Rehabilitation 2022. CPP Environmental.

10. Guide to Ecological Sites of the Dry Mixedwood Subregion. 2021. Willoughby, M.G. et.al. Alberta Government.

11. Urban Ecological Field Guide for the City of Edmonton, Alberta, Canada. 2015. Parks and Biodiversity Section, Sustainable Development.

12. Canadian Food Inspection Agency. 2008. Invasive Alien Plants in Canada. CFIA. Ottawa. Ontario.

13. Urban Primary Land and Vegetation Inventory (uPLVI). 2015. City of Edmonton. https://data.edmonton.ca/stories/s/uPLVI-Information-Portal/3fsu-hkrk/. Edmonton. Alberta.

14. Adams, B.W., G. Ehlert, C. Stone, M. Alexander, D. Lawrence, M. Willoughby, D. Moisey, C. Hincz, A. Burkinshaw, J. Richman, K. France, C. DeMaere, T. Kupsch, T. France, T. Broadbent, L. Blonski, A. J. Miller. 2016. Rangeland Health Assessment for Grassland, Forest and Tame Pasture. AEP, Rangeland Resource Stewardship Section.

15. QGIS Development Team. 2023. QGIS Geographic Information System. Open-Source Geospatial Foundation Project. http://qgis.osgeo.org.

16. City of Edmonton Erosion and Sedimentation Control Field Manual (January 2005).

17. Alberta Transportation erosion and sediment control manual, Appendix C – Erosion and Sediment Control Best Management Practices (BMPs). 2011. Alberta Transportation.

18. Fish Habitat Manual – guidelines and procedures for watercourse crossings in Alberta. 2009. Government of Alberta.