Appendix M – Buffer Guidance.

Introduction

The purpose of this guidance is to assist you in complying with the requirements in Part 2.1.2 of the permit regarding the establishment of natural buffers or equivalent controls. This guidance provides you information on the following aspects of Part 2.1.2:

- What sites are required to comply with Part 2.1.2 (Section 1).
- How to comply with the three different compliance alternatives in Parts 2.1.2.1.a, 2.1.2.1.b, and 2.1.2.1.c (Section 2).

Part 2.1.2 of the permit requires that in order to minimize sediment discharges, if any waters of the U.S. are located on or immediately adjacent to your site, you must ensure that any discharges through the area between the disturbed portions of your site and such waters are treated by an area of undisturbed natural vegetation that alone or through the use of additional sediment and erosion controls achieves a reduction in sediment load equivalent to that achieved by a 50-foot buffer of undisturbed natural vegetation. To meet this requirement, you are provided with the following compliance alternatives:

Part 2.1.2.1.a: Provide and maintain a 50-foot buffer of undisturbed natural vegetation between the disturbed portions of your site and any waters of the U.S.; or

Part 2.1.2.1.b: Provide an undisturbed naturally vegetated buffer that is less than 50 feet between the disturbed portions of your site and any waters of the U.S. that is supplemented by additional sediment and erosion controls, which in combination achieves the equivalent sediment load reduction as a 50-foot buffer of undisturbed natural vegetation; or

Part 2.1.2.1.c: If it is infeasible to provide an undisturbed naturally vegetated buffer of any size between the disturbed portion of your site and any waters of the U.S., implement sediment and erosion controls that achieve the equivalent sediment load reduction as an undisturbed naturally vegetated, 50-foot buffer.

The compliance alternative selected above must be maintained throughout the duration of permit coverage. If you choose compliance alternative 2.1.2.1.a or 2.1.2.1.b, above, throughout your period of coverage under this permit you must keep the buffer naturally vegetated and no construction activities may be conducted in this area. All discharges through the buffer must be non-channelized or non-concentrated, and must first be treated by the site’s sediment and erosion controls.

If you choose to implement either alternative 2.1.2.1.b or 2.1.2.1.c, above, you must also comply with the following:

1. Provide documentation in your SWPPP of the buffer to be retained, and information supporting your compliance with the requirement to achieve the equivalent sediment reduction as an undisturbed naturally vegetated 50-foot buffer; and
2. Comply with stabilization deadlines that are tighter than the standard deadlines.

These requirements do not apply to the following types of construction projects, provided that you limit the area of disturbance to the minimum needed to complete the construction and to access the site, and that you retain natural vegetation in the buffer outside this area.
1. Construction of water crossings authorized under a CWA Part 404 permit (where required) for water lines, sewer lines, utility lines, and roadways;

2. Construction of water-dependent structures and water access areas (piers, boat ramps, etc.) approved under a CWA Part 404 permit (where required); or

3. Development of a site where no buffer area exists due to prior disturbances. For example, sites where all vegetation in the buffer area has been removed and replaced with impervious surfaces as a result of prior development are not subject to the buffer requirement at all.

You must also comply with any local or state requirements affecting construction in the buffer.

Section 1 – What Sites Are Required to Comply with Part 2.1.2

Part 2.1.2 applies to you only if there is a water of the U.S. within or immediately adjacent to your construction site. Therefore, you will first need to determine whether such a waterbody exists at your site.

To make a determination as to whether a particular water on or adjacent to your site is considered a “water of the U.S.”, you should refer to the following definition from EPA’s regulations (40 CFR 122.2) describing the types of waters that this definition encompasses:

1. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

2. All interstate waters including interstate wetlands;

3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairieponds, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
   (i) Which are or could be used by interstate or foreign travelers for recreational or other purposes; or
   (ii) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
   (iii) Which are used or could be used for industrial purposes by industries in interstate commerce;

4. All impoundments of waters otherwise defined as waters of the United States under this definition;

5. Tributaries of waters identified in paragraphs (s)(1) through (4) of this section;

6. The territorial sea;

7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (s)(1) through (6) of this section; waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR 423.11(m) which also meet the criteria of this definition) are not waters of the United States.

To help illustrate examples of sites that would be required to comply with the requirements in Part 2.1.2 due to their proximity to a water of the U.S., Figure 1 provides a depiction of a water of the
U.S. occurring within a site, while Figure 2 provides a depiction of a water of the U.S. located immediately adjacent to a site.

**Figure 1. Example of a water of the U.S. within the construction site.**

**Figure 2. Example of a water of the U.S. immediately adjacent to the construction site.**
Section 2 – How to Comply with the Buffer Alternatives

If in Section 1 you determine that your site is required to comply with the requirements in Part 2.1.2, you have three compliance alternatives from which to choose. In this section, EPA provides information to assist you in complying with these alternatives.

A. Compliance Alternative 2.1.2.1.a: 50-foot Naturally Vegetated Buffer

If you have chosen to comply with Part 2.1.2 by establishing and maintaining a 50-foot buffer surrounding waters of the U.S. on or immediately adjacent to your site, the following guidance is intended to assist you in complying with that requirement.

- Buffer Width Measurement
  The buffer must be established on both sides of the water of the U.S. to the extent that the buffer area occurs on your property. The 50-foot buffer area is measured horizontally from any of the following points, whichever is further landward from the water:

  1. The ordinary high water mark of the water body as indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris; or

  2. The edge of the stream or river bank, bluff, or cliff, whichever is applicable.

Refer to Figures 3 and 4. You may find that specifically measuring these points is challenging if the flow path of the waterbody changes frequently, thereby causing the 50-foot line for the buffer to fluctuate continuously along the path of the waterbody. Where this is the case, EPA suggests that rather than measuring each change or deviation along the water’s edge, it may be easier to select regular intervals from which to conduct your measurement. For instance, you may elect to conduct your buffer measurement every 5 to 10 feet along the length of the water.
Figure 3. This image shows buffer measurement from the ordinary high water mark of the water body, as indicated by a clear natural line impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation, and/or the presence of litter/debris.

Figure 4. This figure shows buffer measurement from the edge of the bank, bluff, or cliff, whichever is applicable.
• Natural Vegetation in the Buffer

Part 2.1.2.1 requires that the buffer remain naturally vegetated throughout your period of coverage under this permit. EPA recommends that whatever native vegetation exists in the buffer area at the time that construction activities are commenced be retained since this vegetation is likely already providing many of the water quality functions that are well documented for buffers. Similarly, EPA encourages you to maintain, and if necessary, restore the vegetation in your buffer so that the water quality protection benefits of the buffer are maximized. You are also encouraged to limit the removal of leaf litter, woody debris, and other biomass, as this material contributes to the ability of the buffer to retain water and filter pollutants.

You may also want to consider enhancements to the buffer area with targeted plantings or maintenance where either limited vegetation exists or where invasive or noxious plant species (see http://plants.usda.gov/java/noxiousDriver) have taken over. For instance, it is suggested that you remove invasive and non-native plant species in the buffer and establish a diversity of native trees, shrubs, and herbaceous plants that are well-adapted to the climatic, soil, and hydrologic conditions on the site.

Natural Vegetation Considerations in Arid/Semi-Arid Areas: The climatic, hydrologic, and topographic differences in arid/semi-arid areas influence buffer composition and function. In arid/semi-arid areas, buffers predominantly receive overland flow, and buffer vegetation is generally less dense than in non-arid areas. Buffers in arid/semi-arid areas play an important role in reducing stream channelization, and for that reason, should be designed to maximize their effectiveness at promoting sheet flow through vegetation establishment. Generally, the vegetative target for buffers in arid/semi-arid areas is narrow bands of trees and shrubs, as well as sparse drought-tolerant shrubs, grasses, and herbaceous vegetation. Buffer restoration goals in arid/semi-arid areas should be to stabilize stream banks through the establishment of dense native vegetation that is appropriate for the geomorphology, stream type, and native plant community.

Additional Considerations: Many factors influence the effectiveness of buffers in controlling stormwater discharges, apart from vegetation type and density, including, but not limited to:

- Slope gradient and length;
- Soil type and condition;
- Type of water body (buffers around headwater streams are particularly important);
- Climatic conditions;
- Contributing flow length and velocity; and
- Groundwater table.

When providing the buffer on your site, it is important to take into account your site-specific conditions to maximize its pollutant removal effectiveness.

• Limits to Disturbances Within the Buffer

To ensure that the water quality protection benefits of the buffer are provided during your period of permit coverage, Part 2.1.2.1 prohibits any earth-disturbing activities within the buffer. In furtherance of this requirement, prior to commencing earth-disturbing activities on your site you must clearly mark off all buffer areas with flags, tape, or a similar marking device. The purpose of this requirement is to make the buffer area clearly visible to the people working on your site in order to minimize the potential for any unintended disturbances.
EPA recognizes situations where disturbances within the buffer are unavoidable, including but not limited to the following minor disturbances:

- Buffer restoration and maintenance activities, which include those activities such as the removal of non-native or invasive species, and the establishment of native vegetation; and
- Stream restoration activities authorized under a CWA Part 404 permit.

Any impacts to the water quality protection effectiveness of the buffer from these minor disturbances should be minimized where possible.

In addition, if your project involves the construction of a water crossing or water-dependent structures, EPA reminds you that these types of buffer disturbances are authorized under the permit. For any of these buffer impacts, EPA requires that the disturbance be limited to the minimum needed to complete the construction and to access the site, and that you retain the natural vegetation in the buffer outside this area.

- **Discharges to the Buffer**

  Part 2.1.2.1 requires that any discharges to your buffer area be non-channelized or non-concentrated. The purpose of this requirement is to decrease the rate of stormwater flow, and increase the rate of infiltration within the buffer. To comply with this requirement, construction operators typically will use devices that physically dissipate stormwater flows so that the discharge entering the buffer will have the opportunity to remove sediment through infiltration. For instance, you may consider using a level spreader to comply with this requirement. Refer to [http://www.bae.ncsu.edu/stormwater/PublicationFiles/LevelSpreaders2006.pdf](http://www.bae.ncsu.edu/stormwater/PublicationFiles/LevelSpreaders2006.pdf), which is a useful reference to consider relating to the design, installation, and maintenance of level spreaders.

### B. Compliance Alternatives 2.1.2.1.b or 2.1.2.1.c: Equivalent Sediment Controls

As described above in the introduction, if it is impracticable or infeasible to retain a 50-foot buffer, you may comply in either of the following ways:

- **Part 2.1.2.1.b**: Provide an undisturbed naturally vegetated buffer that is less than 50 feet between the disturbed portions of your site and any waters of the U.S. that is supplemented by additional sediment and erosion controls, which in combination achieves the equivalent sediment load reduction as a 50-foot buffer of undisturbed natural vegetation.

- **Part 2.1.2.1.c**: If it is infeasible to provide an undisturbed naturally vegetated buffer of any size between the disturbed portion of your site and any waters of the U.S., implement sediment and erosion controls that achieve the equivalent sediment load reduction as an undisturbed naturally vegetated, 50-foot buffer

The information in this section is intended to assist you in complying with either of these two alternatives.

1. Determine whether it is feasible to provide a buffer of less than 50 feet:

   If you determine that it is impracticable or infeasible to comply with the compliance alternative in Part 2.1.2.1.a to provide and maintain 50 feet of buffer on your site, you must next determine if it is feasible to retain a vegetated buffer width of less than 50 feet. Making this determination will be highly site-specific. If you determine that you can retain a buffer of less than 50 feet, you must follow the requirements in Part 2.1.2.1.b to
provide supplemental sediment and erosion controls that, in combination with the buffer area retained, achieves an equivalent sediment load reduction as a 50-foot vegetated buffer. You must also comply with quicker stabilization deadlines for disturbances in the buffer area and additional documentation in your SWPPP (as well as your NOI). You are encouraged to retain as much buffer as possible on your site to maximize the water quality protection benefits and to minimize the additional controls needed on your site to achieve an equivalent reduction as the 50 foot buffer. For guidance on providing and maintain your buffer of less than 50 feet, refer to Section 2.A above in this Appendix. For any buffer width retained, you are reminded that prior to commencing earth-disturbing activities on your site you must comply with the requirement in Part 2.1.1.1 to clearly mark off all buffer areas with flags, tape, or a similar marking device.

EPA recognizes that there will be a number of situations in which it will be infeasible to provide and maintain a buffer of any width on a site. Some examples include, but are not limited to, the following:

- Prevailing patterns of development within the general, urbanized area have eliminated much of the buffer area;

- Subdivided lots exist entirely within the buffer thereby making the retention of vegetated areas infeasible; and

- The nature of the project requires close proximity to the waterfront (e.g., a marina, boardwalk).

Note: If pre-existing development on the site has resulted in significant disturbances within the 50-foot buffer (for example, sites where all vegetation in the 50-foot buffer area has been removed and replaced with impervious surfaces as a result of prior development), you are exempt from complying with the requirements in Part 2.1.2.

If you determine it is infeasible to provide a buffer of any size, then you must follow the requirements in Part 2.1.2.1.c. and must also provide supplemental sediment and erosion controls to achieve the equivalent sediment load reduction as a 50-foot vegetated buffer, as well as quicker stabilization in the buffer area and additional documentation in your SWPPP (as well as your NOI).

(2) Design Treatment to Provide Equivalent Sediment Reduction as 50-foot Buffer

If you have chosen either of the alternatives in Part 2.1.2.1.b or 2.1.2.1.c, you must next determine what additional controls must be implemented on your site that alone or in combination with any retained buffer vegetation achieve a reduction in sediment loads from stormwater flows discharged into the buffer area equivalent to that achieved by a 50-foot buffer of undisturbed natural vegetation. To comply with this requirement, you will be required to do the following:

1. Estimate the sediment reduction expected from your site if you had established a 50-foot, naturally vegetated buffer;

2. Design controls that alone or in combination with any width of buffer retained achieve the same sediment removal efficiency as that expected from the 50-foot buffer; and

3. Document in your SWPPP how site-specific controls will achieve the sediment removal efficiency of the 50-foot buffer.

Guidelines to help you work through these requirements are provided below.
Step 1: Estimate Sediment Reduction from the 50-foot Buffer

In order to design controls that match the sediment removal efficiency of a 50-foot buffer, you first need to know what this efficiency is for your site. The sediment removal efficiencies of vegetated buffers vary according to a number of site-specific factors, including precipitation, soil type, land cover, slope length, width, and steepness, and the types of sediment controls used to reduce sediment loads prior to the buffer. EPA has simplified this calculation by developing buffer performance tables covering a range of vegetative types and soil types for geographic areas covered by the CGP (Tables 1–8). The intent of these buffer performance tables is to provide the estimated sediment removal efficiency of natural buffers for the most commonly encountered conditions in your geographic area.

Using Tables 1–8, you can determine the sediment removal efficiency of a 50-foot buffer for your geographic area by matching the vegetative cover type that best describes your buffer area with the type of soils that predominate at your site. For example, if your site is located in Massachusetts (Table 2), and your buffer vegetation corresponds most closely with that of cool season dense grass, and the soil type at your site is best typified as sandy loam, your site’s sediment removal efficiency would be 99%. Note: buffer performance values in Tables 1–8 represent percent of sediment retained through the use of perimeter controls (i.e., silt fences) and 50-foot buffers at disturbed sites of fixed proportions and slopes. As perimeter controls are a standard requirement with or without a buffer (see Part 2.1.3.2.b), you must employ a perimeter control as a part of any alternative to the natural buffer.

Because of the wide variety of environmental conditions, including different soil types, slopes, and vegetation types that exist on any given site, you are provided the flexibility to use your professional judgment when choosing the closest match between your site’s vegetation and soil type in the table that matches your geographic location. The following Q&A’s are provided as guidance for using the buffer performance tables.

- **What if my specific buffer vegetation is not represented in Tables 1–8?** Tables 1-8 provide a wide range of factors affecting buffer performance; however, there may be instances where the specific buffer vegetation type on your site is not listed. If you do not see a description of the type of vegetation present at your site, you should choose the vegetation type that most closely matches the vegetation type on your site.

- **What if there is high variability in local soils?** EPA recognizes that there are a wide range of options when assessing the soil type(s) on construction sites. General soil information can be obtained from USDA soil survey reports or from individual site assessments performed by a certified soil expert. Tables 1–8 present eleven generic soil texture classes, grouping individual textures where EPA has determined that performance is similar. If your site contains different soil texture classes, you should use the soil type that best approximates the predominant soil type at your site.

- **What if my post-grading site slope is greater than 9 percent?** As indicated in the buffer performance tables, the estimated sediment removal efficiencies are valid for disturbed slopes up to 9 percent grade. Where your graded site has an average slope of greater than 9 percent, you will need to calculate a site-specific buffer performance using the model EPA used (i.e., RUSLE2) or a different model of your choosing.

- **How do I calculate my own estimates for sediment reduction at my specific site?** If you determine that it is necessary to calculate your own sediment removal efficiency using site-specific conditions (e.g., slopes at your site are greater than 9 percent), you
can do so by choosing from a range of available mathematical models that are available to facilitate this calculation, including USDA’s RUSLE-series programs and the WEPP erosion model, SEDCAD, SEDIMOT, or other equivalent models.

- What is my estimated buffer performance if my site location is not represented by Tables 1 – 8? If your site is located in an area not represented by Tables 1 – 8, you should use the table that most closely approximates conditions at your site. You may also choose to conduct your own, site-specific calculation using one of the mathematical models described above.

- What if only a portion of my site drains to the buffer area? If only a portion of your site drains to a water of the U.S. located on or immediately adjacent to your site, you are only required to meet the equivalency requirement for the stormwater flows corresponding to those portions of the site. See Example 2 below for an example of how this is expected to work.

Table 1. Estimated 50-foot Buffer Performance in Idaho*

<table>
<thead>
<tr>
<th>Type of Buffer Vegetation**</th>
<th>Estimated % Sediment Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clay</td>
</tr>
<tr>
<td>Tall Fescue Grass</td>
<td>42</td>
</tr>
<tr>
<td>Medium-density Weeds</td>
<td>28</td>
</tr>
<tr>
<td>Low-density Warm-season Native Bunchgrass (i.e., Grama Grass)</td>
<td>25</td>
</tr>
<tr>
<td>Northern Mixed Prairie Grass</td>
<td>28</td>
</tr>
<tr>
<td>Northern Range Cold Desert Shrubs</td>
<td>28</td>
</tr>
</tbody>
</table>

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation

Table 2 – Estimated 50-foot Buffer Performance in Massachusetts and New Hampshire*

<table>
<thead>
<tr>
<th>Type of Buffer Vegetation**</th>
<th>Estimated % Sediment Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clay</td>
</tr>
<tr>
<td>Warm-season Grass (i.e., Switchgrass, Lemongrass)</td>
<td>79</td>
</tr>
<tr>
<td>Cool-season Dense Grass (Kentucky Bluegrass, Smooth Bromegrass, Timothy)</td>
<td>78</td>
</tr>
<tr>
<td>Tall Fescue Grass</td>
<td>76</td>
</tr>
<tr>
<td>Medium-density Weeds</td>
<td>66</td>
</tr>
</tbody>
</table>

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation
### Table 3 – Estimated 50-foot Buffer Performance in New Mexico*

<table>
<thead>
<tr>
<th>Type of Buffer Vegetation **</th>
<th>Clay</th>
<th>Silty Clay or Clay-Loam</th>
<th>Sand</th>
<th>Sandy Clay Loam, Loamy Sand or Silty Clay</th>
<th>Loam, Silt, Sandy Loam or Silt Loam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tall Fescue grass</td>
<td>71</td>
<td>85</td>
<td>80</td>
<td>86</td>
<td>96</td>
</tr>
<tr>
<td>Medium-density Weeds</td>
<td>56</td>
<td>73</td>
<td>55</td>
<td>66</td>
<td>78</td>
</tr>
<tr>
<td>Low-density Warm-season Native Bunchgrass (i.e., Grama Grass)</td>
<td>53</td>
<td>70</td>
<td>51</td>
<td>62</td>
<td>67</td>
</tr>
<tr>
<td>Southern Mixed Prairie Grass</td>
<td>53</td>
<td>71</td>
<td>52</td>
<td>63</td>
<td>50</td>
</tr>
<tr>
<td>Southern Range Cold Desert Shrubs</td>
<td>56</td>
<td>73</td>
<td>55</td>
<td>65</td>
<td>53</td>
</tr>
</tbody>
</table>

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation

### Table 4 – Estimated 50-foot Buffer Performance in Washington, DC*

<table>
<thead>
<tr>
<th>Type of Buffer Vegetation **</th>
<th>Clay</th>
<th>Silty Clay or Clay-Loam</th>
<th>Sand</th>
<th>Sandy Clay Loam, Loamy Sand or Silty Clay</th>
<th>Loam, Silt, Sandy Loam or Silt Loam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm-season Grass (i.e., Switchgrass, Lemongrass)</td>
<td>82</td>
<td>95</td>
<td>97</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>Cool-season Dense Grass (Kentucky Bluegrass, Smooth Bromegrass, Timothy)</td>
<td>81</td>
<td>94</td>
<td>95</td>
<td>97</td>
<td>97</td>
</tr>
<tr>
<td>Tall Fescue Grass</td>
<td>79</td>
<td>91</td>
<td>83</td>
<td>89</td>
<td>92</td>
</tr>
<tr>
<td>Medium-density Weeds</td>
<td>71</td>
<td>79</td>
<td>66</td>
<td>75</td>
<td>74</td>
</tr>
</tbody>
</table>

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation

### Table 5 – Estimated 50-foot Buffer Performance in American Samoa*

<table>
<thead>
<tr>
<th>Type of Buffer Vegetation **</th>
<th>Clay</th>
<th>Silty Clay or Clay-Loam</th>
<th>Sand</th>
<th>Sandy Clay Loam, Loamy Sand or Silty Clay</th>
<th>Loam, Silt, Sandy Loam or Silt Loam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahiagrass (Permanent cover)</td>
<td>82</td>
<td>93</td>
<td>94</td>
<td>97</td>
<td>83</td>
</tr>
<tr>
<td>Warm-season Grass (i.e., Switchgrass, Lemongrass)</td>
<td>82</td>
<td>94</td>
<td>96</td>
<td>98</td>
<td>85</td>
</tr>
<tr>
<td>Dense Grass</td>
<td>82</td>
<td>93</td>
<td>92</td>
<td>95</td>
<td>83</td>
</tr>
<tr>
<td>Tall Fescue Grass</td>
<td>82</td>
<td>89</td>
<td>82</td>
<td>89</td>
<td>79</td>
</tr>
<tr>
<td>Medium-density Weeds</td>
<td>70</td>
<td>73</td>
<td>62</td>
<td>75</td>
<td>59</td>
</tr>
</tbody>
</table>

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation
Table 6 – Estimated 50-foot Buffer Performance in Guam*

<table>
<thead>
<tr>
<th>Type of Buffer Vegetation **</th>
<th>Clay</th>
<th>Silty Clay Loam or Clay-Loam</th>
<th>Sand</th>
<th>Sandy Clay Loam, Loamy Sand or Silty Clay</th>
<th>Loam, Silt, Sandy Loam or Silt Loam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahiagrass (Permanent cover)</td>
<td>80</td>
<td>94</td>
<td>94</td>
<td>96</td>
<td>89</td>
</tr>
<tr>
<td>Warm-season Grass (i.e., Switchgrass, Lemongrass)</td>
<td>80</td>
<td>94</td>
<td>96</td>
<td>97</td>
<td>91</td>
</tr>
<tr>
<td>Dense Grass</td>
<td>79</td>
<td>93</td>
<td>90</td>
<td>94</td>
<td>89</td>
</tr>
<tr>
<td>Tall Fescue Grass</td>
<td>76</td>
<td>90</td>
<td>80</td>
<td>88</td>
<td>87</td>
</tr>
<tr>
<td>Medium-density Weeds</td>
<td>63</td>
<td>73</td>
<td>53</td>
<td>68</td>
<td>61</td>
</tr>
</tbody>
</table>

* Applicable for sites with less than nine percent slope  
** Characterization focuses on the under-story vegetation

Table 7 – Estimated 50-foot Buffer Performance in Puerto Rico*

<table>
<thead>
<tr>
<th>Type of Buffer Vegetation **</th>
<th>Clay</th>
<th>Silty Clay Loam or Clay-Loam</th>
<th>Sand</th>
<th>Sandy Clay Loam, Loamy Sand or Silty Clay</th>
<th>Loam, Silt, Sandy Loam or Silt Loam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahiagrass (Permanent cover)</td>
<td>83</td>
<td>94</td>
<td>96</td>
<td>97</td>
<td>94</td>
</tr>
<tr>
<td>Warm-season Grass (i.e., Switchgrass, Lemongrass)</td>
<td>83</td>
<td>94</td>
<td>97</td>
<td>98</td>
<td>96</td>
</tr>
<tr>
<td>Dense Grass</td>
<td>83</td>
<td>94</td>
<td>94</td>
<td>96</td>
<td>94</td>
</tr>
<tr>
<td>Tall Fescue Grass</td>
<td>82</td>
<td>91</td>
<td>84</td>
<td>91</td>
<td>89</td>
</tr>
<tr>
<td>Medium-density Weeds</td>
<td>72</td>
<td>78</td>
<td>65</td>
<td>76</td>
<td>64</td>
</tr>
</tbody>
</table>

* Applicable for sites with less than nine percent slope  
** Characterization focuses on the under-story vegetation

Table 8 – Estimated 50-foot Buffer Performance in Virgin Islands*

<table>
<thead>
<tr>
<th>Type of Buffer Vegetation **</th>
<th>Clay</th>
<th>Silty Clay Loam or Clay-Loam</th>
<th>Sand</th>
<th>Sandy Clay Loam, Loamy Sand or Silty Clay</th>
<th>Loam, Silt, Sandy Loam or Silt Loam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahiagrass (Permanent cover)</td>
<td>85</td>
<td>94</td>
<td>97</td>
<td>98</td>
<td>93</td>
</tr>
<tr>
<td>Warm-season Grass (i.e., Switchgrass, Lemongrass)</td>
<td>86</td>
<td>95</td>
<td>97</td>
<td>98</td>
<td>94</td>
</tr>
<tr>
<td>Dense Grass</td>
<td>85</td>
<td>94</td>
<td>95</td>
<td>96</td>
<td>92</td>
</tr>
<tr>
<td>Tall Fescue Grass</td>
<td>85</td>
<td>92</td>
<td>88</td>
<td>92</td>
<td>89</td>
</tr>
<tr>
<td>Medium-density Weeds</td>
<td>75</td>
<td>77</td>
<td>71</td>
<td>78</td>
<td>63</td>
</tr>
</tbody>
</table>

* Applicable for sites with less than nine percent slope  
** Characterization focuses on the under-story vegetation
Step 2: Design Controls That Match the Sediment Removal Efficiency of the 50-foot Buffer

Once you have determined the estimated sediment removal efficiency of a 50-foot buffer in Step 1, you are now required to design sediment controls that will treat stormwater flows discharged into the buffer area to achieve that same expected sediment removal efficiency. These controls can include the installation of a single designed control, such as a sediment pond or other device, or a combination of controls and any retained buffer vegetation. Whichever control(s) you implement, you must meet the sediment removal efficiency for a 50-foot buffer on your site that you determined in Step 1.

To make the determination that your controls and/or buffer area achieve an equivalent sediment load reduction as the 50-foot buffer, you will need to use a model or other calculator. As mentioned above, there are a variety of models available that can be used to support your calculation, including USDA’s RUSLE-series programs and the WEPP erosion model, SEDCAD, SEDIMOT, or other equivalent models. A few examples are provided below to help illustrate how this determination could be made.

Example 1. Large Development Site Example in a Comparatively Wet Location (7.5 acre site located in Massachusetts)

The operator of a 7.5 acre construction site in Massachusetts has determined that it is infeasible to establish a 50-foot buffer, and is required to demonstrate controls used on the site that will achieve an equivalent sediment load reduction as that estimated in Table 2 for her site conditions. The first step is to identify what percentage of eroded sediment is estimated to be retained on a hypothetical 50-foot buffer. For this example problem, it is assumed that the site has a relatively uniform gentle slope (3 percent), so Table 2 can be used to estimate the 50-foot buffer sediment load reduction. If the site’s buffer vegetation is best typified by cool-season dense grass and the underlying soil is of a type best described as loamy sand, the 50-foot buffer is projected to capture 96 percent of eroded sediment from the construction site.

The second step is to determine, based on the 96 percent sediment removal efficiency from Table 2, what sediment controls, either alone or in combination with any retained buffer area, will achieve 96 percent or more of eroded sediment. For this example, using the RUSLE2 profile model, it was determined that installing a pair of shallow-sloped diversion ditches to convey runoff to a well-designed and maintained sediment basin provides the equivalent sediment removal. See Figure 5. Because there is no remaining vegetated buffer, the operator is not required to ensure that the discharge be non-concentrated or non-channelized; however, the requirement to provide a non-erosive discharge must still be met.

As shown in Figure 5, the estimated sediment reduction of 99 percent is greater than the required 96 percent. Therefore, the operator will have met the buffer alternative requirement by installing and maintaining the diversion dikes, swales, and sediment pond that were used as the basis for predicting a 99 percent sediment removal.
Figure 5. Example 1 – Equivalent Sediment Load Reductions at a 7.5 ac Site in MA.

Example 2. Site Development in an Arid Location (6.5 acre site located in New Mexico)

This example assumes that the construction site is disturbing 6.5 acres of land, but that only 1.5 acres of the total disturbed area are flowing to the buffer area. Similar to Example 1, the equivalence analysis starts with Step 1 with a review of the New Mexico buffer performance table (Table 3). Assuming the buffer area is vegetated with prairie grass and the soil type is similar to silt, and that the site is of a uniform, shallow slope (e.g., 3 percent grade), Table 3 estimates the 50-foot buffer to retain 50 percent of eroded soil.

The second step is to determine, based on the 50 percent sediment removal efficiency from Table 3, what sediment controls, either alone or in combination with any retained buffer area, will achieve 50 percent or more of eroded sediment. The site is able to retain 28 feet of the original prairie grass buffer, which can be accounted for in determining what mixture of controls to use. For this example, using the RUSLE2 profile model, it was determined that installing a fiber roll barrier between the silt fence and the 28-foot buffer will meet the requirement to provide controls that meet the 50 percent sediment retention estimate for the 50-foot buffer (See Figure 6). The operator will also be able to
show that the flow through the fiber roll to the buffer is non-channelized and non-concentrated as required.

As shown in Figure 6, the estimated sediment reduction of 84 percent is greater than the required 50 percent. Therefore, the operator will have met the buffer alternative requirement by installing and maintaining the fiber roll and 28-foot buffer that were used as the basis for predicting a 84 percent sediment removal.

Figure 6. Example 2 – Equivalent Sediment Load Reductions at a 6.5 ac Site in NM.

Step 3: Document How Site-Specific Controls Will Achieve the Sediment Removal Efficiency of the 50-foot Buffer

In Steps 1 and 2, you determined both the expected sediment removal efficiency of a 50-foot buffer at your site, and you used this number as a performance standard to design controls to be installed at your site, which alone or in combination with any retained buffer vegetation, achieves the expected sediment removal efficiency of a 50-foot buffer at your site. The final step is to document in your SWPPP the following:

- If the buffer is less than 50 feet, the width of the buffer vegetation to be retained; and
- Information you relied on to calculate the equivalent sediment reduction as an undisturbed naturally vegetated buffer on your site.
EPA will consider your documentation to be sufficient if it generally meets the following:

- For Step 1, refer to the table (i.e., any of the Tables 1 – 8) that you used to derive your 50-foot buffer performance, include information about your buffer vegetation and soil type that corresponds with the particular types you selected from the Tables 1 – 8.

- For Step 2, provide information on: (1) the model you used to estimate sediment load reductions from the controls you have designed and/or any retained buffer area; (2) the results of calculations showing how your controls will meet or exceed the required buffer performance.

EPA will also expect to see documentation showing how discharges to the remaining buffer area are non-channelized or non-concentrated.

1 EPA used the following when developing the buffer performance tables:

- The sediment removal efficiencies are based on the U.S. Department of Agriculture’s RUSLE2 (“Revised Universal Soil Loss Equation 2”) model for slope profiles using a 100-foot long denuded slopes.

- Sediment removal was defined as the annual sediment delivered at the downstream end of the 50-foot natural buffer (tons/yr/acre) divided by the annual yield from denuded area (tons/yr/acre).

- As perimeter controls are also required by the CGP, sediment removal is in part a function of the reduction due to a perimeter control (i.e., silt fence) located between denuded land and the upstream edge of the natural buffer and non-concentrated flow traveling through a 50-foot buffer of undisturbed natural vegetation.

- It is assumed that construction sites have a relatively uniform slope without topographic features that accelerate the concentration for erosive flows.

- It is assumed that vegetation has been removed from the denuded portion of the site and a combination of cuts and fills have resulted in a smooth soil surface with limited retention of near-surface root mass

To represent the influence of soil, EPA analyzed 11 general soil texture classifications in its evaluation of buffer performance. To represent different types of buffer vegetation, EPA evaluated 4 or more common vegetative types for each state/territory covered under the CGP. For each vegetation type evaluated, EPA considered only permanent non-grazed and non-harvested vegetation, believing that a natural buffer adjacent to the water of the U.S. will typically be undisturbed. The effectiveness of the buffer at retaining sediment is also a function of vegetative density and retardance, which are not shown in the tables, but included in the permit fact sheet for reference. EPA also evaluated slope steepness and found that sediment removal efficiencies present in Tables 1 – 8 are achievable for slopes that are less than nine percent.