Anthony Hicks
9010 Wild Moose Ct. SE
Olympia, WA. 98501

Attn: Mr. Anthony Hicks

Re: Drainage Plan –Drainage Report
18108 and 18107 213th Ave Ct. E
Orting, WA. 98360
Parcel # 0519341042 and 05193410XX

PROJECT DESCRIPTION

INTRODUCTION

We are pleased to submit this "Drainage Plan" and drainage report for the proposed grading located at 18108 and 18107 213th Ave Ct. E in Pierce County, Washington. The site consists of an individual tax parcel (10.18 acres) that is currently in the process of being split into two roughly 5 acre parcels. The site is currently vacant land in a forested condition. It is our understanding that the owner will grade the properties to a pasture type condition- near level area that can serve as possible buildable locations on each of the parcels. The owner is currently not attempting to build upon the cleared area but instead prepare the cleared area to be built upon in the future. Access to both parcels will be from the existing gravel roadway (213th Ave Ct. E. (private road)) and each cleared area will have a gravel access driveway from the proposed hammer head with the thought that at some point someone will possibly construct a new single family residence on each parcel. As part of the grading permit application, Pierce County is requiring that you provide an engineered drainage plan for the grading activities. Final drainage from the proposed driveways will be in the form a 10 foot vegetative flow path. Based on our review of the plans provided, the total cleared area will be less than 2.5 acres for each parcel (Total of 200,000 square feet (approximately 4.5 acres)) of conversion from the current natural forested land to grading for pasture and seeding. At this time no impervious areas are being added other than 2 gravel driveways estimated to be less than 1200 square feet (a 15% reductions for gravel driveways will also be used). The total cleared area will be less than 2.5 acre for each of the proposed roughly 5 acre lots (NEW LOT #1(18108) and NEW LOT #2(18107)). We have calculated the impervious areas (driveways) to be at or around less than 0.3 percent of the site. With this amount of clearing and grading the threshold for requiring "Drainage "plan has been met. Since the project has land disturbing activities that are more than 7000 sq. ft. on the site, minimum requirements 1-5 are required to be addressed. Please refer to the "Minimum Requirements" and the other sections of this report for further information.

EXISTING CONDITIONS

The subject parcel (only one parcel number for 2 addresses) is located at 18108 and 18107 213th Ave Ct. E in Pierce County, Washington. The parcel is extremely odd in shape with no two sides being of equal length. As stated before the property is a 10 plus acre parcel that is proposed to be split into two 5 plus acre parcels. The current parcel measures approximately 605 feet in length (north to south) on the eastern edge, approximately 521 feet in length (trending northwest) on the northern edge, approximately 559 feet in length (trending southwest) on the upper western edge, approximately 86 feet in length (trending west) bump out, approximately 214 feet in length (trending southwest) on the lower western edge, and approximately 1016 feet in length (trending southeast) on the southern edge and encompasses approximately 10.18 acres. The proposed separation of the current parcel into two separate parcels (NEW LOT #1(18108) and NEW LOT #2(18107)) will be done by a new property line approximately 639 feet in length trending northeast from the south property line to the north property line (just east of 213th Ave Ct. E) and it will create a 5 acre parcel (NEW LOT #1 (18108) – 219553 sq ft) and a 5.1 acre parcel (NEW LOT #2 (18107)- 224029 sq ft). Therefore NEW LOT #1 (18108 213th Ave. Ct. E.) will be shaped similar to a backwards upper case L and will have the following dimesions; approximately 639 feet in length trending northeast (south to north) on the eastern edge, approximately 270 feet in length (trending northwest) on the northern edge, approximately 559 feet in length (trending southwest) on the upper western edge, approximately 86 feet in length (trending west) bump out, approximately 214 feet in length (trending southwest) on the lower western edge, and approximately 525 feet in length (trending southeast) While NEW LOT #2 (18107 213th Ave. Ct. E.) will be trapezoidal in shape and will have the following dimensions; approximately 605 feet in length (north to south) on the eastern edge, approximately 251 feet in length (trending northwest) on

the northern edge, approximately 639 feet in length trending northeast (south to north) on the western edge, and approximately 491 feet in length (trending southeast) on the southern edge.

INFILTRATION RATE/SOILS REPORT

The site is listed on the USDA NRCS website for Pierce County Soil Survey- as consisting of Barneston gravelly ashy coarse sand loam soils. Through our onsite investigation we determined the soils were indeed Barneston gravelly ashy coarse sand loam soils. Barneston gravelly ashy coarse sand loam soils are comprised of glacial outwash and have a high to very high permeability (listed in the SCS as 3.54 to 21.26 inches/hour). Critical areas and/or site development limitations were noted and are addressed in the 6-15-18 Geotechnical Report.

WELLS AND SEPTIC SYSTEMS

The site currently has no wells or septic systems installed. However in order to short plat the 10.18 acre property, locations for proposed well sites and potential septic drain field locations were submitted and approved. The locations are shown in the attached site plan.

FUEL TANKS

There are no known fuel tanks on the property.

SUB-BASIN DESCRIPTION

There is negligible off-site drainage; existing drainage patterns will not be significantly altered in a negative manner by the proposed clearing and grading.

ANAYLSIS OF THE 100 YEAR FLOOD

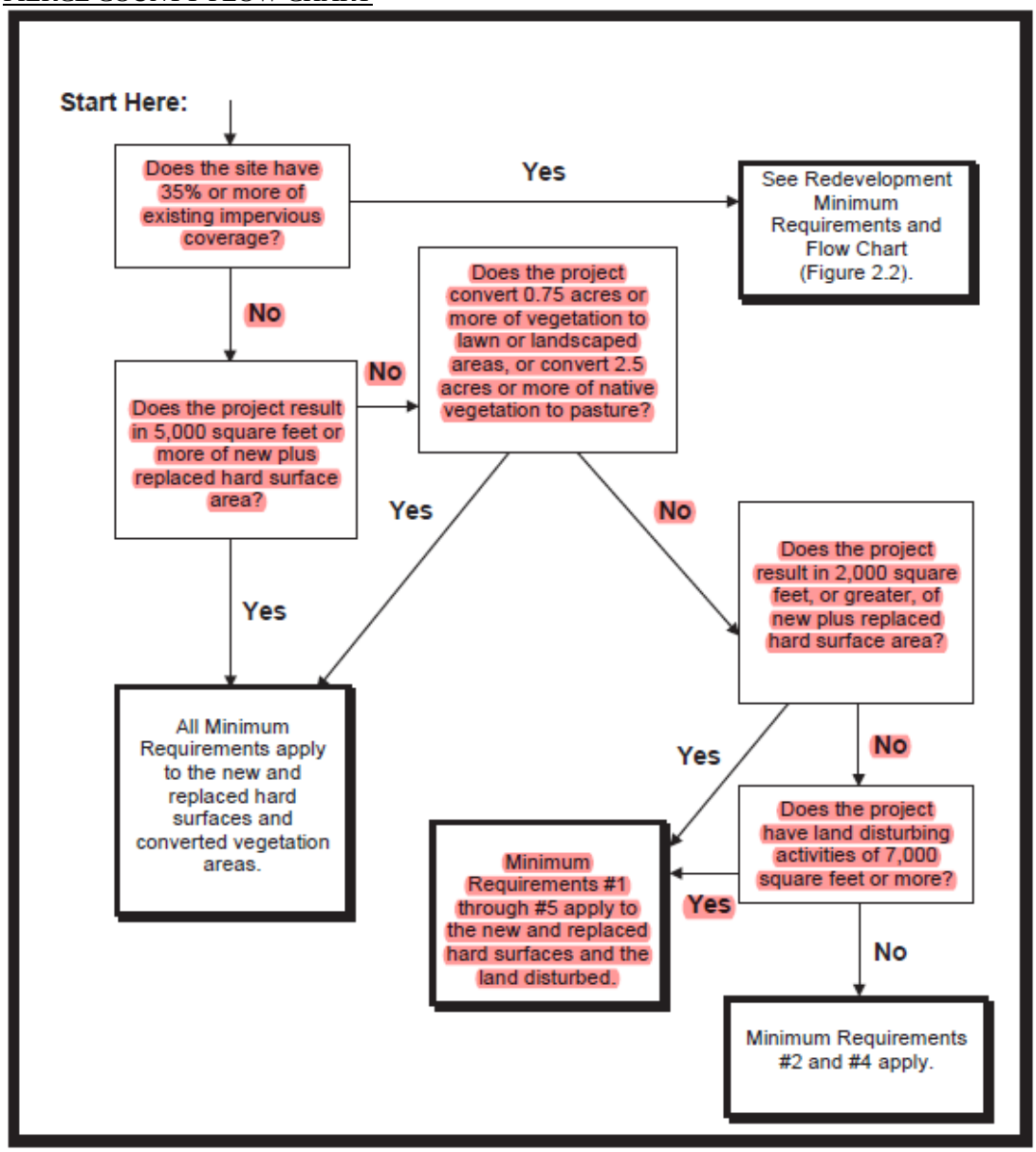
Not applicable.

AESTETIC CONSIDERATIONS FOR FACILITIES

Typical grass seeding will be installed on all cleared and graded areas. No other requirements will be necessary.

PIERCE COUNTY CRITERIA

PIERCE COUNTY FLOW CHART



PROPOSED DRAINAGE

According to Minimum Requirement #5 (Onsite Stormwater Management) in the Pierce County 2015 Stormwater Management and Site Development Manual (SWMSDM). Projects shall employ onsite stormwater management BMP's in accordance with the projects thresholds, standards, and lists to infiltrate, disperse, and retain stormwater runoff onsite to the extent feasible without causing flooding or erosion impacts.
See Figure 2.3- flow chart for summary of core componenets of Minimum Requirement #5

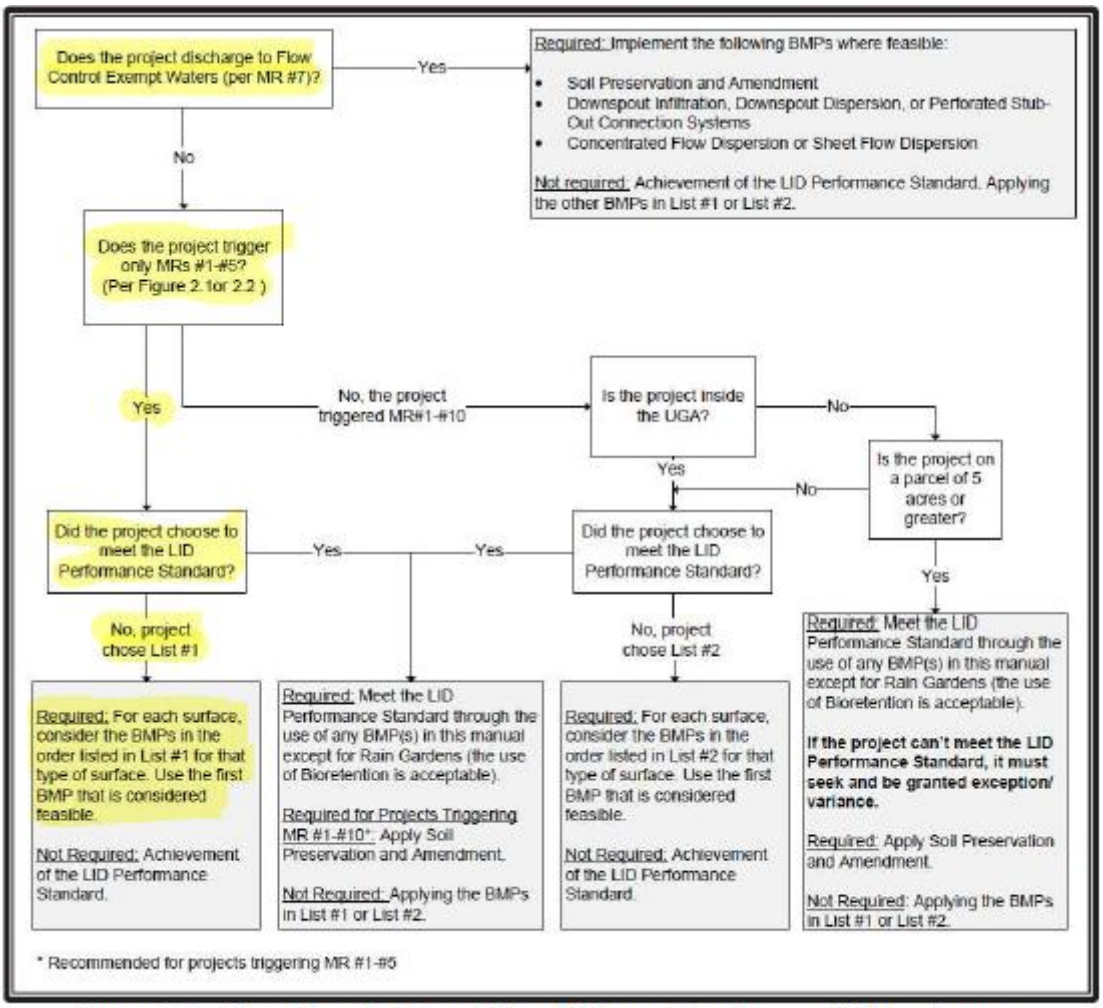


Figure 2.3. Flow Chart for Determining Minimum Requirement #5 Requirements.

Minimum Requirement #5 (Onsite Stormwater Management) in the Pierce County 2015 Stormwater Management and Site Development Manual (SWMSDM). Drainage from the proposed development will be addressed following the "List #1" and "List #2" criteria.

List #1: (Onsite Stormwater Management BMPs for Projects Triggering Minimum Requirements #1 through #5) as follows,

Lawn And Landscaped Area:
1. Soil preservation and amendment BMP in Volume III, Section 3.1

Roofs:
1. 65/10 dispersion BMP in Volume VI, Section 2.3 or downspout infiltration BMP in Volume III, Section 3.9.3.
2. Rain garden BMP in Volume III, Section 3.8 or bio retention BMP in Volume III, Section 3.4, or ONLY for the sites that are underlain by Spanaway Soils, down spout dispersion BMP in Volume III, Section 3.9.3. The rain garden or bio-retention area must have a minimum horizontal projected surface area below the overflow which is at least 5percent of the area draining into it. The downspout dispersion BMP must have a slope of 10% or less.
3. Downspout dispersion BMP in Volume III, Section 3.9.4
4. Perforated Stub-out connections in Volume III, Section 3.9.5

Other Hard Surfaces:
1. 65/10 dispersion BMP in Volume VI, Section 2.3
2. Permeable pavement BMP in Volume III, Section 3.5 or Rain garden BMP in Volume III, Section 3.8 or bio retention BMP in Volume III, Section 3.4. The rain garden or bio-retention area must have a minimum horizontal projected surface area below the overflow which is at least 5 percent of the area draining to it.
3. Sheet flow dispersion BMP in Volume III, Section 3.2.3, or concentrated flow dispersion BMP in Volume III, Section 3.2.4

List #2: (Onsite Stormwater Management BMPs for Projects Triggering Minimum Requirements #1 through #10) as follows,,

Lawn And Landscaped Area:
1. Soil preservation and amendment BMP in Volume III, Section 3.1

Roofs:
1. 65/10 dispersion BMP in Volume VI, Section 2.3 or downspout infiltration BMP in Volume III, Section 3.9.3.
2. Bio retention BMP in Volume III, Section 3.4 that have a minimum horizontal projected surface area below the overflow which is at least 5percent of the total surface area draining into it, or ONLY for the sites that are underlain by Spanaway Sols, down spout dispersion BMP in Volume III, Section 3.9.3. The downspout dispersion BMP must have a slope of 10% or less.
3. Downspout dispersion BMP in Volume III, Section 3.9.4
4. Perforated Stub-out connections in Volume III, Section 3.9.5

Other Hard Surfaces:
1. 65/10 dispersion BMP in Volume VI, Section 2.3
2. Permeable pavement BMP in Volume III, Section 3.5
3. Bio retention BMP in Volume III, Section 3.4 that have a minimum horizontal projected surface area below the overflow which is at least 5percent of the total surface area draining into it
4. Sheet flow dispersion BMP in Volume III, Section 3.2.3, or concentrated flow dispersion BMP in Volume III, Section 3.2.4

Of the above options soil preservation and amendment is practical and feasible and will be employed as appropriate during construction.

Proposed Roof Drainage:
Not applicable for this site.

Proposed Hard Surfacing:
Not applicable for this site.

Erosion control measures will be in place throughout the project. On a temporary basis, they will consist of either vegetative buffers when possible or silt fence installed along downhill sections of the site and along areas being graded. The site entrance/exit will also have a temporary construction entrance installed (per PCSWMM Appendix C, Detail 4). Permanent erosion control will consist of grass seeding.

MINIMUM REQUIREMENTS

Minimum Requirement # 1- Preparation of Stormwater Site Plans
This has been addressed by the submittal of the referenced Engineered Plan documents.

Minimum Requirement # 2- Construction Stormwater Pollution Prevention
This information has been provided within the included SWPP report prepared by JECB on January 16, 2020

Minimum Requirement # 3- Source Control Pollution
The implementation of the temporary erosion and sediment control plan along with the provided drainage design is adequate to meet this requirement for construction of the grading per Pierce County Title 17A.

Minimum Requirement # 4- Preservation of Natural Drainage Systems and Outfalls
The stormwater runoff will be dispersed onsite similar to the existing drainage patterns.

Minimum Requirement # 5- Onsite Stormwater Management
Onsite stormwater management consists of dispersing stormwater through direct infiltration through vegetated surfaces as indicated above. The provided plans and design adequately address stormwater management for the proposed site clearing and grading.

COVENANTS, DEDICATIONS, EASEMENTS
It is anticipated that no new requirements of this type will be imposed.

PROPERTY OWNERS ASSOCIATIONS, ARTICLES OF INCORPORATION
Not Applicable.

OTHER PERMITS OR CONDITIONS PLACED ON THIS PROJECT
A grading permit will be required for the proposed development.

PROJECT ENGINEERS CERTIFICATION
I hereby state that this drainage and erosion/sediment control plan for Anthony Hicks and other members of the design team has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that Pierce County does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at **(253) 405-4654**.

Respectfully Submitted,
JECB

Jason E.C. Bell P.E.
Geotechnical Engineer

Anthony Hicks
9010 Wild Moose Ct. SE
Olympia, WA. 98501

Attn: Mr. Anthony Hicks

Re: Drainage Plan –SWPP Report
18108 and 18107 213th Ave Ct. E
Orting, WA. 98360
Parcel # 0519341042 and 05193410XX

PROJECT DESCRIPTION

INTRODUCTION

We are pleased to submit this "Drainage Plan" and SWPP report for the proposed grading to be located at 18108 and 18107 213th Ave Ct. E in Pierce County, Washington. The site consists of an individual tax parcel (10.18 acres) that is currently in the process of being split into two roughly 5 acre parcels. The site is currently vacant land in a forested condition. It is our understanding that the owner will grade the properties to a pasture type condition- near level area that can serve as possible buildable locations on each of the parcels. The owner is currently not attempting to build upon the cleared area but instead prepare the cleared area to be built upon in the future. Access to both parcels will be from the existing gravel roadway (213th Ave Ct. E. (private road)) and each cleared area will have a gravel access driveway from the proposed hammer head with the thought that at some point someone will possibly construct a new single family residence on each parcel. As part of the grading permit application, Pierce County is requiring that you provide an engineered drainage plan for the grading activities. Final drainage from the proposed driveways will be in the form a 10 foot vegetative flow path. Based on our review of the plans provided, the total cleared area will be less than 2.5 acres for each parcel (Total of 200,000 square feet (approximately 4.5 acres)) of conversion from the current natural forested land to grading for pasture and seeding. At this time no impervious areas are being added other than 2 gravel driveways estimated to be less than 1200 square feet (a 15% reductions for gravel driveways will also be used). The total cleared area will be less than 2.5 acre for each of the proposed roughly 5 acre lots (NEW LOT #1(18108) and NEW LOT #2(18107)). We have calculated the impervious areas (driveways) to be at or around less than 0.3 percent of the site. With this amount of clearing and grading the threshold for requiring "Drainage "plan has been met. Since the project has land disturbing activities that are more than 7000 sq. ft. on the site, minimum requirements 1-5 are required to be addressed. Please refer to the "Minimum Requirements" and the other sections of this report for further information.

EXISTING CONDITIONS

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the northern edge, approximately 639 feet in length trending northeast (south to north) on the western edge, and approximately 491 feet in length (trending southeast) on the southern edge.

The site is currently vacant land in a forested condition. The current 10.18 acre site is dissected by 213th Ave Ct. E – while the proposed NEW LOT #1 (18108 213th Ave. Ct. E.) (5 acre lot) will have the entire roadway present on it. As you come through the property (10.18 acres) heading north on 213th Ave Ct. E the road cuts through a hill that creates a steep slope condition on the east and west side of the roadway and flattens out on the north edge of the property. The site slopes vary thoughout the site from 10 to 80 approximately percent. The steep slopes that are present on the east and west side of 213th Ave Ct. E (near the middle of the parcel) have been mapped a potentially unstable slopes and will be regraded to a stable condition. Overall elevation change across the site is approximately 220 feet. The site is bounded by 2 to 5 acre large lot residential properties. Access to the site will be via the existing roadway that transects the site – 213th Ave Ct E, a private road.

INFILTRATION RATE/SOILS REPORT

The site is listed on the USDA NRCS website for Pierce County Soil Survey- as consisting of Barneston gravelly ashy coarse sand loam soils. Through our onsite investigation we determined the soils were indeed Barneston gravelly ashy coarse sand loam soils. Barneston gravelly ashy coarse sand loam soils are comprised of glacial outwash and have a high to very high permeability (listed in the SCS as 3.54 to 21.26 inches/hour). Critical areas and/or site development limitations were noted and are addressed in the 6-15-18 Geotechnical Report – Revised 1-20-21.

PIERCE COUNTY SWPP REQUIREMENTS

PIERCE COUNTY REQUIRED SWPP ELEMENTS

#1. MARK CLEARING LIMITS: Clearing limits are clearly shown on Sheet SW-3 of the SWPP plan set.

#2. ESTABLISH CONSTRUCTION ACCESS: Construction access has been clearly shown on Sheet SW-3 of the SWPP plan set and details of the construction entrance are attached .

#3. CONTROL FLOW RATES: This will be completed with adherence to the attached Temporary Erosion Control plan shown on Sheet SW-4 and the installation of the permanent drainage system.

#4. INSTALL SEDIMENT CONTROLS: The attached plans include the location, details, and notes for; Silt Fence (BMP C233), Construction Entrance (BMP 105), and Vegetative Buffer Zones (BMP C102).

#5. STABILIZE SOILS: Exposed soils will be temporarily stabilized during construction which will include surface roughening (BMP C130), straw placement BMP C121) , and plastic covering (BMP C123) of stockpiled materials. Final site stabilaztion will include topsoiling (BMP C125) and permanent seeding (BMP C120).

#6. PROTECT SLOPES: Steep slopes will be disturbed on the site. These steep slopes are being re-graded in order to make them stable. Some of the current site slopes are labeled as Critical Areas and are currently unstable. The grading onsite will leave the site slopes stable.

#7. PROTECT DRAIN INLETS: There are no drain inlets to be protected.

#8. STABILIZE CHANNELS AND OUTLETS: Not applicable to this project.

#9. CONTROL POLLUTANTS: The project is assumed to be low risk for potential construction pollution due to the nature of the work onsite. Contractors are required to follow standard procedures for site clean up, contaminant spills, materials storage, etc.

#10. CONTROL DEWATERING: Due to the depth of the ground water table it is not anticipated to be required on this site.

#11. MAINTAIN BMP'S: It will be the responsibility of the contractor and owner to maintain the installed BMP's. BMP's shall be installed in a manner to not impede the site work while at the same time maintaining the BMP's effectiveness. Details of the BMP's are included within this report and locations of BMP's are shown on Sheet SW-4 of the SWPP plan set .

#12. MANAGE THE PROJECT: It will be the responsibility of the contractor and owner to manage the project. Due to the limited amount of clearing and small nature (single family residence) of the project it is anticipated that minimal effort will be required to manage the stormwater generated onsite.

#13. PROTECT LOW-IMPACT DEVELOPMENT (LID) BMP'S: There are no LID BMP's proposed for the project.

CONSTRUCTION PHASING

Due to the small scale nature of the project, no construction phasing is anticipated for this project.

CONSTRUCTION SCHEDULE

Construction scheduling should be as follows;

#1. Mark clearing limits as shown on Sheet SW-3 of the SWPP plan set.

#2. Install temporary construction entrance (BMP C105) as shown on Sheet SW-4 of the SWPP plan set in accordance with attached detail.

#3. Install silt fence. Clear and grub site. Install any temporary erosion control measures as shown on Sheet SW-4 of the SWPP plan set in accordance with attached details. Additional BMP's may be required that are or are not specifically shown on the SWPP plan set in order to prevent erosion and sediment control (silty water) from leaving the project site.

#4. Any area stripped of vegetation, where no work is anticipated to occur (including stockpiles) for a period of 2 days during the wet season and 7 days during the dry season, shall be immediately stabilized with sediment and erosion control measures such as plastic covering (BMP C124), straw placement (BMP C121), temporary or permanent seeding (BMP C120), surface roughening (BMP C130) or netting/blankets (BMP C122).

#5. Grade site, and construct the driveways.

#6. Topsoil (BMP C125) and hydroseed (BMP C120) lawn areas or plant landscape areas to permanently stabilize.

#7. Remove (within 30 days) temporary erosion control measures after site has become stabilized (grass growing and plants established).

#8. Remove any silt that has accumulated in the permanent storm drainage system.

SUMMARY

LIABILITY

The property owner is ultimately responsible for any discharge from the site and therefore should employ a contractor or sub contractors who will follow and implement the principle elements of the attached SWPP. It is recommended that the owner employ a contractor who has a Certified Erosion and Sediment Control Lead (CESCL) on staff or at least have personel that are well versed in CESCL activities and are cognizant of the SWPP and the goals of sediment and erosion control. It is our opinion that due to the small site, extremely good soils, and limited scope of work that there is minimal risk involved of sediment laden discharge as long as the owner and contractor stay vigilant and work diligently to ensure the erosion and sediment control measures are working properly.

PROJECT ENGINEERS CERTIFICATION

I hereby state that this Construction Stormwater Pollution Prevention Plan for Anthony Hicks and other members of the design team has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that Pierce County does not and will not assume liability for the sufficiency, suitability, or performance of Construction SWPP BMP's prepared by me.

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at **(253) 405-4654**.

Respectfully Submitted,

JECB

Jason E.C. Bell, P.E.
Geotechnical Engineer

ATTACHMENTS

VICINITY MAP

PIERCE COUNTY SHORT PLAT

FOR

ANTHONY R. HICKS

A PORTION OF THE NORTHEAST QUARTER OF THE NORTHEAST QUARTER,
SECTION 34, TOWNSHIP 19 NORTH, RANGE 5 EAST,
WILLAMETTE MERIDIAN, PIERCE COUNTY, WASHINGTON

LEGEND:

- SECTION CORNER AS NOTED
- QUARTER CORNER AS NOTED
- REBAR WITH CAP SET LS 34145
- OTHER CORNERS FOUND AS NOTED
- HUB AND TACK SET
- SOIL LOG
- EG — EDGE OF GRAVEL
- MONUMENT LINE
- (R) RECORD INFORMATION
- (C) CALCULATED INFORMATION
- (M) MEASURED INFORMATION

BASIS OF BEARING:

N89° 20' 29"W
BETWEEN TWO FOUND AND MEASURED MONUMENTS ALONG THE SOUTH LINE OF THE NORTHEAST QUARTER OF SECTION S34-T19N-R5E,W.M.

VERTICAL DATUM

NAVD 88 FROM GPS OBSERVATION
WA 4601 NORTH ZONE U.S. FEET

HORIZONTAL DATUM:

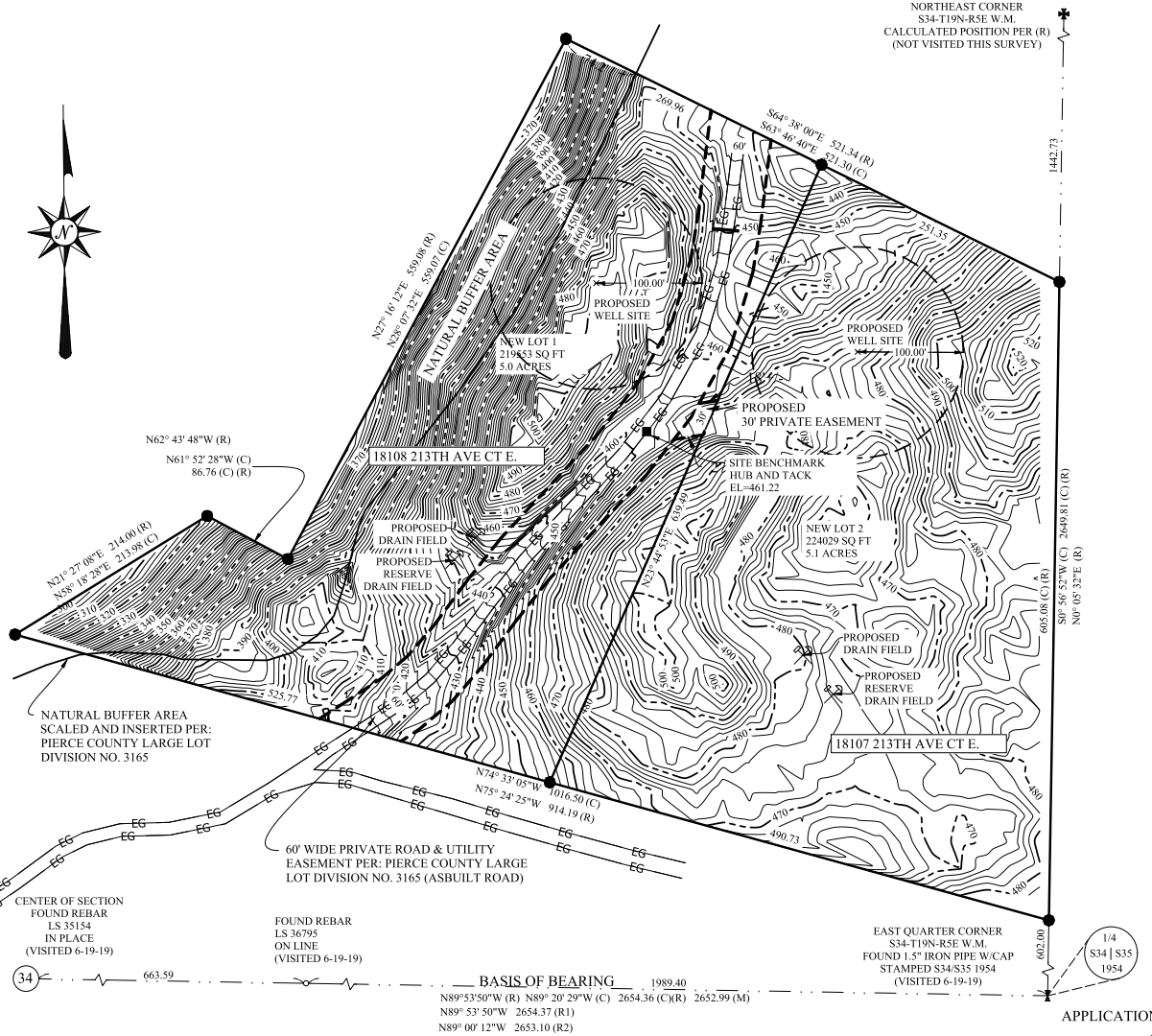
NAD 83/2011 WASHINGTON
SOUTH ZONE 4602 U.S. FEET

SITE BENCHMARK:

HUB AND TACK ON
GRAVEL ROAD
EL= 416.22 U.S. FEET

REFERENCE SURVEY:

(R) PIERCE COUNTY LARGE LOT DIVISION NO. 3165
(R1) RECORD OF SURVEY #9003230341
(R2) RECORD FO SURVEY #201902255001



GRAPHIC SCALE 1"= 80'

0 80' 160' 240'

APPLICATION NUMBER: 928807

SHEET 3 OF 4

PRELIMINARY ONLY

H.D.G.A.

PHIL SARGENT
STATE OF WASHINGTON
34145
REGISTERED
PROFESSIONAL LAND SURVEYOR

FILE NAME	HICKS
DRAWN	K.WHITEHOUSE
CHECKED BY	GPS
DATE	09/17/2020
JOB NO.	1702
FIELD BOOK NO.	624

HOLMVIG, DEWITT, GALLION & ASSOC., LLC.
LAND SURVEYING & ENGINEERING SUPPORT
1036 COLE STREET, ENUMCLAW, WA 98022 (360) 825-6963
www.hdgallion.com

GENERAL

ITEM	QUANTITY	UNIT	ADDITIONAL REMARKS
Total Property (Lot 1 and Lot 2)	*443,582*	*Sq. Ft.*	*10.1 Acres*
Lot 1 (Only)	*219,553*	*Sq. Ft.*	*5 Acres*
Lot 2 (Only)	*224,029*	*Sq. Ft.*	*5.1 Acres*
Lot 1 Propose Clear/add Imperv	*62,996/900*	*Sq. Ft.*	*Gravel Hammer Head Driveway*
Lot 2 Propose Clear/add Imperv	*1,369/300*	*Sq. Ft.*	*Gravel Hammer Head Driveway*
Total Impervious Surf.- Lot 1/2	*765/255*	*Sq. Ft.*	*Include 15% Reduction Gravel Drive*
Total Percent of Site- Lot 1/2	*0.35/0.11*	*Percent*	*Include 15% Reduction Gravel Drive*

1. All workmanship and materials shall be in accordance with county standards and the most current copy of the State of Washington Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT/ APWA) and as amended by the County or the State.
2. Temporary erasion/ water pollution prevention measures shall be required in accordance with section 1-07.15, as modified by the APWA Supplement, of the current State of Washington Standard Specifications and the Pierce County Stormwater Management Manual.

   Should the temporary erosion and sedimentation control measures as shown on this drawing not prove adequate to control erosion and sedimentation, the applicant/ contractor shall install additional facilities as necessary to protect adjacent properties, sensitive areas, natural water courses, and/or storm drainage systems.
3. Call the underground locate line 1-800-424-5555 a minimum of 48 hours prior to any excavations.
4. The storm drainage system shall be constructed according to approved plans on file with the County. Any significant deviation from the approved plans will require written approval from the County.
5. A copy of the approved stormwater plans must be on the job site whenever construction is in progress.
6. All erosion control and stormwater facilities shall be regularly inspected and maintained by the contractor during construction.
7. It shall be the sole responsibility of the contractor to obtain street use and other related or required permits prior to any construction activity in the Municipality's right-of-way. It shall also be the responsibility of the contractor to obtain all required permits prior to construction. The contractor shall abide by all requirements for traffic control and safety when working in the road right-of way.
8. The contractor shall notify the Project Engineer in the event or discovery of poor soils, standing groundwater, or severe discrepancies from soil log descriptions as noted on the plans.
9. For public systems, the contractor shall call for inspection 48 hours prior to covering any drainage structure.

EARTHWORK

Excavation

1. Clearing limits shall be marked by flagging
2. Cut Slopes
   - A. Slopes shall be no steeper than is safe for the intended use and shall not be steeper than 2 horizontal to 1 vertical, or as recommended by a Soils Engineer.
   - B. The catch point of the top of the slope shall be set back from the site boundary line in accordance with the following table, unless a retaining wall is designed by the Engineer and constructed for the project.
3. Setback from property lines.

Cut Depth	Setback Distance
Under 5 feet	2 Feet
5 to 20 feet	Height/2
Over 20 feet	10 Feet

Fill Standards

1. Slopes shall be no steeper than is safe for the intended use and shall not be steeper than one and one half horizontal to one vertical, or as recommended by a Soils Engineer. Fill sites must be approved by the engineer as suitable locations for the proposed fill.
2. The ground surface for fills over five feet in heigth shall be prepared by removing vegatation, noncomplying fill, topsoil, and other unsuitable materials; scarifying to provide a bond with the new fill, and where existing slopes are steeper than five horizontal to one vertical, by benching into competent material as determined by the engineer. The bench under the toe of a fill on a slope steeper than five horizontal to one vertical shall be at least 10 feet wide or as recommended a Soils Engineer.
3. Except as permitted by the county, no material other than earth material shall be buried or placed in fills. Placement of other than earth material is regulated by State statute or Federal laws, and additional permits may be required.
4. Fills shall be constructed using earth materials, compaction methods, and construction techniques so that stabile fills are created.
5. The toe or catch point of fill slopes shall be set back from the site boundary line in accordance with the following table unless a retaining wall is designed by an Engineer and constructed for the project.

Fill Depth	Setback Distance
Under 5 feet	2 feet
5-40 feet	height of fill/2
over 40 feet	20 feet

EROSION AND SEDIMENT CONTROL

1. On-site erosion control measures shall be the responsibility of the developer. Any problems occuring before final acceptance of the storm systen by the Municipality shall be corrected by the applicant and/or the contractor.
2. In case erosion or sedimentation occurs to adjacent property, all construction work within the development that will aggravate the situation must cease and the Applicant/ Contractor shall imediately commence restoration or mitigation measures. Restoration activity shall continue until such time as the problem is rectified.
3. All erosion and sedimentation control devices shown on this drawing shall be installed prior to the first state of of site preparation.
4. Should the temporary erosion and sedimentation control measures as shown on this drawing not prove adequate to control erosion and sedimentation, the Applicant or Contractor shall install additional facilities as necessary to protect adjacent properties sensitive areas, natural water courses, and/or storm drainage systems.
5. In any area which has been stripped of vegetation or experienced land disturbing activities and where no further work is anticipated for a period exceeding the listed criteria, all disturbed areas must be immediately stabilized with mulching, grass planting, or other approved erosion control treatment applicable to the time of year in question. Grass seeding alone will be acceptable only during the months of April through September, inclusive. Seeding may proceed, however it is in the interest of the Aplicant/Contractor, but must be augmented with mulching, netting, or other treatment.
6. Use plastic covering when land areas will not be actively worked for more than 5 days.
7. The project engineer or project surveyor will be responsible for field locating the clearing limits and establishing those boundaries with bright colored flagging. The contractor shall clear to the limits as established on this plan and as flagged in the field.
8. The County shall be responsible for the inspection and acceptance of all clearing and grading work and erosion and sedimentation control facilities. The Applicant and/or Contractor shall notify the County forty-eight hours in advance of each required erosion and sediment control inspection.

Inspection #1	Installation of erosion control facilities prior to clearing
Inspection #2	Completion of clearing
Inspection #3	Upon completion of excavation, filling, and earthwork
Inspection #4	Completion of project
Inspection #5	As needed to determine compliance with approved plans and/or specifications (Does not require advanced notice)

9. All work associated with stabilizing the disturbed areas shall be in accordance with the Pierce County Stormwater Management Manual.
10. All necessary facilities shall be maintained onsite to prevent debris, dust, and mud from accumulating on the public right-of-way.

Stockpile Management

1. Stockpiles shall be stabilized (with plastic covering or other approved device) daily between November 1 to March 31.
2. In any season, sediment leaching from stockpiles must be prevented.

Track Walking

1. Track walking shall be used to roughen surface prior to hydroseed placment.
2. Track walking shall be performed perpendicular to the slope. No tracks shall be parallel to the slope to avoid channeling of surface waters. Tracks shall overlap accross the entire slope face.
3. Track walking shall be used as temporary erosion control only. Track walking may be used may be used in conjunction with permanent erosion control pocedures.

Construction Entrances

1. Material shall be 4" by 8" quarry spals (4 to 6 inch for residentail single family lots) and may be top-dressed with 1" to 3" rock. (State Standard Specifications, Section 8-15).
2. The rock pad shall be at least 12" thick and 50' long (20' for sites with less than 1 acre of disturbed soil). Width shall be the full width of the vehicle ingress and egress area. Smaller pads may be approved for single-family residential and small commercial sites.
3. Additional rock shall be added periodically to maintain proper function of the pad.

Level Spreader

Install level spreader using 4" PVC Schedule 40 Pipe.

1. Tightline level spreader pipe to location of designated dispersion area.
2. Perforations in the level spreader shall be at minimum 1 foot O.C. located on the bottom of pipe.

Filter Fabric Fences

Install silt fencing to prevent migration of soils off site.

1. Filter fabric shall be purchased in a continuous roll and cut to the length of the barrier to avoid use of joints. When joints are necessary, filter cloth shall be spliced together only at a support post, with a minimum 6 inch overlap, and securely fastened at both ends to the post.
2. Posts shall be spaced at a maximum of 6' apart and driven securely into the ground (minimum 30")
3. A trench shall be excavated approximately 8" wide and 12" deep along the line of posts and upslope from the barrier. This trench shall be backfilled with washed gravel.
4. When standard strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy-duty wire staples at least 1" long, tie wire, or hog rings. The wire shall extend into the trench a minimum of 4" and shall not extend more than 24" above the original ground surface.
5. The standard strength filter fabric shall be stapled or wired to the fence, and 20" of the fabric shall be extended into the trench. The fabric shall not extend more than 24" above the original ground surface. Filter fabric shall not be stapled to existing trees.
6. When extra-strength filter fabric and closer post spacing is used, the wire mesh support fence may be eliminated. In such a case, the filter fabric is stapled or wired directly to the post with all other provisions of the above notes applying.
7. Filter fabric fences shall not be removed before the upslope area has been permanently stabilized.
8. Filter fabric fences shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.
9. Silt fences will be installed parallel to any slope contours.
10. Contributing length to fence will not be greater than 100'.
11. Do not install below an outlet pipe or weir.
12. Install down slope of exposed areas.
13. Do not drive over or fill over silt fence.

PERMANENT STABILIZATION

Slope Preparation

1. Graded areas with slopes greater than 3 horizontal to 1 vertical but less than 2 horizontal to one vertical shall be roughened before seeding.
2. Graded areas steeper than 2 horizontal to on vertical shall be stair-stepped with benches. (Not anticipated on this site)

Seeding

1. Seed mixture shall be as follows; 30 % (by weight) Blue Wildrye, 30 % (by weight) Slender Wheatgrass, 25% (by weight) Mountain Brome, 10% (by weight) Tufted Hairgrass, 5% (by weight) Mountain Lupine, and shall be applied at a rate not to exceed 25 pounds per acre.
2. Seed beds to be planted between May 1 and October 31 will require irragation and other maintenance as necessary to foster and protect the root structure.
3. For seed beds planted between October 31 and April 30, armoring of the seed bed will be necessary. (e.g. geotextiles, jute mats, mulch, clear plastic covering).
4. Before seeding, install needed surface runoff control measures such as gradient terraces, interceptor dikes, swales, level spreaders, and sediment basins.
5. The seed bed shall be firm with a fairly fine surface, following surface roughening. Perform all operations accross or at right angles to the slope.

Mulching

1. Mulch materials used shall be wood fiber mulch, and shall be applied at a rate not to exceed 25 pounds per acre.
2. Mulches shall be applied in all areas with exposed slopes greater than 2 horizontal to 1 vertical.
3. Mulching shall be used immediately after seeding or in areas which can not be seeded because of the season.

DRAINAGE

1. Drainage from gravel driveway to be directed to vegetative buffers onsite.
2. No known underground storage tanks onsite.

PERMANENT ACCESS

Driveway

1. Install 25' Wide X 30' Long Gravel Hammer Head Driveway Each Lot.

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PREPARED FOR
CLIENT NAME: Anthony Hicks
MAILING ADDRESS: 9010 Wild Moose Ct. SE
Olympia, WA. 98501
PHONE NUMBER: (360) 481-2300

PROJECT INFORMATION
SITE ADDRESS: 18107 and 18108 213th Ave. Ct. E
Orting, WA. 98360
PARCEL NUMBER: 051934104 2 and 05193410XX

SHEET
SW 2

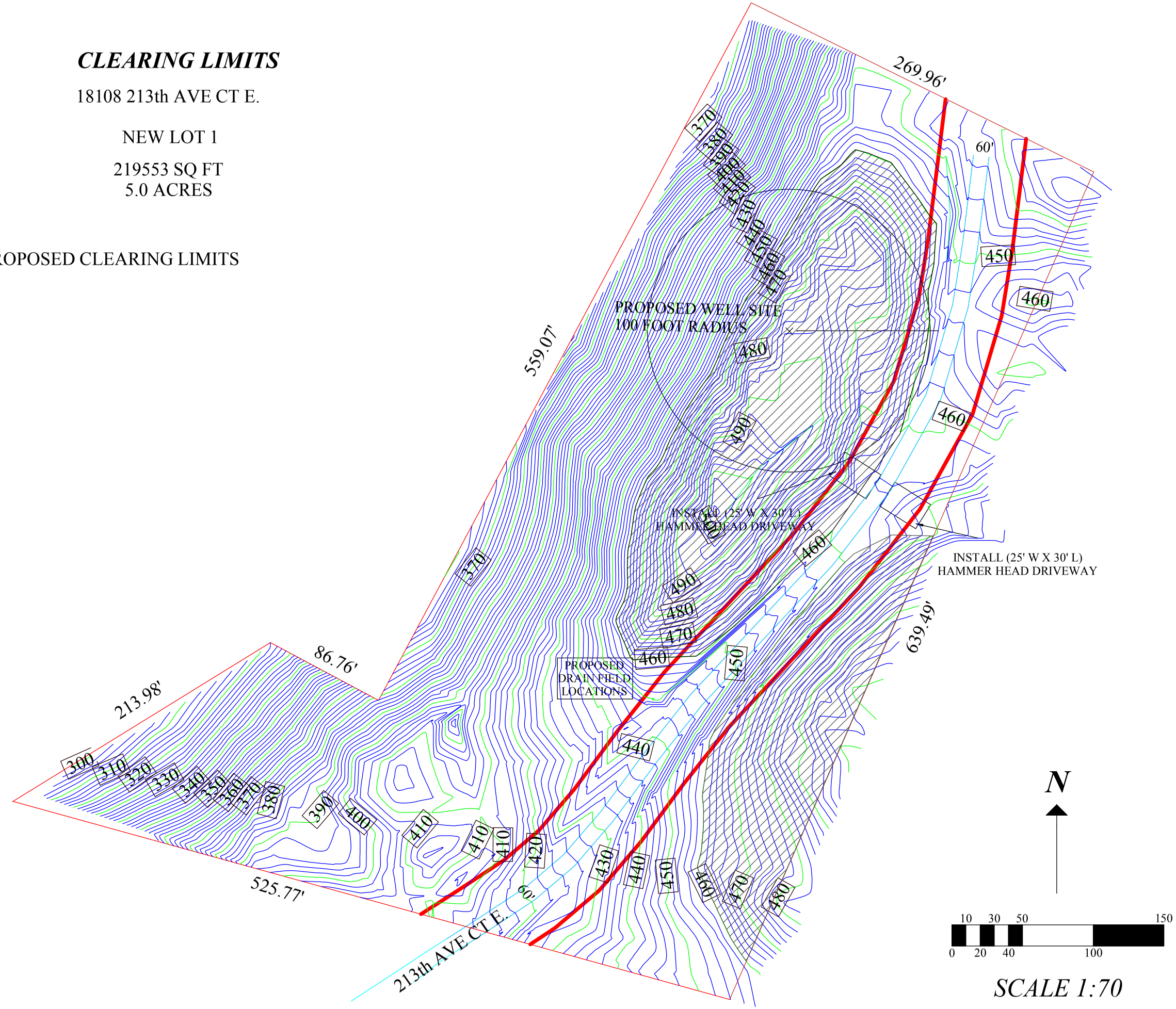
CLEARING LIMITS

18108 213th AVE CT E.

NEW LOT 1

219553 SQ FT
5.0 ACRES

PROPOSED CLEARING LIMITS



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PROJECT INFORMATION
SITE ADDRESS: 18108 213th Ave. Ct. E
Orting, WA. 98360
PARCEL NUMBER: 0519341OXX

SHEET
SW
3A

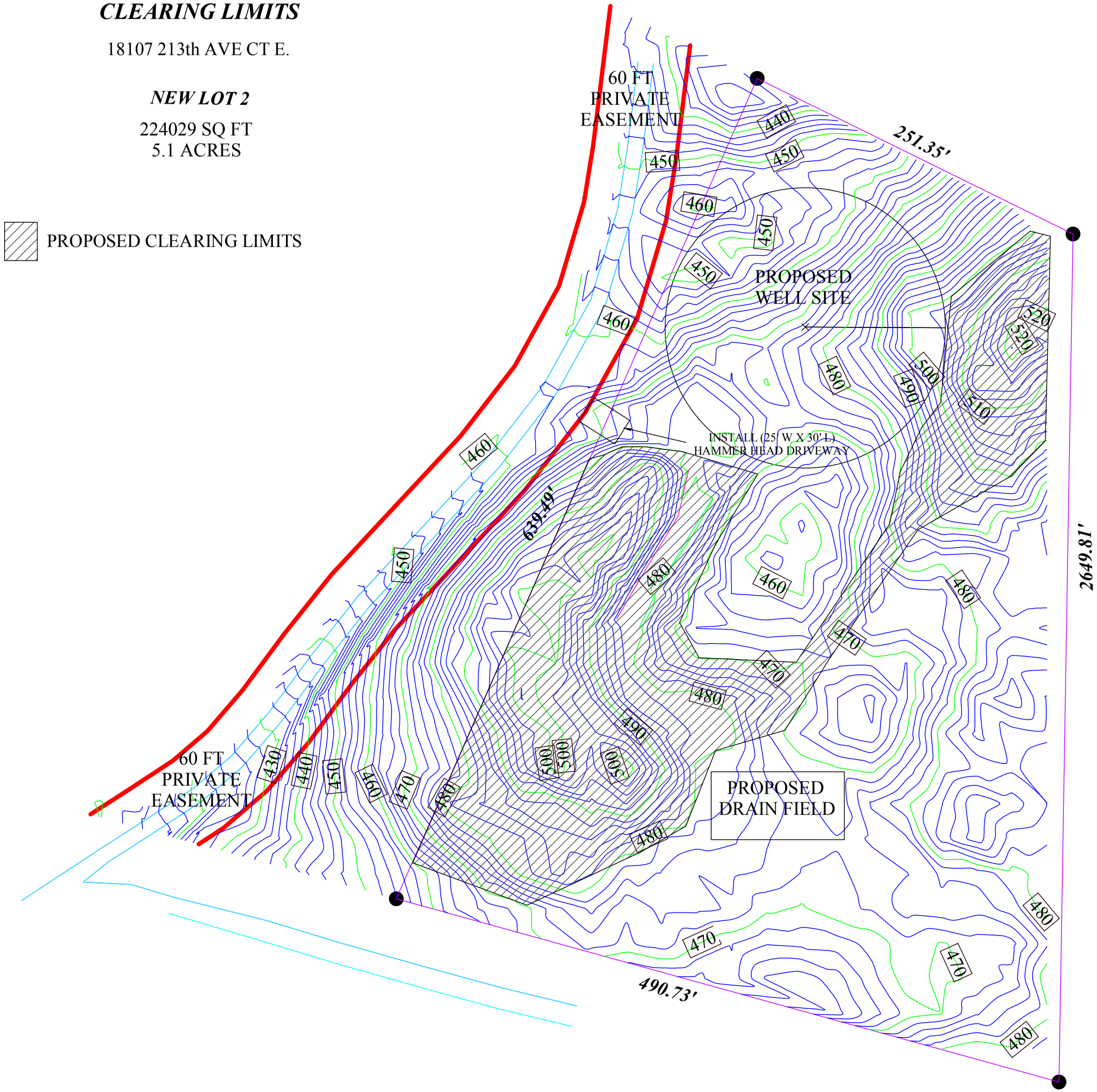
CLEARING LIMITS

18107 213th AVE CT E.

NEW LOT 2

224029 SQ FT
5.1 ACRES

PROPOSED CLEARING LIMITS



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PROJECT INFORMATION
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Orting, WA. 98360
PARCEL NUMBER: 0519341042

SHEET
SW
3B

TEMPORARY SEDIMENT CONTROL

18108 213th AVE CT E.

NEW LOT 1

219553 SQ FT
5.0 ACRES

CONSTRUCTION ENTRANCE/EXIT (BMP C-105)

SEDIMENT TRAP (BMP C-240)

WATTLES (BMP C-235)

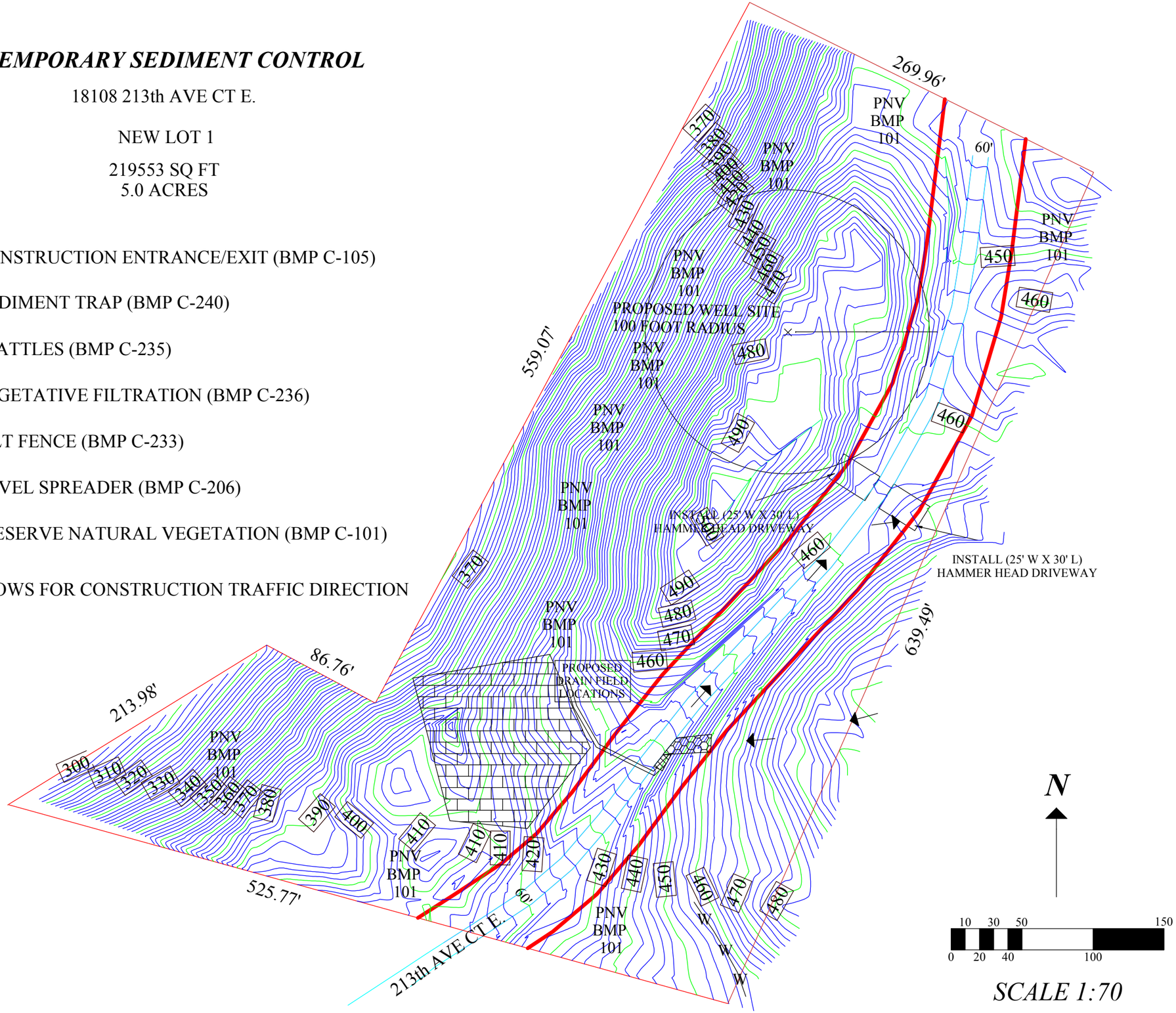
VEGETATIVE FILTRATION (BMP C-236)

SILT FENCE (BMP C-233)

LEVEL SPREADER (BMP C-206)

PNV BMP 101 PRESERVE NATURAL VEGETATION (BMP C-101)

ARROWS FOR CONSTRUCTION TRAFFIC DIRECTION



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SHEET
SW
4A

TEMPORARY EROSION CONTROL

18107 213th AVE CT E.

NEW LOT 2

224029 SQ FT
5.1 ACRES

CONSTRUCTION ENTRANCE/EXIT (BMP C-105)

SEDIMENT TRAP (BMP C-240)

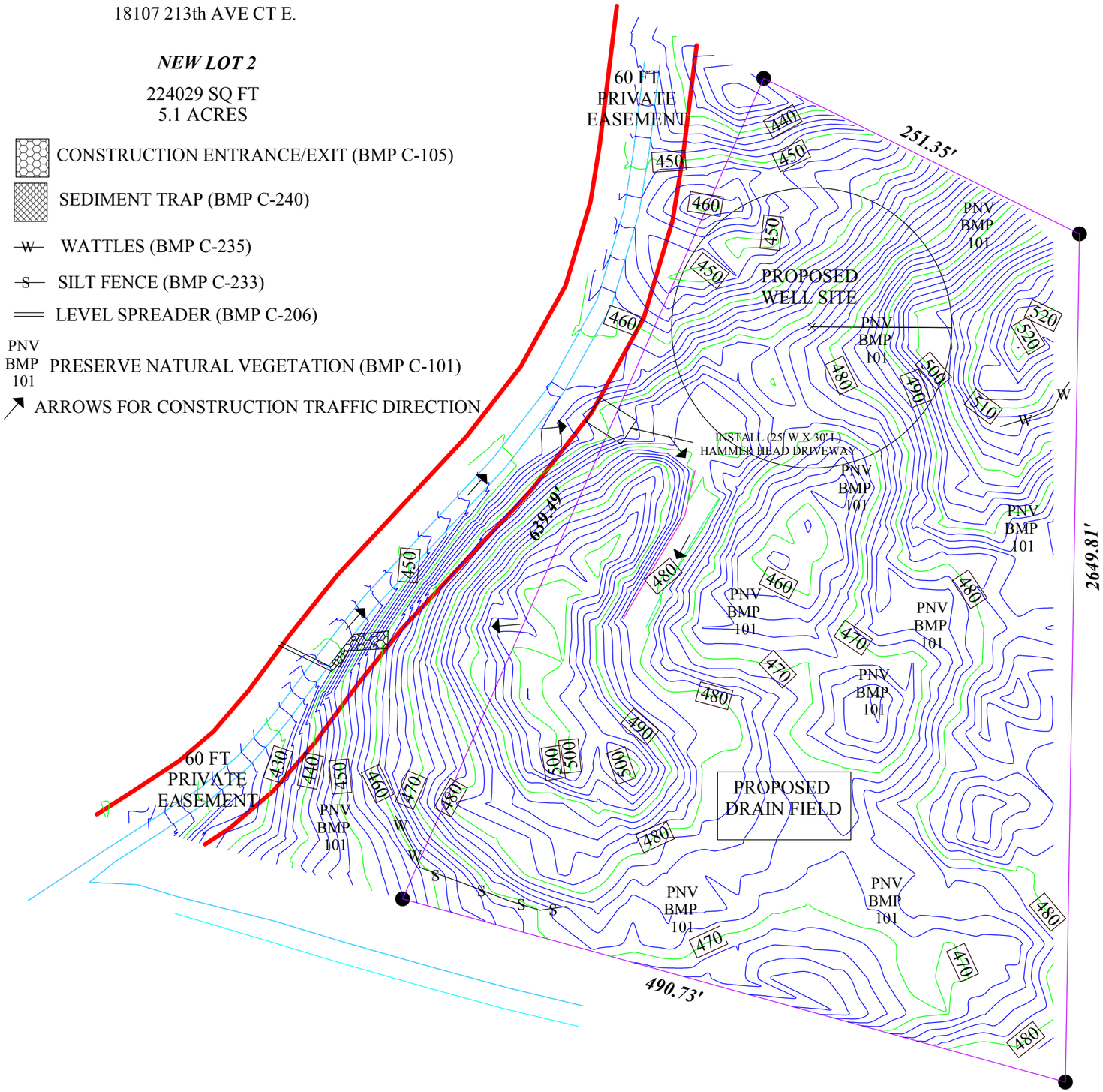
W WATTLES (BMP C-235)

S SILT FENCE (BMP C-233)

LEVEL SPREADER (BMP C-206)

PNV BMP 101 PRESERVE NATURAL VEGETATION (BMP C-101)

ARROWS FOR CONSTRUCTION TRAFFIC DIRECTION



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Orting, WA. 98360
PARCEL NUMBER: 0519341042

SHEET
SW
4B

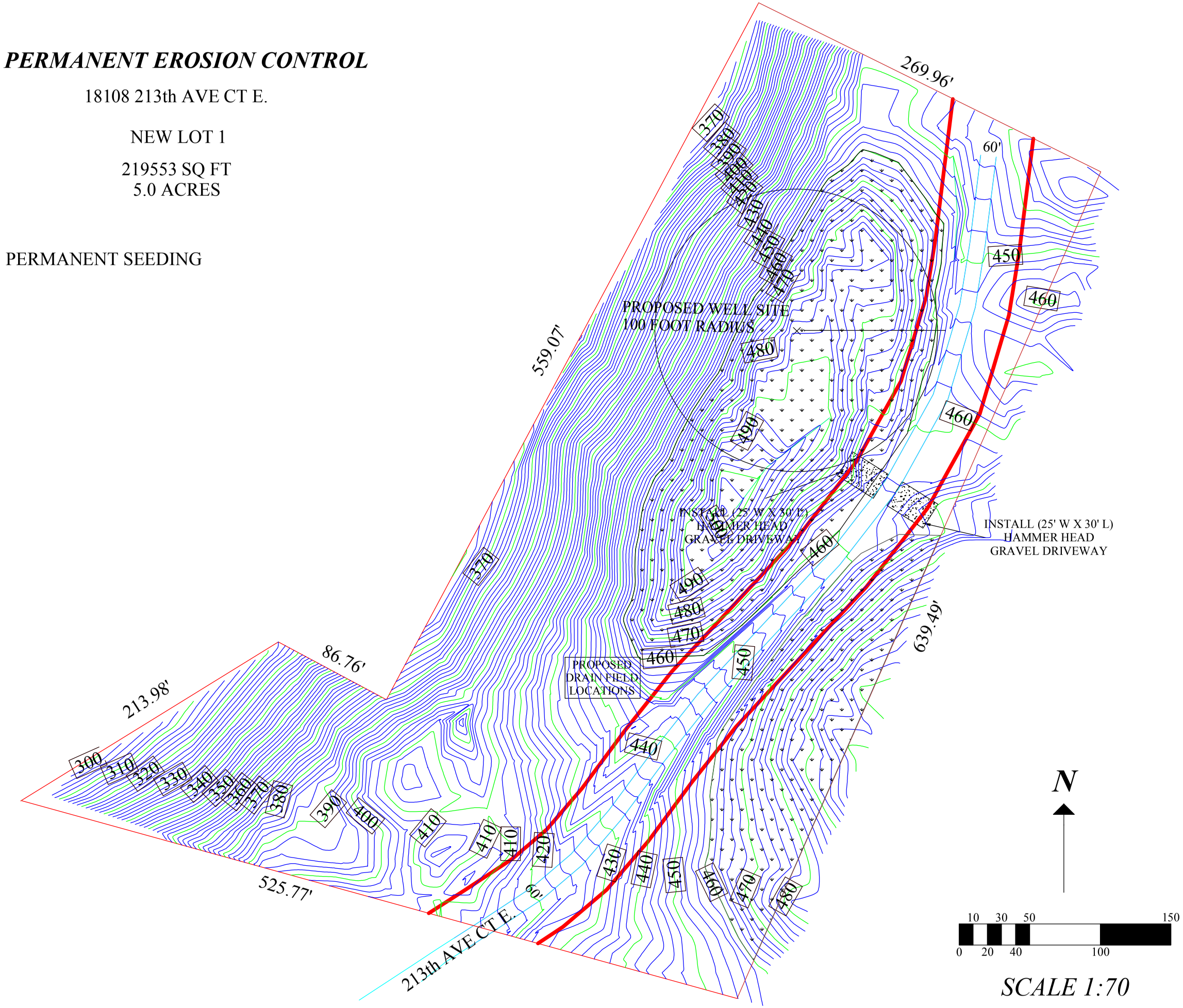
PERMANENT EROSION CONTROL

18108 213th AVE CT E.

NEW LOT 1

219553 SQ FT
5.0 ACRES

PERMANENT SEEDING



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SCALE 1:70

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SHEET
SW
5A

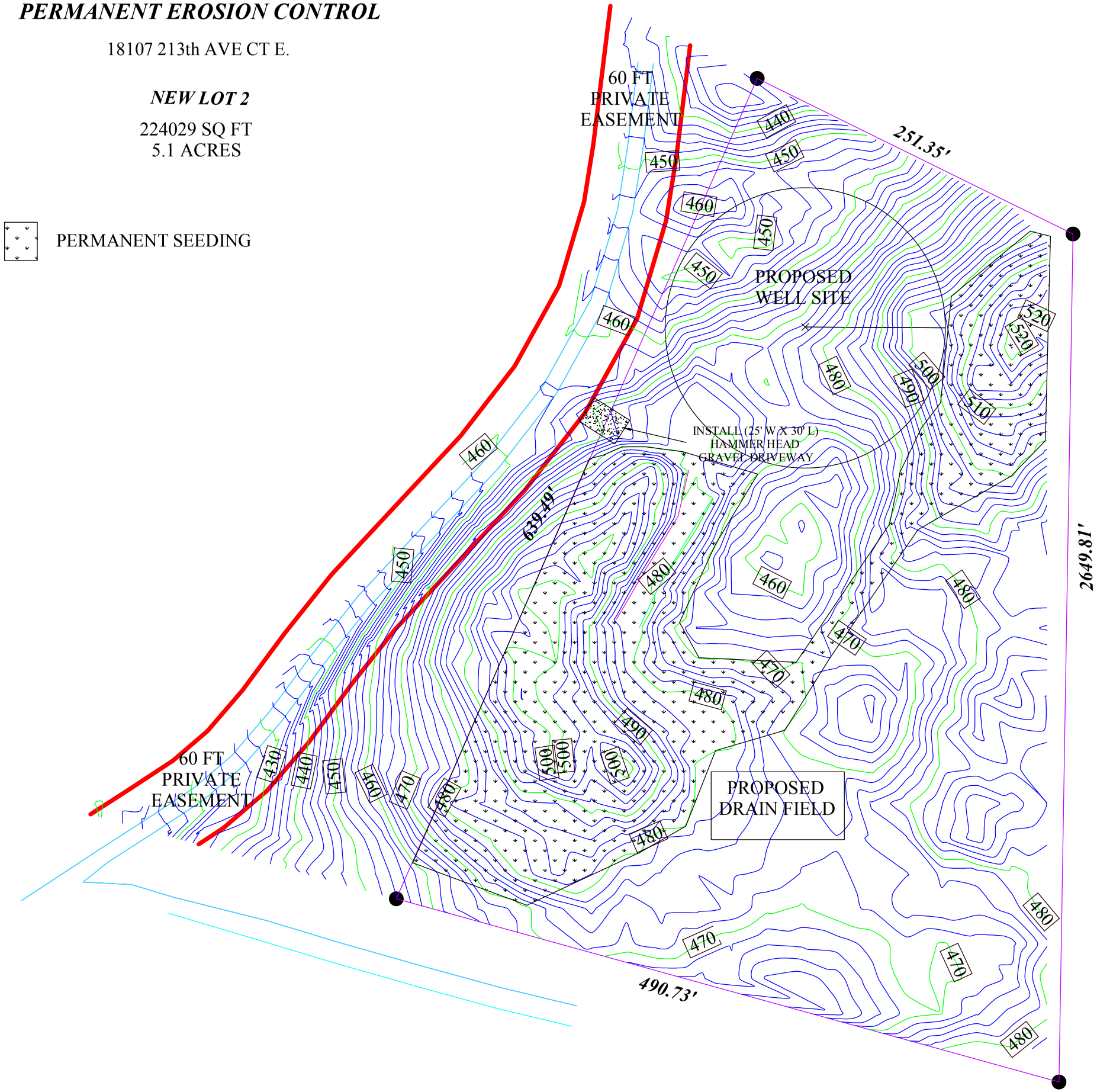
PERMANENT EROSION CONTROL

18107 213th AVE CT E.

NEW LOT 2

224029 SQ FT
5.1 ACRES

PERMANENT SEEDING



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SHEET
SW
5B

REFERENCED BMP's (PIERCE COUNTY)

BMP C101: Preserving Natural Vegetation

Purpose

The purpose of preserving natural vegetation is to reduce erosion wherever practicable. Limiting site disturbance is the single most effective method for reducing erosion. For example, conifers can hold up to about 50 percent of all rain that falls during a storm. Up to 20 to 30 percent of this rain may never reach the ground but is taken up by the tree or evaporates. Another benefit is that the rain held in the tree can be released slowly to the ground after the storm.

Conditions of Use

- Natural vegetation should be preserved on steep slopes, near perennial and intermittent watercourses or swales, and on building sites in wooded areas.

- As required by the county or other agencies.

Design and Installation Specifications

Natural vegetation can be preserved in natural clumps or as individual trees, shrubs and vines.

The preservation of individual plants is more difficult because heavy equipment is generally used to remove unwanted vegetation. The points to remember when attempting to save individual plants are:

- Is the plant worth saving? Consider the location, species, size, age, vigor, and the work involved. County ordinances to save natural vegetation and trees should be reviewed.

- Fence or clearly mark areas around trees that are to be saved. It is preferable to keep ground disturbance away from the trees at least as far out as the dripline.

Plants need protection from three kinds of injuries:

- **Construction Equipment:** This injury can be above or below the ground level. Damage results from scarring, cutting of roots, and compaction of the soil. Placing a fenced buffer zone around plants to be saved prior to construction can prevent construction equipment injuries.

- **Grade Changes**: Changing the natural ground level will alter grades, which affects the plant's ability to obtain the necessary air, water, and minerals. Minor fills usually do not cause problems although sensitivity between species does vary and should be checked. Trees can typically tolerate fill of 6 inches or less. For shrubs and other plants, the fill should be less.

When there are major changes in grade, it may become necessary to supply air to the roots of plants. This can be done by placing a layer of gravel and a tile system over the roots before the fill is made. A tile system protects a tree from a raised grade. The tile system should be laid out on the original grade leading from a dry well around the tree trunk. The system should then be covered with small stones to allow air to circulate over the root area.

Lowering the natural ground level can seriously damage trees and shrubs. The highest percentage of the plant roots are in the upper 12 inches of the soil and cuts of only 2 to 3 inches can cause serious injury. To protect the roots it may be necessary to terrace the immediate area around the plants to be saved. If roots are exposed, construction of retaining walls may be needed to keep the soil in place. Plants can also be preserved by leaving them on an undisturbed, gently sloping mound. To increase the chances for survival, it is best to limit grade changes and other soil disturbances to areas outside the dripline of the plant.

- **Excavations:** Protect trees and other plants when excavating for drainfields, power, water, and sewer lines. Where possible, the trenches should be routed around trees and large shrubs. When this is not possible, it is best to tunnel under them. This can be done with hand tools or with power augers. If it is not possible to route the trench around plants to be saved, then the following should be observed:

    - Cut as few roots as possible. When you have to cut, cut clean. Paint cut root ends with a wood dressing like asphalt base paint if roots will be exposed for more than 24 hours.

    - Backfill the trench as soon as possible.

    - Tunnel beneath root systems as close to the center of the main trunk to preserve most of the important feeder roots.

Some problems that can be encountered with a few specific trees are:

- Maple, Dogwood, Red alder, Western hemlock, Western red cedar, and Douglas fir do not readily adjust to changes in environment and special care should be taken to protect these trees.

- The windthrow hazard of Pacific Silver Fir and Madrona is high, while that of Western hemlock is moderate. The danger of windthrow increases where dense stands have been thinned. Other species (unless they are on shallow, wet soils less than 20 inches deep) have a low windthrow hazard.

- Cottonwoods, maples, and willows have water-seeking roots. These can cause trouble in sewer lines and infiltration fields. On the other hand, they thrive in high moisture conditions that other trees would not.

- Thinning operations in pure or mixed stands of Grand Fir, Pacific Silver Fir, Noble Fir, Sitka Spruce, Western Red Cedar, Western Hemlock, Pacific Dogwood, and Red Alder can cause serious disease problems. Disease can become established through damaged limbs, trunks, roots, and freshly cut stumps. Diseased and weakened trees are also susceptible to insect attack.

Maintenance Standards

- Inspect flagged and/or fenced areas regularly to make sure flagging or fencing has not been removed or damaged. If the flagging or fencing has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

- If tree roots have been exposed or injured, prune cleanly with an appropriate pruning saw or loppers directly above the damaged roots and recover with native soils. Treatment of sap flowing trees (fir, hemlock, pine, soft maples) is not advised as sap forms a natural healing barrier.

BMP C103: High Visibility Fence

Purpose

Fencing is intended to:

- Restrict clearing to approved limits
- Prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed
- Limit construction traffic to designated construction entrances, exits or internal roads
- Protect areas where marking with flagging/survey tape may not provide adequate protection.

Conditions of Use

To establish clearing limits plastic, fabric, or metal fence may be used:

- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared
- As necessary to control vehicle access to and on the site.

Design and Installation Specifications

- High visibility plastic fence shall be composed of a high-density polyethylene material and shall be at least 4 feet in height. Posts for the fencing shall be steel or wood and placed every 6 feet on center (maximum) or as needed to ensure rigidity. The fencing shall be fastened to the post every 6 inches with a polyethylene tie. On long continuous lengths of fencing, a tension wire or rope shall be used as a top stringer to prevent sagging between posts. The fence color shall be high visibility orange. The fence tensile strength shall be 360 pounds/feet using the American Society for Testing and Materials (ASTM) D4595 testing method.
- If appropriate install fabric silt fence in accordance with BMP C233 to act as high visibility fence. Except that the silt fence shall be at least 3 feet high and must be highly visible to meet the requirements of this BMP.
- Metal fences are the least preferred but might be appropriate to address security concerns. Metal fencing shall be designed and installed according to the manufacturer's specifications.
- Metal fences shall be at least 4 feet high and must be highly visible.
- Fences shall not be wired or stapled to trees.

Maintenance Standards

- If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

BMP C105: Stabilized Construction Entrance/Exit

Purpose

Stabilized Construction entrances are established to reduce the amount of sediment transported onto paved roads by vehicles or equipment. This is done by constructing a stabilized pad of quarry spalls at entrances and exits for construction sites.

Conditions of Use

Construction entrances shall be stabilized wherever traffic will be entering or leaving a construction site if paved roads or other paved areas are within 1,000 feet of the site.

For residential construction, provide stabilized construction entrances for each residence, rather than only at the main subdivision entrance. Stabilized surfaces shall be of sufficient length/width to provide vehicle access, based on lot size and configuration.

Design and Installation Specifications

- See Attachments Section C, Detail 4.0 for details. Note: the 100 foot minimum length of the entrance shall be reduced to the maximum practicable size when the size or configuration of the site does not allow the full length (100 feet).

- Construct stabilized construction entrances with a 12-inch thick pad of 4-inch to 8-inch quarry spalls, a 4-inch course of asphalt treated base (ATB), or use existing pavement. For single family residential lots pad may be reduced in length to fit site, to no less than 20 feet long, and in depth, to 6-inch thick with 4-inch to 6-inch quarry spalls, provided that performance standards are still met.

- Do not use crushed concrete, cement, or calcium chloride for construction entrance stabilization because these products raise pH levels in stormwater and concrete discharge to surface waters of the State is prohibited.

- A separation geotextile shall be placed under the spalls to prevent fine sediment from pumping up into the rock pad. The geotextile shall meet the following standards:

    - Grab Tensile Strength (ASTM D4751): 200 psi minimum

    - Grab Tensile Elongation (ASTM D4632): 30 percent maximum

    - Mullen Burst Strength (ASTM D3786-80a): 400 psi minimum

    - AOS (ASTM D4751): 20 to 45 (U.S. standard sieve size).

- Fencing (see BMP C103) shall be installed as necessary to restrict traffic to the construction entrance.

- Whenever possible, the entrance shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.

Maintenance Standards

- Quarry spalls shall be added if the pad is no longer in accordance with the specifications.

- On large commercial, highway, and road projects, the designer should include enough extra materials in the contract to allow for additional stabilized entrances not shown in the initial Construction SWPPP. It is difficult to determine exactly where access to these projects will take place; additional materials will enable the contractor to install them where needed.

- Construction entrances should avoid crossing existing sidewalks and back of walk drains if at all possible. If a construction entrance must cross a sidewalk or back of walk drain, the full length of the sidewalk and back of walk drain must be covered and protected from sediment leaving the site.

- If the entrance is not preventing sediment from being tracked onto pavement, then alternative measures to keep the streets free of sediment shall be used. This may include replacement/cleaning of the existing quarry spalls, street sweeping, an increase in the dimensions of the entrance, or the installation of a wheel wash.

- Any sediment that is tracked onto pavement shall be removed by shoveling or street sweeping. The sediment collected by sweeping shall be removed or stabilized onsite. The pavement shall not be cleaned by washing down the street, except when high efficiency sweeping is ineffective and there is a threat to public safety. If it is necessary to wash the streets, the construction of a small sump to contain the wash water may be required. The sediment would then be washed into the sump where it can be controlled.

- Perform street sweeping by hand or with a high efficiency sweeper. Do not use a non-high efficiency mechanical sweeper as these sweepers create dust and throw soil into nearby storm systems or conveyance ditches.

- Any quarry spalls that are loosened from the pad, which end up on the roadway shall be removed immediately.

- If vehicles are entering or exiting the site at points other than the construction entrance(s), fencing (see BMP C103) shall be installed to control traffic.

- Upon project completion and site stabilization, all construction accesses intended as permanent access for maintenance shall be permanently stabilized.

Approved as Equivalent

Ecology has approved specific products as able to meet the requirements of BMP C105. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. The county has reviewed these products for application in Pierce County, and has developed a county-specific list of the approved and prohibited products. This county-specific list can be obtained from Pierce County Planning and Land Services' (PALS) web site: <piercecountywa.org/PALS>. The county web site is updated routinely, but the latest list from Ecology is available on Ecology's web site at <www.ecy.wa.gov/programs/wq/stormwater/newtech/equivalent.html>.

Contact the county if a new Ecology approved product is not listed on the county web site.

BMP C120: Temporary and Permanent Seeding

Purpose

Seeding reduces erosion by stabilizing exposed soils with a well-established vegetative cover. This is one of the most effective methods of reducing erosion.

Conditions of Use

- Use seeding throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.
- The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1.
- Between July 1 and August 30 seeding requires irrigation until 75 percent grass cover is established.
- Between October 1 and March 30 seeding requires a cover of mulch with straw or an erosion control blanket until 75 percent grass cover is established.
- Where the term "fully established" is used to describe vegetative cover or plantings, it shall be understood to mean that healthy vegetation covers 90 percent of exposed soil.
- Inspect all disturbed areas in late August to early September and complete all seeding by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.
- Mulch is required at all times for seeding because it protects seeds from heat, moisture loss, and transport due to runoff. Mulch can be applied on top of the seed or simultaneously by hydroseeding. See BMP C121: Mulching for specifications.
- Seed and mulch all disturbed areas not otherwise vegetated at final site stabilization. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions, or geotextiles) that will prevent erosion.

Design and Installation Specifications

- Seed retention/detention ponds as required.
- Install channels intended for vegetation before starting major earthwork and hydroseeded with a Bonded Fiber Matrix (BFM). For vegetated channels that will have high flows, install erosion control blankets over hydroseed. Before allowing water to flow in vegetated channels, establish 75 percent vegetation cover. If vegetated channels cannot be established by seed before water flow,

install sod in the channel bottom – over hydromulch and erosion control blankets.

- Confirm the installation of all required surface water control measures to prevent seed from washing away.
- The seedbed should be firm and rough. All soil should be roughened no matter what the slope. If compaction is required for engineering purposes, slopes must be track walked before seeding. Backblading or smoothing of slopes greater than 4:1 is not allowed if they are to be seeded.
- New and more effective restoration-based landscape practices rely on deeper incorporation than that provided by a simple single-pass rototilling treatment. Wherever practical the subgrade should be initially ripped to improve long-term permeability, infiltration, and water inflow qualities. At a minimum, permanent areas shall use soil amendments to achieve organic matter and permeability performance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches the rototilling process should be done in multiple lifts, or the prepared soil system shall be prepared properly and then placed to achieve the specified depth.
- Organic matter is the most appropriate form of "fertilizer" because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form. A natural system typically releases 2 to 10 percent of its nutrients annually. Chemical fertilizers have since been formulated to simulate what organic matter does naturally.
- In general, 10-4-6 N-P-K (nitrogen-phosphorus-potassium) fertilizer can be used at a rate of 90 pounds per acre. Slow-release fertilizers should always be used because they are more efficient and have fewer environmental impacts. It is recommended that areas being seeded for final landscaping conduct soil tests to determine the exact type and quantity of fertilizer needed. This will prevent the over-application of fertilizer. Fertilizer should not be added to the hydromulch machine and agitated more than 20 minutes before it is to be used. If agitated too much, the slow-release coating is destroyed.
- There are numerous products available on the market that takes the place of chemical fertilizers. These include several with seaweed extracts that are beneficial to soil microbes and organisms. If 100 percent cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal is a good source of long-term, slow-release, available nitrogen.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre of mulch with 3 percent tackifier. See BMP C121: Mulching for specifications.
- On steep slopes, BFM or Mechanically Bonded Fiber Matrix (MBFM) products should be used. BFM/MBFM products are applied at a minimum rate

of 3,000 pounds per acre of mulch with approximately 10 percent tackifier. Application is made so that a minimum of 95 percent soil coverage is achieved. Numerous products are available commercially and should be installed per manufacturer's instructions. Most products require 24 to 36 hours to cure before a rainfall and cannot be installed on wet or saturated soils. Generally, these products come in 40 to 50 pound bags and include all necessary ingredients except for seed and fertilizer.

- BFMs and MBFMs have some advantages over blankets:
  - No surface preparation required
  - Can be installed via helicopter in remote areas
  - On slopes steeper than 2.5:1, blanket installers may need to be roped and harnessed for safety
  - They are at least $1,000 per acre cheaper installed.
- In most cases, the shear strength of blankets is not a factor when used on slopes, only when used in channels. BFMs and MBFMs are good alternatives to blankets in most situations where vegetation establishment is the goal.
- Areas that will have seeding only and not landscaping may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Re-install native topsoil on the disturbed soil surface before application. See also soil preservation and amendment in Volume III, Section 3.1.
- When installing seed via hydroseeding operations, only about one-third of the seed actually ends up in contact with the soil surface. This reduces the ability to establish a good stand of grass quickly. To overcome this, consider increasing seed quantities by up to 50 percent.
- Enhance vegetation establishment by dividing the hydromulch operation into two phases:

  1. Phase 1 – Install all seed and fertilizer with 25 to 30 percent mulch and tackifier onto soil in the first lift.
  2. Phase 2 – Install the rest of the mulch and tackifier over the first lift.

  Or, enhance vegetation by:

  1. Installing the mulch, seed, fertilizer, and tackifier in one lift.
  2. Spread or blow straw over the top of the hydromulch at a rate of 800 to 1,000 pounds per acre.
  3. Hold straw in place with a standard tackifier.

Both of these approaches will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:

- Irrigation
- Reapplication of mulch
- Repair of failed slope surfaces.

This technique works with standard hydromulch (1,500 pounds per acre minimum) and BFM or Mechanically Bonded Fiber Matrix (MBFM) (3,000 pounds per acre minimum).

- Seed may be installed by hand if:
  - Temporary and covered by straw, mulch, or topsoil
  - Permanent in small areas (usually less than 1 acre) and covered with mulch, topsoil, or erosion blankets.
- The seed mixes listed in the tables below include recommended mixes for both temporary and permanent seeding.
- Apply these mixes, with the exception of the wetland mix, at a rate of 120 pounds per acre. This rate can be reduced if soil amendments or slow-release fertilizers are used.
- Consult the local suppliers or the local conservation district for their recommendations because the appropriate mix depends on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic. Alternative seed mixes approved by the county may be used.
- Other mixes may be appropriate, depending on the soil type and hydrology of the area.
- Table 3.2 represents the standard mix for areas requiring a temporary vegetative cover.

Table 3.2. Temporary Erosion Control Seed Mix.

	% Weight	% Purity	% Germination
Chewings or annual blue grass (*Festuca rubra var. commutata* or *Poa anna*)	40	98	90
Perennial rye (*Lolium perenne*)	50	98	90
Redtop or colonial bentgrass (*Agrostis alba* or *Agrostis tenuis*)	5	92	85
White dutch clover (*Trifolium repens*)	5	98	90

- Table 3.3 lists a recommended mix for landscaping seed.

Table 3.3. Landscaping Seed Mix.

	% Weight	% Purity	% Germination
Perennial rye blend (*Lolium perenne*)	70	98	90
Chewings and red fescue blend (*Festuca rubra var. commutata* or *Festuca rubra*)	30	98	90

- Table 3.4 lists a turf seed mix in dry situations where there is no need for watering. This mix requires very little maintenance.

Table 3.4. Low-Growing Turf Seed Mix.

	% Weight	% Purity	% Germination
Dwarf tall fescue (several varieties) (*Festuca arundinacea var.*)	45	98	90
Dwarf perennial rye (Barclay) (*Lolium perenne var. Barclay*)	30	98	90
Red fescue (*Festuca rubra*)	20	98	90
Colonial bentgrass (*Agrostis tenuis*)	5	98	90

- Table 3.5 lists a mix for bioswales and other intermittently wet areas.

Table 3.5. Bioswale Seed Mix.[a]

	% Weight	% Purity	% Germination
Tall or meadow fescue (*Festuca arundinacea* or *Festuca elatior*)	75 to 80	98	90
Seaside/Creeping bentgrass (*Agrostis palustris*)	10 to 15	92	85
Redtop bentgrass (*Agrostis alba* or *Agrostis gigantea*)	5 to 10	90	80

[a] *Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix*

- Table 3.6 lists a low-growing, relatively non-invasive seed mix appropriate for very wet areas that are not regulated wetlands. Apply this mixture at a rate of 60 pounds per acre. Consult Hydraulic Permit Authority (HPA) for seed mixes if applicable.

Table 3.6. Wet Area Seed Mix.[a]

	% Weight	% Purity	% Germination
Tall or meadow fescue (*Festuca arundinacea* or *Festuca elatior*)	60 to 70	98	90
Seaside/Creeping bentgrass (*Agrostis palustris*)	10 to 15	98	85
Meadow foxtail (*Alepocurus pratensis*)	10 to 15	90	80
Alsike clover (*Trifolium hybridum*)	1 to 6	98	90
Redtop bentgrass (*Agrostis alba*)	1 to 6	92	85

[a] *Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix*

- Table 3.7 lists a recommended meadow seed mix for infrequently maintained areas or non-maintained areas where colonization by native plants is desirable. Likely applications include rural road and utility right-of-way. Seeding should take place in September or very early October in order to obtain adequate establishment prior to the winter months. Consider the appropriateness of clover, a fairly invasive species, in the mix. Amending the soil can reduce the need for clover.

Table 3.7. Meadow Seed Mix.

	% Weight	% Purity	% Germination
Redtop or Oregon bentgrass (*Agrostis alba* or *Agrostis oregonensis*)	20	92	85
Red fescue (*Festuca rubra*)	70	98	90
White dutch clover (*Trifolium repens*)	10	98	90

Maintenance Standards

- Reseed any seeded areas that fail to establish at least 80 percent cover (100 percent cover for areas that receive sheet or concentrated flows). If reseeding is ineffective, an alternate method, such as sodding, mulching, or nets/blankets, shall be used. If winter weather prevents adequate grass growth, this time limit may be relaxed at the discretion of the county when sensitive areas would otherwise be protected.

- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. Reseed and protect by mulch any eroded area.

- Supply seeded areas with adequate moisture, but do not water to the extent that it causes runoff.

Approved as Equivalent

Ecology has approved specific products as able to meet the requirements of BMP C120. The products did not pass through the Technology Assessment Protocol – Ecology

(TAPE) process. The county has reviewed these products for application in Pierce County, and has developed a county-specific list of the approved and prohibited products. This county-specific list can be obtained from Pierce County Planning and Land Services' (PALS) web site: <piercecountywa.org/PALS>. The county web site is updated routinely, but the latest list from Ecology is available on Ecology's web site at <www.ecy.wa.gov/programs/wq/stormwater/newtech/equivalent.html>. Contact the county if a new Ecology approved product is not listed on the county web site.

BMP C123: Plastic Covering

Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

Conditions of Use

- Plastic covering may be used on disturbed areas that require cover measures for less than 30 days, except as stated below.
- Plastic is particularly useful for protecting cut and fill slopes and stockpiles. Note: The relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for long-term (greater than 6 months) applications.
- Due to rapid runoff caused by plastic covering, do not use this method upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
- Plastic sheeting may result in increased runoff volumes and velocities, requiring additional onsite measures to counteract the increases. Creating a trough with wattles or other material can convey clean water away from these areas.
- To prevent undercutting, trench and backfill rolled plastic covering products.
- While plastic is inexpensive to purchase, the added cost of installation, maintenance, removal, and disposal make this an expensive material, up to $1.50 to $2 per square yard.
- Whenever plastic is used to protect slopes install water collection measures at the base of the slope. These measures include plastic-covered berms, channels, and pipes used to covey clean rainwater away from bare soil and disturbed areas. Do not mix clean runoff from a plastic covered slope with dirty runoff from a project.
- Other uses for plastic include:
    - Temporary ditch liner
    - Pond liner in temporary sediment pond
    - Liner for bermed temporary fuel storage area if plastic is not reactive to the type of fuel being stored
    - Emergency slope protection during heavy rains
    - Temporary drainpipe (“elephant trunk”) used to direct water.

Design and Installation Specifications

- Plastic slope cover must be installed as follows:
    - Run plastic up and down slope, not across slope.
    - Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet.
    - Minimum of 8-inch overlap at seams.
    - On long or wide slopes, or slopes subject to wind, tape all seams.
    - Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath.
    - Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and tie them together with twine to hold them in place.
    - Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil which causes extreme erosion.
    - Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.
- Plastic sheeting shall have a minimum thickness of 6 mil.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

Maintenance Standards

- Torn sheets must be replaced and open seams repaired.
- Completely remove and replace the plastic if it begins to deteriorate due to ultraviolet radiation.
- Completely remove plastic when no longer needed.
- Dispose of old tires used to weight down plastic sheeting appropriately.

Approved as Equivalent

Ecology has approved specific products as able to meet the requirements of BMP C123. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. The county has reviewed these products for application in Pierce

County, and has developed a county-specific list of the approved and prohibited products. This county-specific list can be obtained from Pierce County Planning and Land Services' (PALS) web site: <piercecountywa.org/PALS>. The county web site is updated routinely, but the latest list from Ecology is available on Ecology's web site at <www.ecy.wa.gov/programs/wq/stormwater/newtech/equivalent.html>. Contact the county if a new Ecology approved product is not listed on the county web site.

BMP C206: Level Spreader

Purpose

To provide a temporary outlet for dikes and diversions consisting of an excavated depression constructed at zero grade across a slope. To convert concentrated runoff to sheet flow and release it onto areas stabilized by existing vegetation or an engineered filter strip.

Conditions of Use

Used when a concentrated flow of water needs to be dispersed over a large area with existing stable vegetation.

Items to consider are:

1. What is the risk of erosion or damage if the flow may become concentrated?

2. Is an easement required if discharged to adjoining property?

3. Will most of the flow discharge to groundwater and not contribute to surface flow?

4. Is there an unstable area downstream that cannot accept additional groundwater?

Use only where the slopes are gentle, the water volume is relatively low, and the soil will adsorb most of the low flow events.

Design and Installation Specifications

- Use above undisturbed areas that are stabilized by existing vegetation.
- If the level spreader has any low points, flow will concentrate, create channels and may cause erosion.
- Discharge area below the outlet must be uniform with a slope flatter than 5H:1V.
- Outlet to be constructed level in a stable, undisturbed soil profile (not on fill).
- The runoff shall not reconcentrate after release unless intercepted by another downstream measure.
- The grade of the channel for the last 20 feet of the dike or interceptor entering the level spreader shall be less than or equal to 1 percent. The grade of the level spreader shall be 0 percent to ensure uniform spreading of storm runoff.
- A 6-inch high gravel berm placed across the level lip shall consist of washed crushed rock, 2- to 4-inch or 0.75-inch to 1.5-inch size.

- The spreader length shall be determined by estimating the peak flow expected from the 10-year, 24-hour design storm event assuming a NRCS Type 1A rainfall distribution resolved to 10-minute time steps. Alternatively, use the peak flow from a 10-year, 15-minute (or less) time step using an approved continuous runoff model. The length of the spreader shall be a minimum of 15 feet for 0.1 cubic feet per second and shall increase by 10 feet for each 0.1 cubic feet per second thereafter to a maximum of 0.5 cubic feet per second per spreader. Use multiple spreaders for higher flows.

- The width of the spreader should be at least 6 feet.

- The depth of the spreader as measured from the lip should be at least 6 inches and it should be uniform across the entire length.

- Level spreaders shall be setback 100 feet minimum from the property line unless there is an easement for flow or the flow is directed to a natural drainage course.

- Level spreaders, when installed every so often in grassy swales, keep the flows from concentrating. Materials that can be used include sand bags, lumber, logs, concrete, and pipe. To function properly, the material needs to be installed level and on contour. Figures 3.9 and 3.10 provide a cross-section and a detail of a level spreader. A capped perforated pipe could also be used as a spreader.

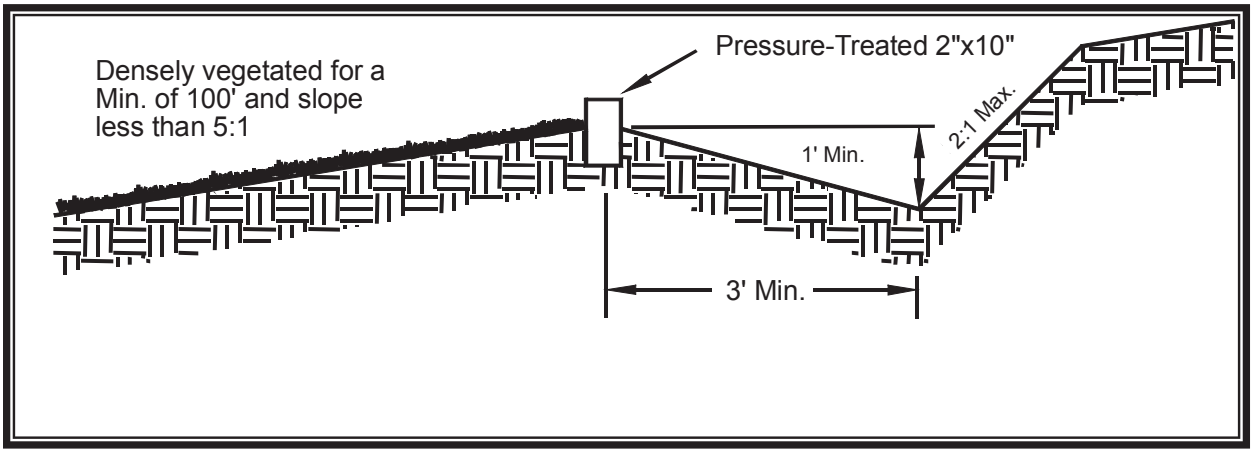


Figure 3.9. Cross-Section of Level Spreader.

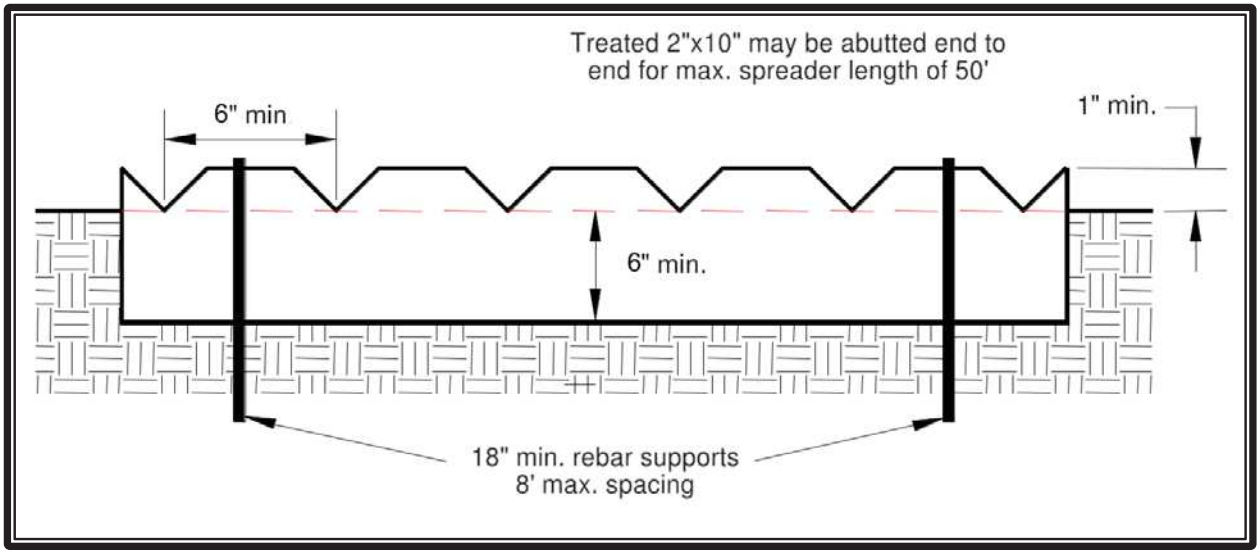


Figure 3.10. Detail of Level Spreader.

Maintenance Standards

- The spreader should be inspected after every runoff event to ensure that it is functioning correctly.
- The contractor should avoid the placement of any material on the structure and should prevent construction traffic from crossing over the structure.
- If the spreader is damaged by construction traffic, it shall be immediately repaired.

BMP C233: Silt Fence

Purpose

Use of a silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow. See Attachments Section C, Detail 8.0 for details on silt fence construction.

Conditions of Use

- Silt fence may be used downslope of all disturbed areas.
- Silt fence shall prevent soil carried by runoff water from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.
- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Convey any concentrated flows through the drainage system to a sediment pond.
- Do not construct silt fences in streams or use in V-shaped ditches. Silt fences do not provide an adequate method of silt control for anything deeper than sheet or overland flow.

Design and Installation Specifications

- Use in combination with sediment basins or other BMPs.
- Maximum slope steepness (normal [perpendicular] to fence line) 1H:1V.
- Maximum sheet or overland flow path length to the fence of 100 feet.
- Do not allow flows greater than 0.5 cubic feet per second.
- The geotextile used shall meet the following standards. All geotextile properties listed below are minimum average roll values (i.e., the test result for any sampled roll in a lot shall meet or exceed the values shown in Table 3.12).
- Standard strength fabrics must be supported with wire mesh, chicken wire, 2-inch x 2-inch wire, safety fence, or jute mesh to increase the strength of the fabric to the 180 lbs minimum threshold. Silt fence materials are available that have synthetic mesh backing attached.
- Filter fabric material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0°F. to 120°F.

Table 3.12. Geotextile Standards.

Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for film wovens (US #30 sieve). 0.30 mm maximum for all other geotextile types (US #50 sieve). 0.15 mm minimum for all fabric types (US #100 sieve).
Water Permittivity (ASTM D4491)	0.02 sec^{-1} minimum
Grab Tensile Strength (ASTM D4632)	180 lbs. Minimum for extra strength fabric. 100 lbs minimum for standard strength fabric.
Grab Tensile Strength (ASTM D4632)	30% maximum
Ultraviolet Resistance (ASTM D4355)	70% minimum

- Include the following standard notes for silt fence on construction plans and specifications:
    - The contractor shall install and maintain temporary silt fences at the locations shown in the plans.
    - Construct silt fences in areas of clearing, grading, or drainage prior to starting those activities.
    - The silt fence shall have a 2 feet min. and 2.5 feet max. height above the original ground surface.
    - The filter fabric shall be sewn together at the point of manufacture to form filter fabric lengths as required. Locate all sewn seams at support posts. Alternatively, two sections of silt fence can be overlapped, provided the contractor can demonstrate, to the satisfaction of the engineer, that the overlap is long enough and that the adjacent fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap.
    - Attach the filter fabric on the up-slope side of the posts and secure with staples, wire, or in accordance with the manufacturer's recommendations. Attach the filter fabric to the posts in a manner that reduces the potential for tearing.
    - Support the filter fabric with wire or plastic mesh, dependent on the properties of the geotextile selected for use. If wire or plastic mesh is used, fasten the mesh securely to the up-slope side of the posts with the filter fabric up-slope of the mesh.
    - Mesh support, if used, shall consist of steel wire with a maximum mesh spacing of 2 inches, or a prefabricated polymeric mesh. The strength of the wire or polymeric mesh shall be equivalent to or greater than 180 pounds grab tensile strength. The polymeric mesh must be as resistant to the same level of ultraviolet radiation as the filter fabric it supports.

- Bury the bottom of the filter fabric 8 inches min. below the ground surface. Backfill and tamp soil in place over the buried portion of the filter fabric, so that no flow can pass beneath the fence and scouring cannot occur. The wire or polymeric mesh shall extend into the ground 3 inches min.

- Drive or place the fence posts into the ground 18 inches minimum. A 12-inch minimum depth is allowed if topsoil or other soft subgrade soil is not present and 18 inches cannot be reached. Increase fence post min. depths by 6 inches if the fence is located on slopes of 3H:1V or steeper and the slope is perpendicular to the fence. If required post depths cannot be obtained, the posts shall be adequately secured by bracing or guying to prevent overturning of the fence due to sediment loading.

- Use wood, steel, or equivalent posts. The spacing of the support posts shall be a maximum of 6 feet. Posts shall consist of either:

  - Wood with dimensions of 2-inches by 2-inches wide min. and a 3-feet min. length. Wood posts shall be free of defects such as knots, splits, or gouges.

  - No. 6 steel reinforcement bar or larger.

  - ASTM A 120 steel pipe with a minimum diameter of 1 inch.

  - U, T, L, or C shape steel posts with a minimum weight of 1.35 pounds/feet.

  - Other steel posts having equivalent strength and bending resistance to the post sizes listed above.

- Locate silt fences on contour as much as possible, except at the ends of the fence, where the fence shall be turned uphill such that the silt fence captures the runoff water and prevents water from flowing around the end of the fence.

- If the fence must cross contours, with the exception of the ends of the fence, place gravel check dams perpendicular to the back of the fence to minimize concentrated flow and erosion. The slope of the fence line where contours must be crossed shall not be steeper than 3H:1V.

  - Gravel check dams shall be approximately 1 foot deep at the back of the fence. Gravel check dams shall be continued perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface behind the fence.

  - Gravel check dams shall consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. Gravel check dams shall be located every 10 feet along the fence where the fence must cross contours.

- Silt fence installation using the slicing method specification details follow:
    - The base of both end posts must be at least 2 to 4 inches above the top of the filter fabric on the middle posts for ditch check dams to drain properly. Use a hand level or string level, if necessary, to mark base points before installation.
    - Install posts 3 to 4 feet apart in critical retention areas and 6 to 7 feet apart in standard applications. Install posts 24 inches deep on the downstream side of the silt fence, and as close as possible to the filter fabric, enabling posts to support the filter fabric from upstream water pressure.
    - Install posts with the nipples facing away from the filter fabric.
    - Attach the filter fabric to each post with three ties, all spaced within the top 8 inches of the filter fabric. Attach each tie diagonally 45 degrees through the filter fabric, with each puncture at least 1 inch vertically apart. Each tie should be positioned to hang on a post nipple when tightening to prevent sagging.
    - Wrap approximately 6 inches of fabric around the end posts and secure with three ties.
    - No more than 24 inches of a 36-inch filter fabric is allowed above ground level, 12 inches must be buried.
- Compact the soil immediately next to the filter fabric with the front wheel of the tractor, skid steer, or roller exerting at least 60 pounds per square inch. Compact the upstream side first and then each side twice for a total of four trips. Check and correct the silt fence installation for any deviation before compaction. Use a flat-bladed shovel to tuck fabric deeper into the ground if necessary.

Maintenance Standards

- Repair any damage immediately.
- Intercept and convey all evident concentrated flows uphill of the fence to a sediment pond.
- Check the uphill side of the fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence or remove the trapped sediment.
- Remove sediment deposits when the deposit reaches approximately one-third the height of the silt fence, or install a second silt fence.
- Replace filter fabric that has deteriorated due to ultraviolet breakdown.

BMP C234: Vegetated Strip

Purpose

Vegetated strips reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

- Vegetated strips may be used downslope of all disturbed areas.
- Vegetated strips are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment pond. The only circumstance in which overland flow can be treated solely by a strip, rather than by a sediment pond, is when the following criteria are met (see Table 3.13):

Table 3.13. Vegetated Strips.

Average Contributing Area Slope	Average Contributing Area Percent Slope	Max Contributing Area Flowpath Length
1.5H:1V or flatter	67% or flatter	100 feet
2H:1V or flatter	50% or flatter	115 feet
4H:1V or flatter	25% or flatter	150 feet
6H:1V or flatter	16.7% or flatter	200 feet
10H:1V or flatter	10% or flatter	250 feet

Design and Installation Specifications

- The vegetated strip shall consist of a continuous strip of dense vegetation with topsoil and have a minimum 25-foot long flowpath. Grass-covered, landscaped areas are generally not adequate because the volume of sediment overwhelms the grass. Ideally, vegetated strips shall consist of undisturbed native growth with a well-developed soil that allows for infiltration of runoff.
- The slope within the strip shall not exceed 4H:1V.
- The uphill boundary of the vegetated strip shall be delineated with clearing limits.

Maintenance Standards

- Any areas damaged by erosion or construction activity shall be seeded immediately and protected by mulch.

- If more than 5 feet of the original vegetated strip width has had vegetation removed or is being eroded, sod must be installed.

- If there are indications that concentrated flows are traveling across the buffer, surface water controls must be installed to reduce the flows entering the buffer, or additional perimeter protection must be installed.

BMP C235: Wattles

Purpose

Wattles are TESC barriers consisting of straw, compost, or other material that is wrapped in biodegradable tubular plastic or similar encasing material. They reduce the velocity and can spread the flow of rill and sheet runoff, and can capture and retain sediment. Wattles are typically 8 to 10 inches in diameter and 25 to 30 feet in length. Wattles are placed in shallow trenches and staked along the contour of disturbed or newly constructed slopes. See Figure 3.13 for typical construction details.

Conditions of Use

- Use wattles:
    - In disturbed areas that require immediate erosion protection
    - On exposed soils during the period of short construction delays, or over winter months
    - On slopes requiring stabilization until permanent vegetation can be established.
- The material used dictates the effectiveness period of the wattle. Typically, wattles are effective for one to two wet seasons.
- Prevent rilling beneath wattles by properly entrenching and abutting wattles together to prevent water from passing between them.

Design Criteria

- Install wattles perpendicular to the flow direction and parallel to the slope contour.
- Narrow trenches should be dug across the slope on contour to a depth of 3 to 5 inches on clay soils and soils with gradual slopes. On loose soils, steep slopes, and areas with high rainfall, the trenches should be dug to a depth of 5 to 7 inches, or one-half to two-thirds of the thickness of the wattle.
- Start building trenches and installing wattles from the base of the slope and work up. Spread excavated material evenly along the uphill slope and compacted using hand tamping or other methods.
- Construct trenches on contours at intervals of 10 to 25 feet apart depending on the steepness of the slope, soil type, and rainfall. The steeper the slope, the closer together the trenches.

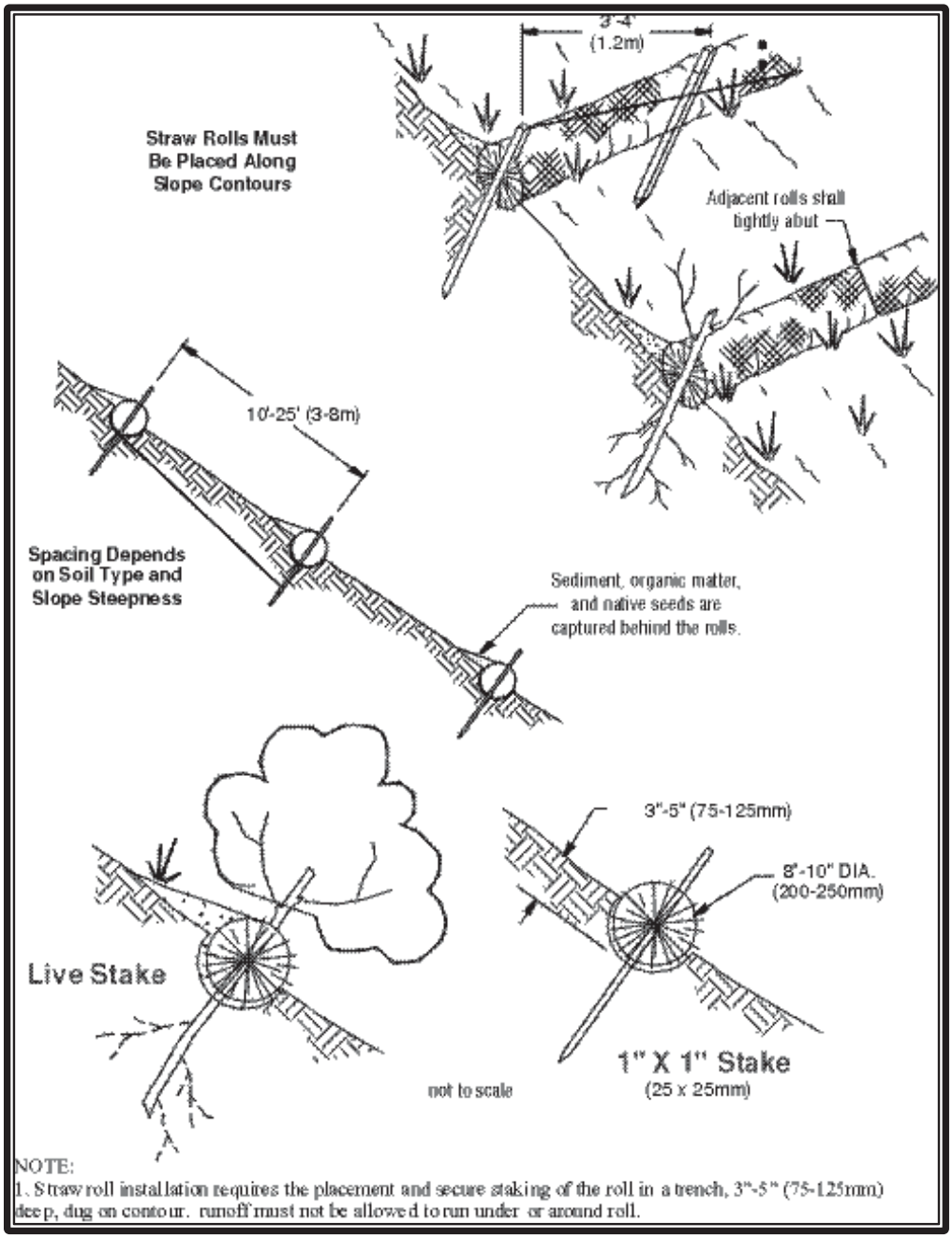


Figure 3.13. Straw Wattles.

- Install the wattles snugly into the trenches and abut tightly end to end. Do not overlap the ends.
- Install stakes at each end of the wattle, and at 4-foot centers along entire length of wattle.
- If required, install pilot holes for the stakes using a straight bar to drive holes through the wattle and into the soil.

- Wooden stakes should be approximately 0.75 x 0.75 x 24 inches min. Willow cuttings or 0.375-inch rebar can also be used for stakes. Note: rebar must be removed at end of project if used, while other fasteners maybe permitted to remain if all parts of the wattles are biodegradable and shown in plans for permanent erosion control.

Maintenance Standards

- Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle.

- Wattles may require maintenance to ensure they are in contact with soil and thoroughly entrenched, especially after significant rainfall on steep sandy soils.

- Inspect the slope after significant storms and repair any areas where wattles are not tightly abutted or water has scoured beneath the wattles.

Approved as Equivalent

Ecology has approved specific products as able to meet the requirements of BMP C235. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. The county has reviewed these products for application in Pierce County, and has developed a county-specific list of the approved and prohibited products. This county-specific list can be obtained from Pierce County Planning and Land Services' (PALS) web site: <piercecountywa.org/PALS>. The county web site is updated routinely, but the latest list from Ecology is available on Ecology's web site at <www.ecy.wa.gov/programs/wq/stormwater/newtech/equivalent.html>. Contact the county if a new Ecology approved product is not listed on the county web site.

BMP C236: Vegetative Filtration

Purpose

Vegetative filtration may be used in conjunction with BMP C241 Temporary Sediment Ponds, BMP C206 Level Spreader, and a pumping system with surface intake to improve turbidity levels of stormwater discharges by filtering through existing vegetation where undisturbed forest floor duff layer or established lawn with thatch layer are present. Vegetative filtration can also be used to infiltrate dewatering waste from foundations, vaults, and trenches as long as runoff does not occur.

Conditions of Use

- For every 5 acres of disturbed soil, use 1 acre of grass field, farm pasture, or wooded area. Reduce or increase this area depending on project size, groundwater table height, and other site conditions.
- Wetlands shall not be used for filtration.
- Do not use this BMP in areas with a high groundwater table, or in areas that will have a high seasonal groundwater table during the use of this BMP.
- This BMP may be less effective on soils that prevent the infiltration of the water, such as hard till.
- Using other effective source control measures throughout a construction site will prevent the generation of additional highly turbid water and may reduce the time period or area need for this BMP.
- Stop distributing water into the vegetated area if standing water or erosion results.

Design Criteria

- Find an on the project site that has a vegetated field, preferably a farm field, or wooded area.
- If the project site does not contain enough vegetated field area consider obtaining easement from adjacent landowners if conditions would allow for proper filtration. An easement is required for any offsite area used to meet the requirements of this BMP.
- Install a pump and downstream distribution manifold depending on the project size. Generally, the main distribution line should reach 100 to 200 feet long (many large projects, or projects on tight soil, will require systems that reach several thousand feet long with numerous branch lines off the main distribution line).

- The manifold should have several valves, allowing for control over the distribution area in the field.

- Install several branches of 4-inch schedule 20, swaged-fit common septic tight-lined sewer line, or 6-inch fire hose, which can convey the turbid water out to various sections of the field. See Figure 3.14.

Figure 3.14. Manifold and Branches in a Wooded, Vegetated Spray Field

- Determine the branch length based on the field area geography and number of branches. Typically, branches stretch from 200 feet to several thousand feet. Always, lay branches on contour with the slope.

- On uneven ground, sprinklers perform well. Space sprinkler heads so that spray patterns do not overlap.

- On relatively even surfaces, a level spreader using 4-inch perforated pipe may be used as an alternative option to the sprinkler head setup. Install drain pipe at the highest point on the field and at various lower elevations to ensure full coverage of the filtration area. Pipe should be place with the holes up to allow for a gentle weeping of stormwater evenly out all holes. Leveling the pipe by staking and using sandbags may be required.

- To prevent the over saturation of the field area, rotate the use of branches or spray heads. Do this as needed based on monitoring the spray field.

- Monitor the spray field on a daily basis to ensure that over saturation of any portion of the field doesn't occur at any time. The presence of standing puddles of water or creation of concentrated flows visually signify that over saturation of the field has occurred.

- Since the operator is handling contaminated water, physically monitor the vegetated spray field all the way down to the nearest surface water, or furthest spray area, to ensure that the water has not caused overland or concentrated flows, and has not created erosion around the spray nozzle.

- Monitoring usually needs to take place 3 to 5 times per day to ensure sheet-flow into waters of the State. Do not exceed water quality standards for turbidity.

- The county recommends that a separate inspection log be developed, maintained, and kept with the existing site logbook to aid the operator conducting inspections. This separate "Field Filtration Logbook" can also aid the facility in demonstrating compliance with permit conditions.

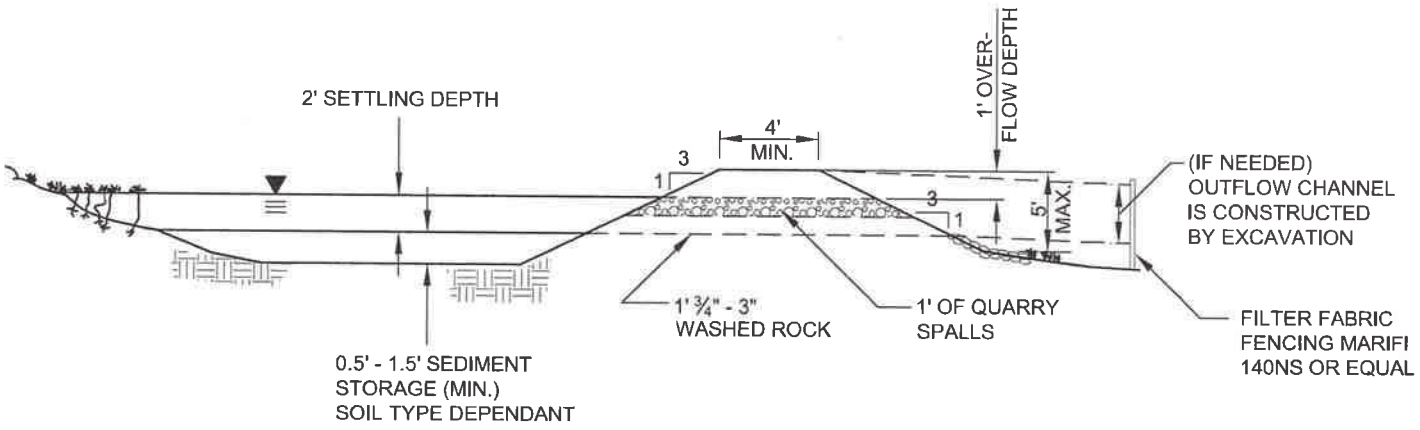
Maintenance Standards

- Inspect the spray nozzles daily, at a minimum, for leaks and plugging from sediment particles.

- If erosion, concentrated flows, or over saturation of the field occurs, rotate the use of branches or spray heads or move the branches to a new field location.

- Check all branches and the manifold for unintended leaks.

Flowpath Guidelines for Vegetative Filtration		
Average Slope	**Average Area Percent Slope**	**Estimated Flowpath Length (ft)**
1.5H:1V	67%	250
2H:1V	50%	200
4H:1V	25%	150
6H:1V	16.7%	115
10H:1V	10%	100



CROSS SECTION

SEE DETAIL 22.0

Pierce County
Public Works
Surface Water Management Division
2702 S 42nd Street, Suite 201
Tacoma, Washington 98409-7322

DATE	REVISION	APPR'D	DRAWN
6/2015	2015 SWMM UPDATE	HPH	RUTKOSKY
5/2008	PUBLISH DATE	HPH	RUTKOSKY

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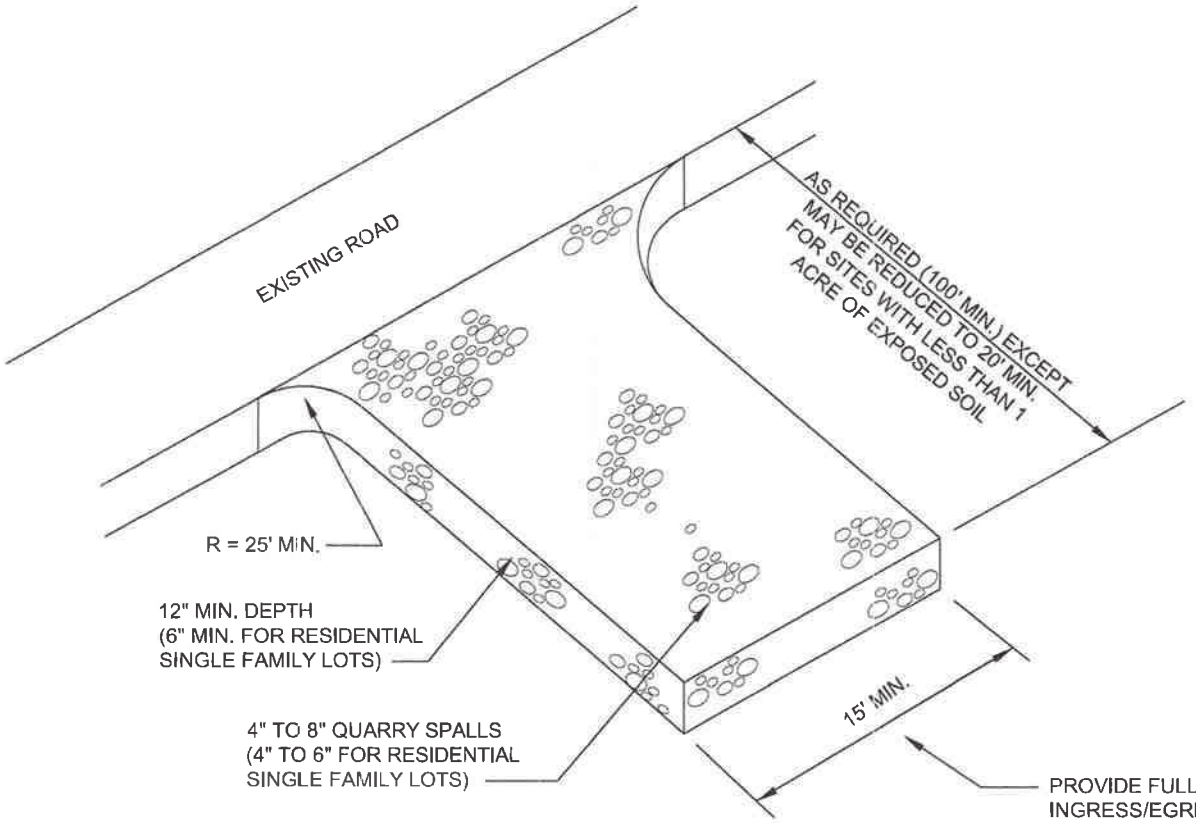
C.I.P. MANAGER

Surface Water Management Division

SEDIMENT TRAP

(NOT TO SCALE)

21.0



NOTE: GEOTEXTILE FABRIC MUST BE PLACED BENEATH QUARRY SPALLS.

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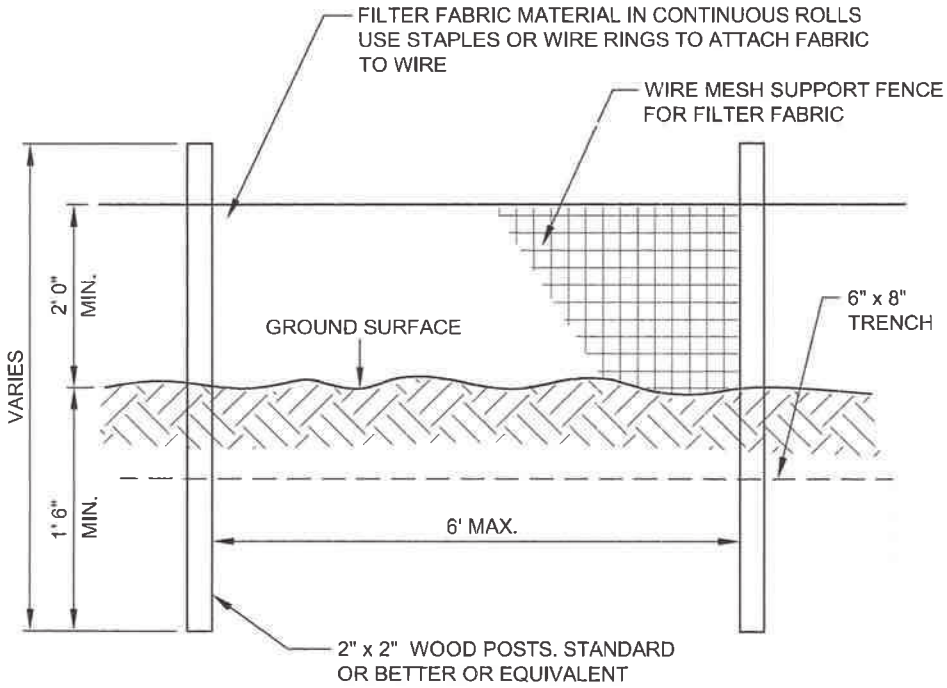
Surface Water Management Division

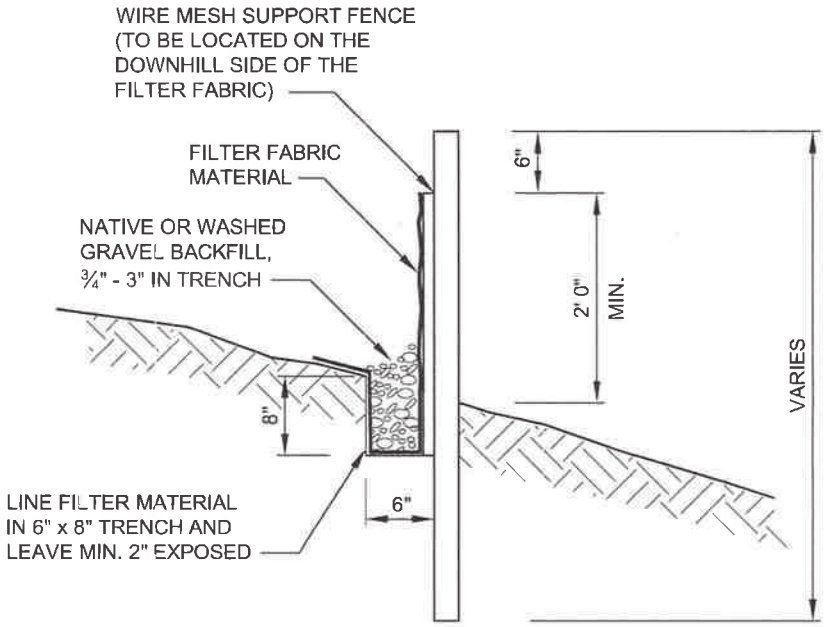
CONSTRUCTION ENTRANCE ROCK PAD

(NOT TO SCALE)

4.0



SECTION



SECTION

Pierce County
Public Works
Surface Water Management Division
2702 S 42nd Street, Suite 201
Tacoma, Washington 98409-7322

DATE	REVISION	APPR'D	DRAWN
6/2015	2015 SWMM UPDATE	HPH	RUTKOSKY
6/2012	2012 SWMM UPDATE	HPH	RUTKOSKY
5/2008	PUBLISH DATE	HPH	RUTKOSKY

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Surface Water Management Division

SILT FENCE DETAIL

(NOT TO SCALE)

8.0

BMP C240: Sediment Trap

Purpose

A sediment trap is a small temporary ponding area with a gravel outlet used to collect and store sediment from sites cleared and/or graded during construction. Sediment traps, along with other perimeter controls, shall be installed before any land disturbance takes place in the drainage area.

Conditions of Use

Prior to leaving a construction site, stormwater runoff must pass through a sediment pond or trap or other appropriate sediment removal BMP. Non-engineered sediment traps may be used onsite upstream to an engineered sediment trap or sediment pond to provide additional sediment removal capacity.

It is intended for use on sites where the tributary drainage area is less than 3 acres, with no unusual drainage features, and a projected build-out time of 6 months or less. The sediment trap is a temporary measure (with a design life of approximately 6 months) and shall be maintained until the site area is permanently protected against erosion by vegetation and/or structures.

Sediment traps are only effective in removing sediment down to about the medium silt size fraction. Runoff with sediment of finer grades (fine silt and clay) will pass through untreated, emphasizing the need to control erosion to the maximum extent first.

Whenever possible, sediment-laden water shall be discharged into onsite, relatively level, vegetated areas (see BMP C234 – Vegetated Strip). This is the only way to effectively remove fine particles from runoff unless chemical treatment or filtration is used. This can be particularly useful after initial treatment in a sediment trap. The areas of release must be evaluated on a site-by-site basis in order to determine appropriate locations for and methods of releasing runoff. Vegetated wetlands shall not be used for this purpose. Frequently, it may be possible to pump water from the collection point at the downhill end of the site to an upslope vegetated area. Pumping shall only augment the treatment system, not replace it, because of the possibility of pump failure or runoff volume in excess of pump capacity.

All projects that are constructing permanent detention facilities or infiltration basins and trenches can use the rough-graded permanent facilities for traps. If infiltration facilities are to be used, the sides and bottom of the facility must only be rough excavated to a minimum of 2 feet above final grade. Final grading of the infiltration facility shall occur only when all contributing drainage areas are fully stabilized. When permanent facilities are used as temporary sedimentation facilities, the surface area requirement of a sediment trap or pond must be met. If the surface area requirements are larger than the surface area of the permanent facility, then the trap or pond shall be enlarged to comply with the surface area requirement. The permanent pond shall also be divided into two cells as required for sediment ponds.

Either a permanent control structure or the temporary control structure (described in BMP C241, Temporary Sediment Pond) can be used. If a permanent control structure is used, it may be advisable to partially restrict the lower orifice with gravel to increase residence time while still allowing dewatering of the pond. A shut-off valve may be added to the control structure to allow complete retention of stormwater in emergency situations. In this case, an emergency overflow weir must be added.

A skimmer may be used for the sediment trap outlet if approved by the county.

Design and Installation Specifications

- See Attachments Section C, Details 21.0 and 22.0 for details.
- If permanent runoff control facilities are part of the project, they should be used for sediment retention.
- To determine the sediment trap geometry, first calculate the design surface area (SA) of the trap, measured at the invert of the weir. Use the following equation:

$$SA = FS(Q_2/V_S)$$

Where: Q_2 = Design inflow (cfs) based on the 2-year recurrence interval flow rate. Use a 15-minute time step using an approved continuous runoff model for the developed (unmitigated) site. If the time of concentration is less than 30-minutes, a 5-minute time step may be required. The 10-year recurrence interval peak flow shall be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection. If no hydrologic analysis is required, the rational method may be used.

V_S = The settling velocity of the soil particle of interest. The 0.02 mm (medium silt) particle with an assumed density of 2.65 g/cm^3 has been selected as the particle of interest and has a settling velocity (Vs) of 0.00096 ft/sec.

FS = A safety factor of 2 to account for non-ideal settling.

- Therefore, the equation for computing surface area becomes:

$$SA = 2 \text{ x } Q_2/0.00096$$

OR

2,080 square feet per cubic feet per second of inflow

Note: Even if permanent facilities are used, they must still have a surface area that is at least as large as that derived from the above formula. If they do not, the pond must be enlarged.

- To aid in determining sediment depth, all sediment traps shall have a staff gauge with a prominent labeled mark each 1-foot interval above the bottom of the trap.

- Sediment traps may not be feasible on utility projects due to the limited work space or the short-term nature of the work. Portable tanks may be used in place of sediment traps for utility projects.

Maintenance Standards

- Sediment shall be removed from the trap when it reaches 1-foot in depth.

- Any damage to the trap embankments or slopes shall be repaired.