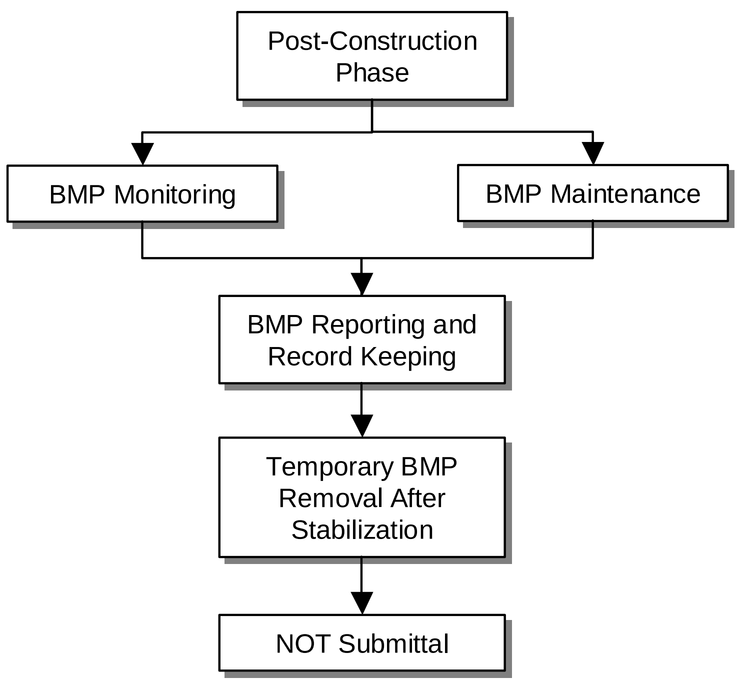
Section 4
Erosion and Sediment Control Post-Construction Phase Process

Overview of Erosion and Sediment Control Post-Construction

The post-construction phase of a project addresses monitoring, maintenance, and removal of temporary erosion and sediment control BMPs after construction activities are completed. During the post-construction phase of a project, the long-term maintenance of BMPs is performed and corrective measures are taken to ensure that the BMPs perform their intended objective of preventing erosion and sedimentation in areas disturbed during construction activities. Post-construction activities include, but are not limited to, monitoring BMP effectiveness; removal of excess sediment trapped by BMPs; monitoring and maintenance of revegetation areas; repair and replacement of damaged BMPs; and removal of BMPs that are no longer required. Failure to properly address the long-term reclamation and erosion and sediment controls of a disturbed site can result in years of environmental damage both on the site and downgradient of the site. A brief overview of the post-construction phase processes as it relates to erosion and sediment control is shown below.



MDT Responsibilities

Following construction close-out, MDT becomes solely responsible for the project, unless maintenance agreements were made with Contractors or other outside organizations. At the project close-out, the project responsibilities are transferred from the Construction Bureau to the Maintenance Division. The Maintenance Division is now responsible for ensuring that all post-construction BMPs are functioning properly, and that permanent and temporary BMPs are monitored and maintained to control erosion and sedimentation. The Maintenance Division is also required to submit a Notice of Termination (NOT) to the regulatory agency.

Contractor Responsibilities

Once MDT has approved the project close-out, the Contractor has minimal if any responsibility for post-construction. The Contractor may be required by MDT to complete some tasks that were not completed during the project close-out. Additionally, the Contractor, or another agency may be brought in to perform routine maintenance on post-construction BMPs. It is important that the Maintenance Division be involved with the final Contractor close-out inspections to ensure that all the repairs were completed prior to responsibility transfer to the Maintenance Division.

Regulatory Agencies Responsibilities

DEQ is the primary regulatory agency involved with the post-construction phase monitoring of BMPs and the protection of surface waters from sedimentation and other pollution related to construction activities for sites not located on Tribal land. DEQ issues a NOT when a site is stabilized. Final stabilization of the site will be achieved when all soil disturbing activities at the site have been completed, and a vegetative cover has been established with a density of at least 70 percent of the pre-disturbance levels, or equivalent permanent, physical erosion reduction methods have been employed. DEQ is responsible to provide site inspections during and after construction activities.

BMP Monitoring/Maintenance Checklist

Yes No

Are BMPs accessible for monitoring and maintenance activities?

Is there evidence of excessive sediment loss or pollution from site?

Are slope stabilization BMPs effective in preventing excess erosion?

Are rills/gullies present on reclaimed slopes?

Do slope stabilization BMPs require maintenance to remove sediment?

Are additional or different BMPs required for slope stabilization?

Are sediment control BMPs effective in preventing excessive soil loss from site?

Is sediment laden water undercutting or bypassing BMPs?

Do sediment control BMPs require maintenance to remove sediment?

Are BMP materials in sufficient condition to work as designed?

Are any off-site conditions or activities negatively affecting on-site BMPs?

Is winterization of BMPs required?

Are wind control BMPs effective in reducing off-site dust?

Are there BMPs that can be removed?

Do sediment traps and desilting basins require sediment removal?

Have BMP monitoring report and maintenance forms been completed for each BMP?

Have maintenance follow-up action items been recorded?

BMP Removal Checklist

Yes No

Is site vegetation of adequate species and density (as specified by MDT Agronomist) to maintain soil stabilization?

Have any rills or gullies formed on reclaimed slopes since last monitoring event?

Is sediment still accumulating behind BMPs?

Are permanent BMPs (if any) functioning properly?

Can BMPs that are designed to collect small volumes of sediment be used in replacement of larger, more intrusive BMPs (e.g. replace silt fence with check dam)?

Section 5
Rules of Thumb

Rules of thumb consist of a variety of different tools to aid in the design and construction process. Within the rules of thumb are erosion and sediment control planning and design checklists, slope measurement tables, slope inclination conversion tables, and seeding application rate tables.

Slope Measurement Tables

Slope measurement tables, like the one listed below, are a useful tool during the design and construction of a variety of earthwork projects. Typically, plan sheets show the run to rise ratio. The table below shows the commonly used slopes with the correspondingly multiplication factor. The Pythagorean Theorem ($A^2 + B^2 = C^2$) describes the relationship between the run, rise, and slope length.

- **Run** is the horizontal change of the slope (A).
- **Rise** is the vertical change of the slope (B).
- **Slope length** at run length is the length of the slope using the run and rise factors (C).
- **Multiplication factor** is multiplied by the run to calculate the slope length.

Slope Measurement

Run	Rise	Slope Length	Multiplication Factor
20	1	20.025	1.00125
10	1	10.050	1.005
9	1	9.055	1.006
8	1	8.062	1.0078
7	1	7.071	1.0102
6	1	6.083	1.0138
5	1	5.099	1.0198
4	1	4.123	1.0308
3	1	3.162	1.0541
2	1	2.236	1.118
1.5	1	1.803	1.2018
1.25	1	1.601	1.2806
1	1	1.414	1.414
0.75	1	1.250	1.667
0.50	1	1.118	2.2361
0.25	1	1.031	4.1231

Slope Inclination Conversion Tables

Slope inclination conversion tables like the one listed below are another useful tool for design and construction of earthwork projects. They allow for the designer to gain another perspective of the slope and its correlation to erosion and sediment control. Three of these perspectives are the rise/run ratio, percent slope, and degree slope.

- **Rise** is the vertical distance used to measure slopes. This distance is usually set at a unit of one and the run is adjusted accordingly.

- **Run** is the horizontal distance used to measure slopes.

- **Run to rise ratio** is simply the run to rise correlation, i.e. 20:1 is 20 units of run for every unit of rise.
- **Percent slope** is the percentage difference between the run and the rise, i.e. a 20:1 slope would be 1 divided by 20, then multiplied by 100, to equal 5.0.
- **Degree slope** is the angle at the toe of the slope formed by the rise and the run. Since Tan θ equals rise over run, the slope in degrees can be calculated by taking the Tan^{-1} of the rise over the run.

Slope Inclination Conversion Worksheet

Run	Rise	Ratio	Percent	Degree
20	1	20:1	5.0	2.86
10	1	10:1	10.0	5.71
9	1	9:1	11.1	6.34
8	1	8:1	12.5	7.12
7	1	7:1	14.3	8.13
6	1	6:1	16.7	9.46
5	1	5:1	20.0	11.31
4	1	4:1	25.0	14.04
3	1	3:1	33.3	18.43
2	1	2:1	50.0	26.57
1.5	1	1.5:1	66.7	33.69
1.25	1	1.25:1	80.0	38.66
1	1	1:1	100.0	45.00
0.75	1	0.75:1	133.3	53.13
0.50	1	0.50:1	200.0	63.43
0.25	1	0.25:1	400.0	75.96

Seed Application Rate Tables

Seeding application rate tables can be found in the Detail Drawings (SS-4, and SS-15) shown in Section 3, Best Management Practices.

Conversion Tables (Metric ↔ English)

Area, Length, and Volume Conversion Factors

Quantity	From English Units	To Metric Units	Multiply By
Length	Mile	Km	<u>1.609 344</u>
	Yard	M	<u>0.914 4</u>
	Foot	M	<u>0.304 8</u>
	Foot	Mm	<u>304.8</u>
	Inch	Mm	<u>25.4</u>
Area	square mile	km^2	2.590
	Acre	m^2	4 046.856
	Acre	ha (10 000 m^2)	0.404 685 6
	square yard	m^2	<u>0.836 127 36</u>
	square foot	m^2	<u>0.092 903 04</u>
	square foot	ha (10 000 m^2)	<u>0.000 009 29</u>
	square inch	mm^2	<u>645.16</u>
Volume	acre foot	m^3	1 233.49
	cubic yard	m^3	0.764 555
	cubic foot	m^3	0.028 316 8
	cubic foot	cm^3	28 316.85
	cubic foot	L (1000 cm^3)	28.316 85
	100 board feet	m^3	0.235 974
	Gallon	L (1000 cm^3)	3.785 41
	1000 gallons	kL (1000 L)	3.785 41
	cubic inch	cm^3	<u>16.387 064</u>
	cubic inch	mm^3	<u>16 387.064</u>

NOTE: Underline denotes exact number

Civil and Structural Engineering Conversion Factors

Quantity	From English Units	To Metric Units	Multiply By
Mass	Lb kip (1000 lb)	kg metric ton (1000 kg)	0.453 592 0.453 592
Mass/unit length	Plf	kg/m	1.488 16
Mass/unit area	Psf	kg/m^2	4.882 43
Mass density	Pcf	kg/m^3	16.018 5
Force	Lb Kip	N kN	4.448 22 4.448 22
Force/unit length	Plf Klf	N/m kN/m	14.593 9 14.593 9
Pressure, stress, modulus of elasticity	Psf ksf psi ksi	Pa kPa kPa MPa	47.880 3 47.880 3 6.894 76 6.894 76
Bending moment, torque, moment of force	ft-lb ft-kip	N·m kN·m	1.355 82 1.355 82
Moment of mass	lb-ft	kg·m	0.138 255
Moment of inertia	$lb\text{-}ft^2$	$kg\cdot m^2$	0.042 140 1
Second moment of area	in^4 ft^4	mm^4 m^4	416 231 0.008 63
Section modulus	in^3	mm^3	<u>16 387.064</u>

NOTE: Underline denotes exact number.