Execution Version

Cooperative Solar No. 1
EK Contract No. SO100-670

TURNKEY ENGINEERING, PROCUREMENT AND CONSTRUCTION AGREEMENT

between

Lendlease (US) Public Partnerships LLC

and

East Kentucky Power Cooperative, Inc.

dated

June 30, 2016

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List of Exhibits

TURNKEY ENGINEERING, PROCUREMENT AND CONSTRUCTION AGREEMENT

This ENGINEERING, PROCUREMENT AND CONSTRUCTION AGREEMENT (this "**Contract**") is entered into as of June 30, 2016 (the "**Effective Date**") by and between LENDLEASE (US) PUBLIC PARTNERSHIPS LLC, a Delaware corporation ("**Contractor**") with offices at 200 Park Avenue, 9th Floor, New York, New York 10166, and EAST KENTUCKY POWER COOPERATIVE, INC. a Kentucky rural electric cooperative ("**Owner**", and together with Contractor, the "**Parties**"), with offices at P.O. Box 707, Winchester, Kentucky 40392-0707.

RECITALS:

(A) Contractor is a company engaged, itself and through its subcontractors, in the design, construction and installation of photovoltaic systems;

(B) Owner is a generation and transmission cooperative, which is engaged in the business of providing wholesale electricity to its member distribution cooperatives;

(C) Owner desires to engage Contractor in the design, engineering, procurement, construction, pre-commissioning, Commissioning (as defined below), start-up, testing and Performance Testing (as defined below) of an 8.5 MW(AC) photovoltaic electric generating facility, to be located at Owner's headquarters in Winchester, Kentucky (the "**Facility**"), and Contractor accepts the engagement by Owner in the foregoing tasks, on a fixed price, turnkey basis upon the terms and conditions specified in this Contract.

NOW, THEREFORE, in consideration of the promises and the mutual covenants and agreements contained herein, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties covenant and agree as follows:

ARTICLE 1
DEFINITIONS; RULES OF USAGE; PRECEDENCE OF DOCUMENTS

Section 1.1 Defined Terms.

As used in this Contract, the following terms shall have the following meanings unless the context otherwise requires:

"Affiliate" means, with respect to any Person, any other Person that directly, or indirectly through one or more intermediaries, controls, is controlled by, or is under common control with, such first Person.

"ALTA Survey" means that certain ALTA/ACSM Land Title Survey, prepared by AGE Engineering Services, Inc., attached hereto as Exhibit B-2.

"Applicable Laws" means all laws, treaties, ordinances, judgments, decrees, injunctions, writs and orders of any Governmental Authority, and codes, standards, requirements, rules, regulations, orders and interpretations of any federal, state, provincial, county, municipal,

regional, environmental or other Governmental Authority or other body having jurisdiction over the Contractor, the Facility, the Site, performance of the Work or the permitting, ownership or operation of the Facility, as in each case may be in effect on the Effective Date, including (i) any and all Permits, and (ii) Applicable Laws related to (y) conservation, improvement, protection, pollution, contamination or remediation of the environment or (z) Hazardous Substances or any handling, storage, release or other disposition of Hazardous Substances.

"Applicable Permits" means all Permits (including Contractor Permits) required to be obtained or maintained in connection with construction of the Facility, performance of the Work, or operation of the Facility.

"Authorized Representative" means, with respect to the Owner, the individual appointed by Owner to act on Owner's behalf with respect to Owner's duties and responsibilities under this Contract in accordance with Section 23.1.

"Balance of Contract Price" has the meaning set forth in Section 14.8(b)(iv)(A).

"Best Management Practices Plan" means Owner's Best Management Practices Plan for the Site, as may be updated from time to time by Owner in its sole discretion.

"Books and Records" has the meaning set forth in Section 21.1(a).

"Business Day" means a calendar day that is not a Saturday, Sunday, or a day that the Federal Reserve member banks in the United States are authorized to be closed. References to "day" shall mean a calendar day, unless the term "Business Day" is used.

"CAD" has the meaning set forth in Section 2.2(c).

"CCM" means the Chief Construction Manager for the Facility assigned by Contractor pursuant to Section 2.3(b) and acting under the authority described therein.

"Change" means a change, modification, addition, or deletion to or in the Work, which may result in a change, modification, addition, or deletion to or in the Engineering and Design Materials, the Construction Documents, the Contract Price, the Project Schedule, or the Guaranteed Substantial Completion Date, as applicable. A Change does not include changes to the Work arising solely from pricing variances for materials or services within the Work, contingencies or normal design developments that bring to light additional detailed requirements to perform or maintain the Work, and normal design and construction variations within the Work.

"Change Order" means a written order pursuant to ARTICLE 7, executed by Owner and Contractor authorizing a Change.

"Changed Criteria" has the meaning set forth in Section 7.1.

"Changes in Law" means any amendment, modification, superseding act, deletion, addition or change in or to Applicable Law (excluding changes to Tax laws where such Taxes

are based upon Contractor's inventory, revenue, income, profits/losses or cost of finance or withholding Tax) that occurs and takes effect after the Effective Date.

"Commissioning" means the successful implementation and completion of (a) the Commissioning Procedures and (b) the Commissioning Test.

"Commissioning Procedures" has the meaning set forth in Section 8.2.

"Commissioning Requirements" has the meaning set forth in Section 8.2.

"Commissioning Test" has the meaning set forth in Section 8.2.

"Concealed Condition" means any (i) subsurface condition, whether manmade or natural (including, but not limited to, caverns, seismic faults and/or subsurface structures, utilities, equipment or other obstructions), (ii) any rare, endangered or threatened species or migration path or critical animal habitat, or (iii) subsurface fossils, antiquities or other archeological or historical finds, which, in the case of any of the above, are encountered by Contractor in the performance of the Work and (a) were not made known to Contractor by or on behalf of Owner prior to the Effective Date, (b) were not discovered or reasonably discoverable by Contractor or any of its Subcontractors, acting in accordance with Prudent Industry Practices, from inspections, investigations or work performed by Contractor or any of its Subcontractors prior to the Effective Date and (c) are materially different from those that are reasonably expected to be encountered due to the nature of the Site.

"Conditions to Notice to Proceed" means the conditions set forth in Section 6.1(b).

"Confidential Information" has the meaning set forth in Section 22.1(a).

"Construction Documents" has the meaning set forth in Section 2.2(b).

"Construction Safety Plan" has the meaning set forth in Section 2.14(a).

"Contract" has the meaning set forth in the introductory paragraph to this Contract, and shall include all Exhibits hereto and all amendments hereof executed in accordance with the provisions of this Contract.

"Contract Price" has the meaning set forth in Section 5.1.

"Contractor" has the meaning set forth in the introductory paragraph to this Contract.

"Contractor Event of Default" has the meaning set forth in Section 14.8(a).

"Contractor Indemnifying Parties" has the meaning set forth in Section 18.1.

"Contractor Indemnitees" means Contractor, its successors and assigns, and each of their owners, directors, officers, employees, representatives and agents.

"Contractor Liability Limit" has the meaning set forth in Section 19.2.

"Contractor Permits" means all Permits, other than Owner Permits, required to be obtained or maintained in connection with the Work (including all Permits necessary for the commencement and completion of construction, and the operation, of the Facility and the performance of Contractor's obligations hereunder). For clarity, Contractor Permits shall not include zoning permits.

"Contractor Personnel" means (a) Contractor, its direct and indirect employees, agents and Subcontractors and (b) any such Subcontractor's direct and indirect employees, agents and subcontractors of any tier.

"Contractor Taxes" has the meaning set forth in Section 2.17(a).

"Contractor-Required Change" has the meaning set forth in Section 7.3(a).

"Contractor's Intellectual Property" has the meaning set forth in Section 16.4(a).

"Corrective Work" has the meaning set forth in Section 11.2(b).

"Cost to Complete" has the meaning set forth in Section 14.8(b)(iv)(A).

"CPCN" means a Certificate of Public Convenience and Necessity to construct and operate the Facility, issued by the Kentucky Public Service Commission.

"CPM" has the meaning set forth in Section 2.8(c).

"Credit Support" has the meaning set forth in Section 2.18.

"Cure Period" has the meaning set forth in Section 10.2.

"Default Rate" means the prime rate plus two and one-half percent (2.5%) as published in "The Monthly Rates" section of The Wall Street Journal (U.S. Edition). Such interest shall be calculated on the basis of the actual number of days elapsed and on the basis of a year of three hundred sixty-five (365) days.

"Defect" has the meaning set forth in Section 11.1(a).

"Defect Correction Period" has the meaning set forth in Section 11.2(b).

"Defective" has the meaning set forth in Section 11.1(a).

"Delay" means any delay, hindrance or disruption that delays the performance of Work that is on the critical path of the Project Schedule.

"Delay LD Cap" has the meaning set forth in Section 10.1.

"Delay Liquidated Damages" has the meaning set forth in Section 10.1.

"Disputes" has the meaning set forth in Section 20.1.

"Dollars" means United States dollars or such coin or currency of the United States of America as at the time of payment shall be legal tender for the payment of public and private debts in the United States of America.

"Drawings" means the graphic and pictorial documents (in written or electronic format) showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams, which are prepared as a part of and during the performance of the Work.

"Effective Date" shall have the meaning set forth in the introductory paragraph to this Contract.

"Engineering and Design Materials" has the meaning set forth in Section 2.2(a).

"Engineering and Design Work" has the meaning set forth in Section 2.2(a).

"Environmental Attributes" means any credit, benefit, reduction, offset, financial incentive, tax credit and other beneficial allowance that is in effect as of the Effective Date or may come into effect in the future, including, to the extent applicable and without limitation, (i) all environmental and renewable energy attributes and credits of any kind and nature resulting from or associated with the Facility and/or its electricity generation, (ii) government financial incentives, (iii) greenhouse gas offsets, (iv) renewable energy certificates or any similar certificates or credits under the laws of the State of Kentucky or any other jurisdiction, (v) tax credits, incentives or depreciation allowances established under any federal or state law, and (vi) other allowances howsoever named or referred to, with respect to any and all fuel, emissions, air quality, or other environmental characteristics, resulting from the use of solar generation or the avoidance of the emission of any gas, chemical or other substance into the air, soil or water attributable to the Facility and/or its electricity generation.

"EPC Requirements" means this Contract (including the Scope of Work and the Project Schedule), all Applicable Laws, all Applicable Permits, Prudent Industry Practices and the Project Documents.

"Equipment" means all equipment (construction and otherwise), machinery, apparatus, materials, articles, components, raw materials, supplies, parts, tools, cranes, scaffolding, systems, structures and any other equipment or items comprising or otherwise necessary or appropriate for completion of the Work in accordance with the EPC Requirements.

"Facility" has the meaning set forth in the Recitals to this Contract.

"Facility Warranty" has the meaning set forth in Section 11.1(b).

"Final Completion" has the meaning set forth in Section 9.7.

"Final Design Size" means the size of the Facility set forth in the final Engineering and Design Materials approved by Owner in accordance with Section 2.2, expressed in peak watts-DC.

"Final Invoice" means the Invoice for the Final Payment under this Contract.

"Final Payment" has the meaning set forth in Section 5.2(c).

"Financing Parties" means all lenders and investors (including tax equity investor(s)) providing Owner construction, interim or long-term financing for Owner, and any trustee or agent acting on their behalf, and any successor or assignee of any such lender, investor, trustee or agent, including the trustee under that certain Indenture of Mortgage, Security Agreement and Financing Statement, dated as of October 11, 2012, between Owner and U.S. Bank National Association, as trustee, as supplemented.

"Force Majeure" has the meaning set forth in Section 15.1.

"Geotechnical Report" means that certain Report of Geotechnical Exploration East Kentucky Power Cooperative – HQ Solar Field, dated June 1, 2016, prepared by S&ME, Inc.

"Governmental Authority" means any federal, national, state, municipal, local, territorial, or other governmental department, commission, court, board, bureau, agency, regulatory authority, instrumentality, judicial or administrative body, and any arbitral tribunal, including any state Governmental Authority and the United States Internal Revenue Service.

"Guaranteed Facility Percentage" has the meaning set forth in Exhibit O.

"Guaranteed Substantial Completion Date" has the meaning set forth in Section 2.8(a).

"Hazardous Substance" means any and all chemicals, constituents, contaminants, pollutants, materials, and wastes and any other carcinogenic, corrosive, ignitable, radioactive, reactive, toxic or otherwise hazardous substances or mixtures (whether solids, liquids, gases), or any substances now or at any time subject to regulation, control, remediation or otherwise addressed as a hazardous substance under Applicable Laws, including those laws, regulations and policies relating to the discharge, emission, spill, release, or threatened release into the environment or relating to the disposal, distribution, manufacture, processing, storage, transport, treatment, transport, or other use of such substances.

"Interconnection Facilities" means the facilities and equipment that are necessary to physically and electrically interconnect the Facility.

"Invoice" means an invoice delivered by Contractor to Owner indicating the amount owed as a Progress Payment.

"Key Personnel" or "Key Persons" has the meaning set forth in Section 2.3(d).

"Limited Notice to Proceed" has the meaning set forth in Section 6.3(a).

"Losses" means any and all claims, liabilities, damages, losses, causes of action, fines, penalties, injuries (personal or bodily), property damage, demands, interest, litigation, lawsuits, administrative proceedings, administrative investigations, costs and expenses, including reasonable attorneys', engineers', architects' and other professionals' fees, court costs, and other

costs of suit, arbitration, dispute resolution or other proceedings, including those owed to third parties. "Losses" includes all costs of repair or replacement work of other contractors destroyed or damaged by correction, removal or replacement of Contractor's Defective Work. For the avoidance of doubt, "Losses" does not include the damages described in Section 19.1.

"Major Subcontract" means any agreement entered between the Contractor and a Major Subcontractor.

"Major Subcontractor" means a Subcontractor providing services or Equipment with an aggregate value equal to or greater than $100,000.

"Manufacturer's Warranties" has the meaning set forth in Section 11.1(d).

"Mechanical Completion" has the meaning set forth in Section 9.1.

"Milestone" means each item of progress in the Work identified as a "Milestone" on Exhibit C.

"Minimum Facility Percentage" has the meaning specified in Exhibit O.

"Month" means a calendar month; "month" means any period of thirty (30) consecutive days.

"Monthly Progress Report" means a progress report containing the information required by Section 2.9(a).

"Notice of Final Completion" has the meaning set forth in Section 9.8(a).

"Notice of Mechanical Completion" has the meaning set forth in Section 9.2(a).

"Notice of Substantial Completion" has the meaning set forth in Section 9.4(a).

"Notice to Proceed" has the meaning set forth in Section 6.1(a).

"Notice to Proceed Date" has the meaning set forth in Section 6.1(b).

"Owner" has the meaning set forth in the introductory paragraph to this Contract.

"Owner Indemnitees" means Owner, Financing Parties, and their respective Affiliates, successors and assigns and each of their respective owners, directors, officers, employees, representatives and agents.

"Owner Permits" means those Permits set forth on Exhibit E.

"Owner-Caused Delay" means a failure by Owner to perform any of its obligations under this Contract (including with respect to the Project Schedule) that, in any case causes a Delay.

"Owner-Directed Change" has the meaning set forth in Section 7.2(a).

"Owner's Construction Site Manager" has the meaning set forth in Section 4.6.

"Owner's Engineer" means such independent engineers as may be selected by Owner or any Financing Party as its independent engineer for the Facility and the successors and assigns of such independent engineer.

"Owner's Project Manager" has the meaning set forth in Section 4.6.

"Owner's Safety Policies" means the Owner's Contractor Safety Handbook, attached as Exhibit FF.

"Party" has the meaning set forth in the introductory paragraph to this Contract.

"Performance Criteria" has the meaning set forth in Exhibit O.

"Performance LD Cap" has the meaning set forth in Section 10.2.

"Performance Liquidated Damages" has the meaning set forth in Section 10.2.

"Performance Test" means those tests to be conducted pursuant to ARTICLE 8 and in accordance with the Performance Test Procedures.

"Performance Test Procedures" has the meaning set forth in Section 8.3.

"Performance Testing" means the successful implementation and completion of (a) the Performance Test Procedures and (b) any Performance Test.

"Performance Test Requirements" has the meaning set forth in Section 8.3.

"Perimeter Fence" shall mean a physical security fence or fences installed in a manner as to surround the Site, including any laydown area, in accordance with Exhibit A.

"Permits" means any waiver, franchise, variance, permit, authorization, certificate, permission, concession, license, order, communication, decision or other authorizing/approving act of or from any Governmental Authority having jurisdiction over construction of the Facility, the Site, performance of the Work, or ownership or operation of the Facility, as may be in effect from time to time.

"Person" means any individual, corporation, partnership, limited liability company, association, joint stock company, trust, unincorporated organization, joint venture, government or political subdivision or agency thereof.

"Pre-Existing Hazardous Substances" means Hazardous Substances other than Hazardous Substances that have been brought onto, or generated or Released at, the Site by Contractor or any Subcontractor.

"Preventative Maintenance Plan" has the meaning set forth in Section 2.6(e).

"Progress Payment" means each payment so identified on Exhibit C.

"Project" means, collectively, the design, engineering, permitting, procurement, construction, installation, commissioning, start-up, testing and completion of the Facility in the manner and at the times required under this Contract.

"Project Documents" has the meaning set forth in Section 2.2(b).

"Project Schedule" has the meaning set forth in Section 2.8(c).

"Proposal" has the meaning set forth in Exhibit A.

"Proposed Monthly Invoice" has the meaning set forth in Section 5.2(a).

"Prudent Industry Practices" means the practices, methods, techniques and standards that (a) are generally accepted for construction and professional engineering firms performing design, engineering, procurement, construction, commissioning, testing, operation and maintenance services in the United States for facilities similar to the Facility in scope, scale, function, schedule, budget, quality, complexity, size and type all in a manner consistent with Applicable Laws, Applicable Permits, all other EPC Requirements, reliability, safety, good workmanship, environmental protection, economy and expediency, and (b) conform to the manufacturer's design, engineering, construction, testing, operation and maintenance guidelines applicable to the equipment in question. Prudent Industry Practices are not limited to the optimum practice or method to the exclusion of others, but rather refer to commonly used and reasonable practices and methods.

"Punch-List" means the list prepared in accordance with Section 9.6(a), which list shall set forth all items of work that remain to be performed in order to ensure that the Work fully complies with all of the standards and requirements set forth herein. The Punch-List shall not include any items of Work, alone or in the aggregate, the non-completion of which prevents the Facility from (a) reaching Substantial Completion, (b) operating in accordance with the EPC Requirements, or (c) being legally, safely and reliably placed in commercial operation.

"Quality Management System" means the system, including quality plans and procedures, used by Contractor to direct and control its organization with regard to quality, the requirements of which are set forth in Section 2.21(j) and Exhibit U.

"Recovery Plan" has the meaning set forth in Section 6.4(b).

"Release" means any actual or threatened releasing, spilling, emitting, leaking, pumping, pouring, emptying, injecting, escaping, dumping, disposing, discharging, depositing, leaching, dumping of any Hazardous Substances or abandoning or allowing the same to escape or migrate into or through the environment (including ambient air, soil, surface water, groundwater, land surface or subsurface strata or within any building or structure).

"Replacement Contractor" has the meaning set forth in Section 14.8(b)(iii).

"Representatives" has the meaning set forth in Section 22.1(a).

"Retainage" has the meaning set forth in Section 5.2(a)(iv).

"Safety Remedial Measures" has the meaning set forth in Section 2.14(c).

"Schedule of Values" has the meaning set forth in Section 5.2(a)(i).

"Scope of Work" means the scope of work attached hereto as Exhibit A.

"Site" means that portion of real property on which the Project will be located, as described in the Indicative Array Layout Sheet 1.0, dated May 13, 2016, attached hereto as Exhibit B-1 which is contained with the real property described in the ALTA Survey. The Site shall be enclosed by the Perimeter Fence in accordance with Exhibit A.

"Specifications" means those documents consisting of the written requirements for Equipment, standards and workmanship for the Work and performance of related services.

"Start-up Spare Parts" has the meaning set forth in Section 2.5(c).

"Subcontract" means any contract with a Subcontractor with respect to performing any part of the Work or providing any equipment or materials in connection with the Work.

"Subcontractor" means each and every vendor, manufacturer, supplier, materialmen or contractor, other than Contractor, performing any part of the Work or providing any Equipment or materials in connection with the Work, including any subcontractor of a Subcontractor.

"Submittal Schedule" means the schedule for the submission of documents and information by Contractor set forth on Exhibit CC.

"Substantial Completion" has the meaning set forth in Section 9.3.

"Taxes" means any and all license, documentation, recording and registration fees, and all taxes (including federal, state, local or foreign income, payroll, gross receipts, value-added, sales, use, personal property (tangible and intangible), real estate, excise, stamp, environmental, profits, severance, premium, franchise, import, employment, occupation and privilege taxes), levies, imposts, duties, assessments, fees, charges, and withholdings of any nature whatsoever, whether or not presently in existence, together with any penalties, fines, additions to tax, or interest thereon, imposed by any Governmental Authority.

"Termination Amount" has the meaning set forth in Section 14.8(b)(iv)(B)(II).

"Termination Notice" has the meaning set forth in Section 14.3(a).

"Termination Payment" has the meaning set forth in Section 14.4(a)(i).

"Third Party Proprietary Work Product" has the meaning set forth in Section 16.4(a).

"Warranties" has the meaning set forth in Section 11.1(a).

"Weekly Progress Report" has the meaning set forth in Section 2.9(c).

"Work" has the meaning set forth in Section 2.1.

"Work Product" is those Drawings, designs, plans, Specifications, operating and maintenance procedures and manuals, calculations, documents or other technical tangible manifestations of Contractor's efforts (whether written or electronic) prepared specifically for the Facility by Contractor and its Subcontractors and consultants, including all Project Documents, any work done by Contractor or any of its Affiliates or Subcontractors under any other agreements between the Parties related to the Facility.

Section 1.2 Interpretation and Rules of Usage.

The Parties hereby agree that the following rules of usage shall apply to this Contract unless otherwise required by the context or unless otherwise specified:

(a) Precedence of Documents; Conflicts. The body of this Contract and the Exhibits attached hereto are intended to be complementary and interpreted in harmony so as to avoid conflict. In the event of any ambiguity, discrepancy or inconsistency in the documents that constitute this Contract, priority shall be as identified in Section 23.18.

(b) Singular and Plural. Definitions set forth herein shall be equally applicable to the singular and plural forms of the terms defined.

(c) Section References. References to articles, sections, paragraphs, clauses, annexes, appendices, schedules or exhibits are references to articles, sections, paragraphs, clauses, annexes, appendices, schedules or exhibits in this Contract.

(d) Headings. The headings, subheadings and table of contents used in this Contract are solely for convenience of reference and shall not constitute a part of this Contract nor shall they affect the meaning, construction or effect of any provision of this Contract.

(e) References to Persons. References to any Person shall include such Person and its successors and permitted assigns and transferees.

(f) Agreements as Amended. Reference to any agreement (including this Contract) means such agreement as amended, supplemented or otherwise modified from time to time in accordance with the applicable provisions thereof.

(g) Laws as Amended. References to any law include any law as that law may be amended or interpreted (which interpretation is binding on the Parties) after the Effective Date.

(h) Grammatical Forms. Where a word or phrase is specifically defined, other grammatical forms of such word or phrase have corresponding meanings; the words "herein," "hereunder," and "hereof" refer to the provisions of this Contract as a whole and not to any particular portion or provision of this Contract; "including" means "including, but not limited to," and other forms of the verb "to include" are to be interpreted similarly; and masculine includes feminine and neuter.

(i) Days. References to "days" shall mean calendar days, unless the term "Business Days" is used.

(j) Time Periods and Time Zone. Where a period of time is specified to run from or after, or before or prior to, a given hour or day or the hour or day of an act or event, such period is to be calculated exclusive of such day; and where a period of time is specified as commencing on a given hour or day or the hour or day of an act or event, it is to be calculated inclusive of such day. References to time at the Facility or references to time for any payment obligations hereunder are references to the prevailing time in the Eastern Time Zone of the United States, and in observance of Daylight Savings Time.

(k) Joint Negotiation. The Parties have participated jointly in the negotiation and drafting of this Contract. Any rule of construction or interpretation otherwise requiring this Contract to be construed or interpreted against either Party by virtue of the authorship of this Contract shall not apply to the construction and interpretation hereof.

ARTICLE 2
CONTRACTOR'S WORK AND OTHER OBLIGATIONS

Section 2.1 Work.

Contractor shall perform, or cause to be performed, all of the obligations, duties and responsibilities required of Contractor pursuant to this Contract, including (i) all work and services required in connection with the building, design, engineering, permitting, procurement, fabrication, manufacture, construction, installation, pre-commissioning, Commissioning, start-up, testing and Performance Testing, and completion of the Facility, all Equipment incorporated therein, and (ii) procuring and providing the Equipment, spare parts, labor, utilities, chemicals, delivery, storage, transportation, administration and all other services and items required for and related to the foregoing (including training of Owner's operations and maintenance personnel), all in accordance with the EPC Requirements and, without limitation of the foregoing, as further described in Exhibit A (the activities set forth in this ARTICLE 2 and Exhibit A, collectively, the "**Work**"). Contractor shall complete the Work to enable Contractor to deliver to Owner a turnkey, fully functional and operational Facility completed in every material detail within the time and for the purpose designated, and Contractor shall do and furnish everything necessary in connection therewith.

Section 2.2 Engineering, Design, Construction Services and Documentation

(a) Contractor, through itself or a Subcontractor, will (i) perform all design and engineering Work (collectively, the "**Engineering and Design Work**") and (ii) prepare each engineering or design document (collectively, the "**Engineering and Design Materials**"), in each case necessary for the completion of the Work by the applicable date specified in the Project Schedule in accordance with the EPC Requirements, including all Drawings, Specifications, models, plans and other documents reasonably necessary to describe and design the Facility with respect to the civil engineering, structural, instrumentation, control, mechanical, electrical, fire protection and safety systems to be incorporated therein and all other engineering required for the construction of the Facility and all documents specified in, or required by, the Scope of Work.

(i) Contractor shall provide all management, labor, supervision, services, materials, supplies, tools, equipment and other items necessary to complete the Engineering and Design Work and Engineering and Design Materials in accordance with the EPC Requirements.

(ii) Contractor shall perform all Engineering and Design Work and prepare all Engineering and Design Materials in accordance with the EPC Requirements (including Applicable Law) and Prudent Industry Practices for the design of projects similar to the Facility and with the requisite and appropriate expertise, supervision, skill, and competence, utilizing Contractor's best skill and judgment, and in a safe, expeditious, good, and workmanlike manner.

(iii) Contractor will cooperate and coordinate with Owner, Owner's Engineer and Governmental Authorities having jurisdiction over the Work, the Facility or the Site. All Engineering and Design Work requiring stamping or certification under Applicable Law shall be stamped or certified by professional engineers properly licensed under Applicable Law and properly qualified to perform such engineering services thereunder. The Parties acknowledge and agree that any such certification may be provided by a Subcontractor of Contractor and need not be provided by an employee of Contractor.

(iv) Drafts of the Engineering and Design Materials will be submitted to Owner for review from time to time in accordance with the Submittal Schedule. Owner shall use commercially reasonable efforts to provide comments on the draft Engineering and Design Materials to Contractor within ten (10) Business Days after Owner's receipt thereof, and Contractor shall make commercially reasonable efforts to incorporate such Owner comments into the final Engineering and Design Materials. Owner's (or Owner's Engineer's) review of any of Engineering and Design Materials shall in no event be deemed a waiver of any of Contractor's obligations to perform the Work in accordance with the EPC Requirements. Contractor shall not be entitled to any Change Order or adjustment to the Contract Price, Project Schedule or Guaranteed Substantial Completion Date as a result of changes to the Work resulting from any comments provided by Owner to the Engineering and Design Materials to the extent such Owner comments are consistent with the EPC Requirements.

(b) Contractor, through itself or a Subcontractor, will prepare, and submit to Owner for review, all Drawings, Specifications and other documentation based on the Engineering and Design Materials necessary for the construction of the Facility in accordance with the EPC Requirements (collectively, the "**Construction Documents**" and together with the Engineering and Design Materials, the "**Project Documents**").

(i) Drafts of the Construction Documents will be submitted to Owner for review from time to time in accordance with the Submittal Schedule. Owner shall use commercially reasonable efforts to provide comments on the drafts of such documents to Contractor within ten (10) Business Days after Owner's receipt thereof, and Contractor make commercially reasonable efforts to incorporate such Owner comments into

consideration in the final Construction Documents to the extent such Owner comments are consistent with the Scope of Work and the Engineering and Design Materials.

(ii) Owner's (or Owner's Engineer's) review of any Construction Documents shall in no event be deemed a waiver of any of Contractor's obligations to perform the Work in accordance with the EPC Requirements. Contractor shall not be entitled to any Change Order or adjustment to the Contract Price, Project Schedule or Guaranteed Substantial Completion Date as a result of changes to the Work resulting from any comments or requirements provided by Owner to the Construction Documents to the extent such comments are consistent with the EPC Requirements.

(c) Unless otherwise expressly provided under this Contract, all Drawings and Specifications prepared by Contractor or its Subcontractors under this Contract shall be prepared using computer aided design ("**CAD**"). All CAD drawing files shall be in fully operable and editable AutoCAD.dwg (Version 10) or Intergraph 3D model in native format. Contractor shall provide Drawings, including Specifications, in accordance with the Owner Drawing requirements set forth on Exhibit AA, and shall use best efforts to provide Drawings, including Specifications, in other formats requested by Owner.

(d) During construction, Contractor shall keep a redlined, marked, up-to-date set of as-built Drawings and Specifications on the Site. Contractor shall deliver to Owner the Drawings and Specifications no later than ninety (90) days after Substantial Completion, which shall include delivery of final as-built drawing files in fully operable and editable AutoCAD.dwg (Version 10) format in accordance with the Owner Drawing requirements set forth on Exhibit AA or other format as agreed by Owner for Drawings.

Section 2.3 Construction Management.

(a) Contractor shall construct the Facility in accordance with the EPC Requirements, including in accordance with Section 2.10. Contractor shall inspect all Equipment to be incorporated in the Project and shall reject those items that Contractor reasonably determines, in its sole discretion, not to be in compliance with the EPC Requirements. Any item that is rejected by Contractor pursuant to the immediately preceding sentence shall be corrected (whether by repair, replacement or otherwise) so that it is in compliance with the EPC Requirements. Contractor shall ensure that all Subcontractors perform their respective Subcontracts in accordance with the EPC Requirements. Contractor shall review and shall be fully responsible for the Work, including any portion of the Work performed by Subcontractors.

(b) Contractor shall within ten (10) days after the Effective Date, by written notice to Owner, designate an individual to serve as the CCM for the Facility. Contractor acknowledges and agrees that the individual designated as CCM shall have substantial experience with management of projects similar in size and scope to the Facility and shall have the academic and professional qualifications customarily held by an individual serving in such capacity. The CCM shall have the authority to agree upon procedures for coordinating Contractor's efforts with those of Owner and shall have day-to-day responsibility for managing the Work, including communicating and coordinating with Owner in respect thereof (including

issuing and receiving all notices, approvals and consents as if given to or received by the Contractor), furnishing information as requested by Owner, and any other matters relating to this Contract. Owner may consult with the CCM at all reasonable times, and the CCM shall be reasonably available to, and communicate regularly with, Owner. Owner shall have the right to approve the Contractor's designated CCM; provided, however, that such approval shall not be unreasonably withheld. Should Owner, at any time, reasonably determine that the performance of the Contractor's CCM to be unacceptable, Owner shall so notify Contractor of its reasons therefor. Contractor shall work diligently in cooperation with Owner to resolve the reasonable objections of Owner with respect to the Contractor's CCM to Owner's satisfaction in a timely manner, including the replacement of such individual, if necessary. Contractor may designate a different Contractor's CCM at any time by written notice to Owner, subject to Owner's approval; provided, however, that such approval shall not be unreasonably withheld.

(c) Without limiting the generality of the CCM's responsibilities described in Section 2.3(b), the CCM shall be present at the Site, following the Notice to Proceed Date through the date of Substantial Completion, as necessary to ensure the Work is being performed in accordance with the EPC Requirements.

(d) Contractor shall maintain personnel sufficient to perform the Work in accordance with the Project Schedule. Exhibit V sets forth Contractor's organizational chart to be implemented for the Work and also contains a list of key personnel ("**Key Personnel**" or "**Key Persons**") from Contractor's organization who will be assigned to the Work. Owner and Contractor acknowledge and agree the continuity of Key Personnel is an important aspect of this Contract and that replacement of a Key Person may be detrimental to Owner and the overall quality of the Work. Key Personnel shall be devoted full-time to the Work for the applicable period of time, as specified in Exhibit V, and Key Personnel shall not be removed or reassigned without timely Owner's prior written approval. All requests for substitution of Key Personnel shall include a detailed explanation and reason for the request and the resumes of professional education and experience for a minimum of two (2) candidates of suitable qualifications and experience. Owner has the right, but not the obligation, to require Contractor to remove or cause to be removed a Key Person who is not, in Owner's reasonable judgment, using Prudent Industry Practices in the performance of the portion of the Work assigned to such Key Person.

Section 2.4 Study and Inspection of the Site and Other Conditions; Changes in Law.

(a) Subject to Section 2.4(c), Contractor acknowledges that it has made all investigations and inspections that it deems necessary to perform the Work in accordance with the Project Schedule, including (a) examining, studying and inspecting to its full satisfaction (i) the Site, including the Site's location, terrain, surroundings, weather, character and accessibility, (ii) any existence of surface obstacles to construction, the subsurface ground and soil conditions, the availability of facilities and utilities, the location and character of existing or adjacent work or structures and other general and local conditions (including labor), (iii) all geotechnical and geo-morphological/hydro-geological studies/restraints disclosed to Contractor by Owner, (iv) all Applicable Laws, as in effect as of the Effective Date, and (v) all other investigations and inspections that it deems necessary to perform the Work in accordance with the Project Schedule and (b) taking all other reasonable steps necessary to obtain a full understanding of the physical

conditions at the Site and the difficulties which may be encountered in performing the Work resulting from any of the foregoing conditions (including the review of all Site leases and easements relevant to the Facility). Except with respect to the geotechnical and geo-morphological/hydro-geological studies and/or restraints set forth in the Geotechnical Report, Owner makes no guaranty or warranty, express or implied, as to the accuracy, adequacy or completeness of any such information that is contained or referenced in the Scope of Work or that Owner has provided to Contractor.

(b) Subject to Section 2.4(c), Contractor hereby acknowledges that Contractor assumes all risks related to, and waives any right to request a Change Order or claim an adjustment in the Contract Price, Project Schedule or Guaranteed Substantial Completion Date in respect of, any failure to timely perform the Work in accordance with the Project Schedule as a result of any conditions at the Site or at any other location where the Work is performed, including: (i) topography and subsurface conditions; (ii) customary climatic conditions and tides; (iii) availability of laborers, Subcontractors, Equipment or any other items or supplies (except, as applicable, to the extent caused by Force Majeure events); (iv) adequate availability and transportation of Equipment (except, as applicable, to the extent caused by Force Majeure events); and (v) breakdown or other failure of Equipment under the control of or provided by Contractor or its Subcontractors (except, as applicable, to the extent caused by Force Majeure events).

(c) If during the performance of the Work, a Concealed Condition is discovered, Contractor shall be entitled to a Change Order to the extent permitted pursuant to Section 7.3(a)(iii), *provided that* Contractor shall (i) comply with the notice and Change Order request requirements set forth in Section 7.3, and (ii) use commercially reasonable efforts not to disturb such Concealed Condition prior to Owner's investigation.

(d) Contractor shall perform the Work in accordance with Applicable Laws, whether or not such Applicable Law came into effect before the Effective Date or during the performance of the Work; *provided, however*, (i) Contractor shall be entitled to a Change Order for Changes in Law to the extent allowed under Section 7.3(a). Except for any Changes in Law for which Contractor is entitled to a Change Order under Section 7.3(a), Contractor hereby waives any right to request a Change Order or claim an adjustment in the Contract Price, Project Schedule or Guaranteed Substantial Completion Date in relation to any Changes in Law.

Section 2.5 Procurement of Equipment; Spare Parts.

(a) Contractor shall, in its name, procure, receive, store (on or off the Site), maintain and transport to the Site the Equipment required for completion of the Facility in accordance with the EPC Requirements and any applicable manufacturers' recommendations. Notwithstanding anything to the contrary contained in this Contract, Contractor shall be responsible for damage to, or destruction or loss of, from any cause whatsoever (except for such damage, destruction or loss caused by Owner or any third party for which Owner is responsible), all such Equipment owned, rented or leased by Contractor or its Subcontractors for use in accomplishing the Work. Contractor shall require all insurance policies (including policies of Contractor and all Subcontractors) in any way relating to such Equipment to include clauses stating that each underwriter will waive all rights of recovery, under subrogation or otherwise,

against Owner, the Financing Parties or any of their Affiliates. All costs of the obligations imposed by this Section shall be borne by Contractor and shall not be the subject of a Change hereunder.

(b) All Equipment and other items comprising part of the Work stored at a location other than on the Site shall be segregated from other goods, and, provided Owner has satisfied its then-current payment obligations under Section 5.2 with respect to such Equipment and other items comprising part of the Work, shall be clearly marked as the property of Owner.

(c) As part of the Contract Price, Contractor shall provide (i) all pre-commissioning, Commissioning, testing (including Performance Testing) and start-up spare parts necessary for the Facility to achieve Substantial Completion (collectively, "**Start-up Spare Parts**"), (ii) all spare parts set forth on Exhibit W for use after Substantial Completion (collectively, "**Project Spare Parts**"). Contractor shall, prior to and as a condition precedent to achieving Final Completion, deliver such Start-up Spare Parts and Project Spare Parts to the Site. The cost of all Start-up Spare Parts and Project Spare Parts and all costs associated with all Work related thereto shall be included in the Contract Price, including the cost to procure such Start-up Spare Parts and Project Spare Parts and the actual purchase price thereof.

(d) If, after Substantial Completion and prior to Final Completion, Contractor has any Equipment (including Start-up Spare Parts) that it purchased for the Facility but did not incorporate therein, Owner has the option of either taking such Equipment at Contractor's actual cost for such Equipment (as evidenced by reasonable supporting documentation) or requiring that Contractor haul off such Equipment at Contractor's own cost and expense. Notwithstanding the foregoing, all Project Spare Parts shall be the property of Owner and shall only be utilized by Contractor upon Owner's prior written agreement; provided that Owner has satisfied its then-current payment obligations under Section 5.2 with respect to such Project Spare Parts.

Section 2.6 Start-Up; Initial Operation; Commissioning; Performance Testing Preventative Maintenance Plan; Training of Owner Personnel.

(a) Without limitation of the requirements set forth in Section 2.1, Contractor shall be responsible for (i) all start-up activities, all calibration of controls and Equipment, pre-commissioning activities, Commissioning, testing and Performance Testing, in each case of and for (A) the Facility, (B) all Equipment that is a part thereof and (C) all components of either of the foregoing and (ii) the initial operation of the Facility through Substantial Completion.

(b) Contractor shall be required to integrate and use Owner's (or its Affiliate's) operations and maintenance personnel in Contractor's start-up, pre-commissioning, Commissioning, testing and Performance Testing efforts.

(c) In advance of Contractor's start-up, pre-commissioning, Commissioning, testing and Performance Testing efforts, Contractor shall provide for the initial training of personnel associated with and required for the operation and maintenance of the Facility in accordance with Exhibit EE. Contractor shall submit any proposed training programs as required by Exhibit EE, which shall include but not be limited to training related to the Preventative Maintenance Plan, to Owner at least thirty (30) days prior to the start of any applicable

classroom training. Owner shall have the right to, in a timely manner, review and provide Contractor notice approving such training programs; *provided*, *however*, that such approval shall not be unreasonably withheld.

(d) Contractor shall perform, and re-perform as applicable, all tests, including the Commissioning Tests and the Performance Tests in accordance with the Scope of Work and Exhibits N and O.

(e) No less than thirty (30) days prior to Substantial Completion, Contractor shall, in accordance with Prudent Industry Practices, prepare and submit to Owner a preventative maintenance plan (the "**Preventative Maintenance Plan**"), which shall set forth (i) the maintenance schedule (including sufficient detail regarding the requirements thereof) and (ii) all materials and special tools or Equipment that are required for the proper operation or maintenance of the Facility in accordance with Prudent Industry Practices. All special tools and equipment included in the Preventative Maintenance Plan shall be provided by Contractor as part of the Contract Price.

Section 2.7 Other Work.

As part of the Work, Contractor shall provide any other incidental services or incidental items not specifically described in this Contract if it may be reasonably inferred in accordance with the EPC Requirements that such additional incidental work or incidental item is reasonably necessary to make the Facility operable and capable of performing as specified in accordance with the EPC Requirements.

Section 2.8 Time is of the Essence; Guaranteed Substantial Completion Date; Project Schedule.

(a) The Parties acknowledge that time is of the essence for the performance of Contractor's obligations under this Contract. Contractor guarantees that the Facility will achieve Substantial Completion on or before the date indicated for "Substantial Completion" in the Project Schedule. The Parties further acknowledge and agree that, in accordance with Section 2.8(c), the preliminary indicative construction schedule attached hereto as Exhibit D will be replaced by the Project Schedule and the date indicated on the Project Schedule for "Substantial Completion" shall be the date by which Contractor guarantees that the Facility will achieve Substantial Completion. The date on which Contractor guarantees that the Facility will achieve Substantial Completion, as indicated on the Project Schedule, is subject to extension (i) in each case to the extent permitted pursuant to Section 7.3(a), for circumstances expressly specified under the terms of this Contract wherein Contractor is entitled to a Change Order adjusting the Guaranteed Substantial Completion Date or (ii) as expressly authorized by a Change Order executed by the Parties (such date as it may be adjusted herein, the "**Guaranteed Substantial Completion Date**"); *provided however*, the Guaranteed Substantial Completion Date shall not be extended for any other event or circumstance without the prior written consent of the Owner.

(b) The Parties acknowledge and agree that a preliminary, indicative construction schedule for the performance of the Work is attached hereto as Exhibit D and that

such preliminary construction schedule shall be utilized by the Contractor for the purposes of developing the Project Schedule in accordance with Section 2.8(c).

(c) Within five (5) Business Days after receiving the Notice to Proceed, Contractor shall develop a construction schedule (the "**Project Schedule**"), in form and substance reasonably satisfactory to Owner, using Primavera or equivalent. The Project Schedule shall be no longer in duration than the preliminary schedule attached hereto as Exhibit D. Contractor shall use the critical path method ("**CPM**") of scheduling in accordance with Owner's Contractor scheduling requirements set forth on Exhibit BB. Such Project Schedule will, in Contractor's reasonable discretion, reflect a practical plan to achieve Substantial Completion on or before the Guaranteed Substantial Completion Date, will be sufficient to allow proper oversight of the Work, and will reflect the following tasks, with duration, start and finish dates and designated resources:

(i) the Effective Date,

(ii) the estimated date(s) that Contractor will provide Engineering and Design Materials and Construction Documents to Owner for Owner review,

(iii) the Notice to Proceed Date (and where the Notice to Proceed Date has not yet occurred, the expected or estimated Notice to Proceed Date),

(iv) any required pre-construction meetings with third parties including Governmental Authorities,

(v) the expected starting and completion dates for each trade and/or Subcontractor,

(vi) the procurement schedule for major items of delivery (including order dates and delivery dates),

(vii) Site preparation work,

(viii) delivery dates of major Equipment,

(ix) all Milestones and other construction dates,

(x) anticipated Commissioning and Performance Testing,

(xi) Mechanical Completion,

(xii) Substantial Completion,

(xiii) Final Completion, and

(xiv) may include dates related to any Owner approvals required pursuant to this Contract and Owner's completion of the Interconnection Facilities.

All activities in the CPM schedule shall have proper predecessors and successors required to execute the Work in a logical manner. The CPM network shall have no open ends except for one start milestone and one completion milestone. Owner shall deliver its comments, if any, to the Project Schedule to Contractor within ten (10) Business Days after receipt thereof from Contractor, and Contractor shall make commercially reasonable efforts to incorporate Owner's reasonable comments into the Project Schedule. Contractor shall plan and develop the performance of the Work in accordance with the Project Schedule and supervise, control, and coordinate the performance of the Work in accordance with the Project Schedule. The Guaranteed Substantial Completion Date, not the Project Schedule, shall control in the determination of Delay Liquidated Damages.

Section 2.9 Progress Reports; Meetings.

(a) Contractor shall submit monthly progress reports (each, a "**Monthly Progress Report**") to Owner of actual progress of the Work through the end of each Month by the tenth (10^{th}) day of the following Month. Each Monthly Progress Report shall contain the following information and be in a form reasonably satisfactory to Owner:

(i) a statement regarding whether the Work is or is not proceeding according to the Project Schedule;

(ii) a detailed description of the Work, including Contractor's and all Subcontractors' activities and engineering, designing, manufacturing, construction and testing progress as compared with the Project Schedule and Milestones, a float report on the statused schedule (including any apparent deviation (positive or negative float) in the Project Schedule, in days, from the required date of completion for Substantial Completion, Final Completion, and other designated primary milestones);

(iii) a description of non-payments or payment disputes with Subcontractors;

(iv) a description of problems and deficiencies in the Work performed (including an explanation and evaluation, in reasonably sufficient detail, of any factors that have had or are anticipated to have a material effect on the Project Schedule and, as applicable, the remedies in effect or planned);

(v) the status of Equipment deliveries;

(vi) the status of Contractor Permits;

(vii) any health, environmental and/or safety issues that exist in connection with the Work, including all recordable incidents and/or lost time incidents due to injuries, demonstration of adherence to applicable safety program, and all applicable material safety data sheets for all Hazardous Substances brought onto the Site by Contractor,

(viii) quality assurance reports with respect to all construction activity and other Work at the Site; and

(ix) all other information regarding the Work reasonably requested in writing by Owner or any Governmental Authority.

(b) In addition to any Monthly Progress Report required hereunder, Contractor shall provide immediate verbal safety or environmental incident reports regarding recordable incidents and/or lost time incidents due to injuries (including "near miss" incidents where no individual was injured or property was damaged) to Owner's Site Construction Manager and Owner's Project Manager, and shall thereafter provide corresponding written reports for such incidents within five (5) Business Days after the occurrence of any such incident relating to the Work.

(c) Contractor shall submit weekly progress reports (each a "**Weekly Progress Report**") to Owner setting forth in reasonable summary form the status of actual progress of the Work as of the time such Weekly Progress Report is being provided, including a summary of:

(i) a summary of all safety events, including the demonstration of adherence to their site safety program and a summary reporting on drug testing results to the extent permitted by applicable law;

(ii) a description of the Work, including man-hours worked during the applicable period;

(iii) a float report on the statused schedule (including any apparent deviation (positive or negative float) in the Project Schedule, in days, from the required date of completion for Substantial Completion, Final Completion and other primary milestones);

(iv) description of daily weather conditions at the Site, in accordance with the Scope of Work, for the prior week; and

(v) the agenda for the following weekly construction meeting to be conducted pursuant to Section 2.9(f) in the form attached as Exhibit GG hereto.

(d) Notwithstanding the submission of any Monthly Progress Report or Weekly Progress Report and Owner's receipt thereof, Contractor shall not be relieved from the obligation to meet any Milestone date set forth in the Project Schedule unless such date is extended pursuant to a written Change Order. Upon Owner's request, Contractor shall furnish the documents used by Contractor to prepare any Monthly Progress Report or Weekly Progress Report including estimated material and equipment, procurement, manufacturing, shipping, installation and construction schedules.

(e) After the Effective Date, Contractor will meet Monthly, or as reasonably requested by Owner, with the Owner (by conference call or in person) to discuss, as applicable, (i) issues affecting the administration of the Work and Project Schedule, (ii) issues related to the implementation of the necessary procedures to facilitate the ability of the Parties to perform their obligations under this Contract or (iii) Site, construction or other issues related to the Work.

Promptly after the Effective Date, Contractor and Owner shall establish a standard meeting schedule for such Monthly meetings.

(f) After issuance of any Limited Notice to Proceed or the Notice to Proceed, the Contractor will establish a weekly construction meeting with the Owner (by conference call or in person) at which time the Work completed during the prior period will be reviewed, and Contractor will provide Owner with a three-week prospective look forward to the Work projected to be completed in such prospective period. Contractor shall provide the Weekly Progress Report prior to each weekly construction meeting. The weekly construction meetings shall comply with the protocols and procedures set forth in Exhibit GG.

(g) Contractor shall prepare accurate and reasonably detailed minutes of all meetings and shall promptly afterward provide copies of such meeting minutes to all attendees and Owner.

Section 2.10 Standard of Performance.

Contractor shall perform the Work with the requisite and appropriate expertise, supervision, skill, and competence to complete, and shall complete, the Work in accordance with the EPC Requirements utilizing Contractor's best skill and judgment, and in a safe, prudent, professional, expeditious, good, and workmanlike manner. Contractor shall be solely responsible for construction means, methods, techniques, sequences, procedures and safety and security programs in connection with the performance of the Work.

Section 2.11 Labor and Personnel.

(a) Contractor shall provide and be responsible for the services of Contractor Personnel in connection with the Work. Contractor shall, and shall provide that each Subcontractor shall, use qualified labor and personnel for the performance of the Work in accordance with Prudent Industry Practice. All Contractor Personnel shall be licensed and insured to perform the Work to the extent required by Applicable Law or Prudent Industry Practice. Contractor shall use commercially reasonable efforts in the selection and continuing use of labor and Subcontractors (whether directly or indirectly employed) so as to cause no material conflict or interference with or between the various trades or delay in the performance of Contractor's obligations.

(b) Contractor shall at all times maintain discipline, safety and good order at the Site and in the performance of the Work, including as necessary the removal and replacement of any personnel failing to maintain discipline, safety and good order in Contractor's reasonable judgment. Owner may require replacement of any Contractor Personnel by providing written notice to Contractor if, in Owner's reasonable opinion, such Contractor Personnel is unsafe, incompetent, careless, creates an unsafe or hostile work environment, persists in any conduct which is prejudicial to safety, health or the protection of the environment, disregards any EPC Requirements, including the terms and conditions of this Contract, or is interrupting, interfering with or impeding the timely and proper completion of the Work. Contractor shall work diligently in cooperation with Owner to resolve such request in a timely fashion so as to minimize any disruption in the Project Schedule. Notwithstanding the foregoing, Owner shall

have the right to cause the immediate removal from the Site of any Contractor Personnel if Owner determines, in its reasonable discretion, that such removal is necessary or advisable. As applicable, Contractor shall replace any such employee at its sole cost and expense. NOTWITHSTANDING THE FOREGOING, OWNER SHALL HAVE NO LIABILITY AND CONTRACTOR AGREES TO RELEASE, INDEMNIFY, DEFEND AND HOLD HARMLESS THE OWNER INDEMNITEE FROM AND AGAINST ANY AND ALL CLAIMS, CAUSES OF ACTION, DAMAGES, LOSSES, COST AND EXPENSES (INCLUDING ALL ATTORNEYS' FEES AND LITIGATION EXPENSES) AND LIABILITIES, OF WHATSOEVER KIND OR NATURE, WHICH MAY DIRECTLY OR INDIRECTLY ARISE OR RESULT FROM CONTRACTOR OR ANY SUBCONTRACTOR TERMINATING THE EMPLOYMENT OF OR REMOVING FROM THE WORK ANY EMPLOYEE FOLLOWING A REQUEST BY OWNER TO HAVE SUCH EMPLOYEE REMOVED FROM THE WORK.

(c) Contractor shall be responsible for all labor relations matters relating to the Facility or Contractor's obligations hereunder, including wages, salaries, hours of work, employee benefits, labor contracts, safety and related matters, and shall manage labor relations in such a manner that there is harmony among the employees of Contractor and its Subcontractors performing Work at the Site. Without limitation of the foregoing covenants and responsibilities, Contractor expressly acknowledges and agrees that if, during the performance of the Work, conditions of labor unrest occur at the Site, labor-related threatened or actual strikes or job actions at the Site or which cause a Delay to Contractor's performance of the Work in accordance with the Project Schedule or there is blockage of access to the Site by Persons engaged in any of the foregoing, then Contractor shall immediately take all actions under Applicable Laws to end such events or conditions, it being further acknowledged and agreed that such conditions or events are a Force Majeure only as set forth in Section 15.1 and to the extent such event is not a Force Majeure event, Contractor shall not be entitled to any Change Order or adjustment to the Contract Price, Project Schedule or Guaranteed Substantial Completion Date.

(d) Contractor shall cause all Contractor Personnel to be trained in and made aware of any applicable EPC Requirements related to the Site or pertaining to any part of the Work performed by such Contractor Personnel, including instruction of all such Contractor Personnel regarding conditions at the Site and the Construction Safety Plan.

Section 2.12 Permitting.

(a) Contractor shall timely obtain and maintain in effect (including by timely meeting all application, filing and other reporting requirements) the Contractor Permits and any other Applicable Permits (other than Owner Permits) necessary for the performance of its obligations hereunder, including non-Facility specific Permits necessary for Contractor to do business as a contractor in the State of Kentucky.

(b) Contractor shall reasonably cooperate with Owner in connection with Owner's efforts to obtain the Owner Permits.

(c) Contractor shall perform the Work in compliance with all Applicable Permits.

(d) Contractor shall provide to Owner, within five (5) days after submission or receipt, as applicable, copies of all applications made for any such Contractor Permits and all material correspondence received or sent in respect of such applications. At Substantial Completion, Contractor shall transfer or assign to Owner all Contractor Permits held by Contractor that are necessary for Owner's ownership and operation of the Facility.

(e) In connection with all Work, including without limitation the fulfillment of all conditions and requirements of all Applicable Permits pertaining thereto, all Contractor Personnel shall fully and continuously cooperate with all applicable Governmental Authorities, which cooperation shall include causing the CCM to meet at the Site with Governmental Authorities as may be required and to provide such reports and filings as may be reasonably requested by such Governmental Authorities.

Section 2.13 Clean-Up and Waste Disposal.

(a) During the performance of the Work, Contractor shall, at its own expense, keep the Site clean and free from accumulations of waste materials, rubbish and other debris resulting from the Work, including any waste materials, rubbish or other debris created by any Subcontractor.

(b) Prior to Final Completion, Contractor will remove Contractor's and any Subcontractor's waste materials, rubbish, tools, construction equipment, machinery, surplus materials and other debris from the Facility (to the extent not constituting or intended to constitute the Facility) and the Site and dispose of the same. Without limitation of Contractor's obligations, if Contractor has failed to fulfill its obligations under this Section 2.13 with respect to the Facility and the Site within thirty (30) days after Substantial Completion, then Owner, after having given prior written notice to Contractor, may clear the Site by removing Contractor's waste materials, rubbish, debris, tools, construction equipment, machinery and surplus materials, and Contractor shall be liable to Owner for the reasonable cost and expenses arising therefrom.

Section 2.14 Safety.

(a) The Project shall conform to the Contractor's "Global Minimum Requirements for Environment, Health and Safety Management", attached hereto as Exhibit Y. Contractor will develop a construction safety plan which shall comply with the Contractor's "Global Minimum Requirements for Environment, Health and Safety Management", Owner's Safety Policies and Applicable Laws (the "**Construction Safety Plan**"), and the Construction Safety Plan shall apply to all activities performed at the Site. In the event of a conflict between any requirement or standard of the Owner's Safety Policies and the "Contractor's Global Minimum Requirements for Safety" attached hereto as Exhibit Y, the more strict requirement or standard shall control and be deemed the standard applicable under the Construction Safety Plan as it relates to the applicable safety requirement, protocol or procedure. Contractor shall provide the Construction Safety Plan to Owner in accordance with the Submittal Schedule attached hereto as Exhibit CC.

(b) Contractor shall, and shall cause all Contractor Personnel and each Subcontractor to, perform the Work (onsite and off-site) in accordance with the Construction Safety Plan, and Contractor shall assume all costs associated with compliance therewith. Without limitation to the foregoing, Contractor is responsible for performing the Work in a safe and physically secure manner and shall take all reasonable precautions for the safety of, and shall provide reasonable protection to prevent damage, injury, or loss to, Persons or property resulting from or in connection with the performance of the Work. Contractor shall be fully responsible for initiating, maintaining, and supervising adequate and lawful safety precautions, procedures, and programs in connection with the Work and in accordance with the Construction Safety Plan. Contractor further agrees to provide or cause to be provided necessary training and safety equipment to its employees and Subcontractors to ensure their compliance with the Construction Safety Plan and enforce the use of such training and equipment. Owner's review and approval of the Construction Safety Plan shall not in any way relieve Contractor of its responsibility regarding safety, and Owner, in its review and approval thereof, assumes no liability for the Construction Safety Plan.

(c) In the event that Contractor becomes aware of any activities at the Project site that are not in compliance with the Construction Safety Plan, Contractor shall take such measures within its reasonable discretion to assure full compliance with the Construction Safety Plan, including but not limited to unilaterally stopping all or part of the Work and/or the activities that are not in compliance with the Construction Safety Plan ("**Safety Remedial Measures**").

(d) Contractor shall in writing designate to Owner a safety representative with the necessary qualifications and experience to supervise the implementation of, and monitoring and compliance with, Contractor's safety program described in Section 2.14(a). The safety representative shall make routine inspections of the Site and shall hold regular safety meetings with Contractor Personnel (including Subcontractors and others, as applicable).

(e) Contractor shall maintain all accident, injury and any other records required by Applicable Law or reasonably requested by Owner and shall furnish Owner a Monthly summary of hours worked, injuries and labor hours lost due to injuries. Should Owner at any time observe Contractor, or any of its Subcontractors, performing the Work in an unsafe manner, or in a manner that may, if continued, become unsafe, then Owner shall have the right (but not the obligation) to require Contractor to stop the Work until such time as the manner of performing the Work has been rendered safe to the reasonable satisfaction of Owner; *provided, however*, that at no time shall Contractor be entitled to any Change Order or adjustment to the Contract Price, Project Schedule or Guaranteed Substantial Completion Date based on such work stoppage.

(f) Contractor shall immediately report both verbally and in writing any safety-related injury, loss, damage or accident arising from the Work to Owner and, to the extent mandated by Applicable Laws, to all Governmental Authorities having jurisdiction over safety-related matters involving the Facility or the Work.

(g) Owner shall have the option at Owner's cost to engage a safety consultant to review the Facility and all Contractor procedures and practices with respect thereto, and

Contractor shall be required to implement any reasonable recommendations made by such consultant with respect to the Work.

(h) In the event of any emergency endangering life or property in any way relating to the Work, the Facility or the Site, whether on the Site or otherwise, Contractor shall take such action as may be reasonable and necessary to prevent, avoid or mitigate injury, damage, or loss. The cost of such action shall be paid by Owner as a Change Order unless and to the extent such emergency endangering life or property was due to the action or inaction of any Contractor Personnel. If Contractor has not taken reasonable precautions for the safety of the public or the protection of the Work, and such failure creates an emergency requiring immediate action, then Owner, with or without notice to Contractor may, but shall be under no obligation to, take reasonable action as required to address such emergency. The taking of any such action by Owner, or Owner's failure to take any action, shall not limit Contractor's liability. Contractor shall reimburse Owner for the performance of any work or furnishing of any Equipment or other items in connection with any emergency in an amount equal to the reasonable costs incurred by Owner in such performance of work or furnishing of Equipment or other items.

Section 2.15 Hazardous Substances.

(a) Contractor shall provide all material safety data sheets in connection with any Hazardous Substances which Contractor or any of its Subcontractors plans to bring to the Facility, the Site or any areas adjacent thereto, as applicable, no less than seven (7) days prior to such Hazardous Substances being brought to the Facility, the Site, or any areas adjacent thereto. Contractor will be responsible and strictly liable for any Release of any Hazardous Substances in violation of any Applicable Law by Contractor, any Subcontractor or any Contractor Personnel in the course of performing the Work. Contractor will immediately notify Owner of any Release of Hazardous Substances that occurs during the performance of the Work that is or may be in violation of Applicable Laws.

(b) In compliance with Applicable Laws, Contractor shall remove from the Facility, the Site and areas adjacent thereto, and properly dispose of, all Hazardous Substances brought onto or generated at the Site by Contractor or any Subcontractor during the performance of the Work.

(c) In the event Contractor encounters any Pre-Existing Hazardous Substances at the Site, Contractor shall promptly cease any Work or operations in progress in an orderly, safe and efficient manner and inform Owner of the nature and location of such Pre-Existing Hazardous Substances. As between Owner and Contractor, it shall then be Owner's responsibility, at Owner's sole cost and expense, to immediately eliminate or contain such Pre-Existing Hazardous Substances in a commercially reasonable manner and in compliance with Applicable Law in order to allow Contractor and its Subcontractors to continue or finalize any such Work or operations in progress; *provided, however*, that nothing in this Section 2.15(c) shall represent or shall be construed by any Person to represent, Owner's accepting responsibility for or otherwise in any fashion agreeing to remediate, cure or prevent Hazardous Substances present or hereafter existing at the Site, it being acknowledged and agreed by Contractor and Owner that Owner's liabilities and obligations with respect to such Hazardous Substances (other

than to Contractor as set forth in this Section 2.15(c)) are strictly limited as set forth in Applicable Law.

(d) As a condition to Substantial Completion, Contractor will certify to Owner that, to Contractor's knowledge, based on reasonable inquiry, no Hazardous Substances were brought onto or generated at the Facility or the Site or otherwise incorporated in the Facility by Contractor or any Subcontractor, other than Hazardous Substances required to be incorporated into the Work which have been disclosed in writing to Owner, and that such Hazardous Substances were used, Released, removed or disposed of in compliance with the EPC Requirements.

Section 2.16 Effect on Third Parties; Roads; Protection of Work.

(a) As of the Effective Date, Owner has provided to Contractor copies of all easement, lease, right-of-way or other real property interests that affect the Work and Contractor shall, in the performance of the Work, comply, and cause all Subcontractors performing Work at the Site to comply, with any such identified easement, lease, right-of-way or other real property interests that affect or govern the Site or any other real property used for the purposes of completing the Work.

(b) Contractor shall construct and maintain temporary access and haul roads within the Site as may be necessary for the proper performance of this Contract. Contractor shall construct and maintain public access and viewing areas in accordance with the Scope of Work. Roads constructed on the Site shall be subject to Owner's written approval; provided, however, that such approval shall not be unreasonably withheld. All access areas, laydown areas, delivery routes, fabrication areas, portable office/restroom locations, and similar areas must be designated and submitted by Contractor with the preliminary Engineering and Design Materials provided in accordance with the Submittal Schedule pursuant to Section 2.2.

(c) In the performance of the Work, Contractor will protect and preserve the Site and other public and private property on, along, adjacent to or near the Site by means of erecting a perimeter site fence that meets or exceeds Owner's fence design standards set forth on Exhibit A and otherwise conduct commercially reasonable operations to minimize the risk of theft, loss or damage.

(d) Contractor Personnel shall coordinate and conduct the performance of the Work so as to not interfere with, disrupt the use of, or damage any adjacent property to the Site or public or private roads and footpaths or properties whether in the possession of Owner of any other Person. If Contractor or any Contractor Personnel directly or indirectly cause any damage to any such property or any access roads (excluding ordinary wear and tear) related thereto, then Contractor shall be responsible for all damages, losses, costs and expenses arising out of therefrom and shall promptly repair, rebuild or otherwise restore the same or otherwise make whole such damage in a reasonable manner and, in connection therewith, apply the proceeds of any available insurance received by Contractor in connection with such damage.

Section 2.17 Taxes.

(a) Except as set forth in clause (b) below, the Contract Price includes all Taxes and fees applicable to the Work, including: all corporate income tax, employee benefit taxes for all Work (whether performed by Contractor or any Subcontractor, and whether performed at the Site or elsewhere); Contractor fees for Contractor Permits; Taxes imposed upon the Work or wages of the Contractor's employees, agents, representatives and Subcontractors; and duties, tariffs (including any tax or tariff imposed on any Equipment by reason of its importation from any foreign nation), and other charges, income, excise, import or export, purchase, turnover, added value, consular gross receipts, gross wages, and similar assessments imposed by any Governmental Authority or any subdivision, taxing authority or agency therein with respect to this Contract or the subject matter hereof (all such foregoing taxes collectively, the "**Contractor Taxes**"). Notwithstanding the foregoing, the Contract Price shall be reduced by the amount of any sales and use and other similar tax for which a reduction or exemption is obtained as provided in clause (c) below.

(b) Notwithstanding anything else contained in this Section 2.17, the Contract Price shall exclude (i) any real property taxes with respect to the Site or the improvements from time to time thereon and any Equipment incorporated into the Facility following the transfer of title to such Equipment to Owner and (ii) any and all sales and use taxes. Any and all such real and personal property taxes and sales and use taxes shall be the responsibility of Owner to either pay directly or to reimburse to Contractor.

(c) Owner shall provide copies to Contractor of statutorily required exemption certificates for sales and use tax, if applicable.

(d) Contractor and Owner shall reasonably cooperate with each other to minimize their respective tax liability under this Contract to the extent legally permissible, including separately stating taxable charges on Contractor's invoices and supplying resale and exemption certificates, if applicable, and other information as reasonably requested in all cases by taxing authorities. In addition, to the extent any exemptions, abatements, credits against or deferrals of any taxes may be available to Owner or Contractor under Applicable Law, the Parties shall reasonably cooperate in order to secure any such exemptions, abatements, credits against, or deferrals of, such taxes.

(e) If any Contractor Taxes are due and payable, Contractor shall timely pay such Contractor Taxes. Contractor shall be registered to pay taxes in the state in which the Facility is located and shall provide to Owner a valid entity number from the Secretary of State for the state in which the Facility is located. Contractor shall ensure that its Subcontractors are similarly registered as required by Applicable Law. Upon the failure of Contractor to pay any Contractor Taxes when due, Owner may (but is not obligated to) pay such Contractor Taxes and shall be entitled to recover promptly from Contractor the amount paid together with all reasonable expenses incurred by Owner in connection with such payment. Contractor shall hold harmless, indemnify and defend Owner, together with any and all of its officers, directors, agents and employees from any liability, penalty, interest and expense by reason of Contractor's failure to pay such Contractor Taxes.

(f) Provided Owner has satisfied its then-current payment obligations under Section 5.2, (i) Contractor shall not permit or suffer to exist any lien, charge, or encumbrance on the Equipment, the Site, Facility, or any part thereof or interest therein in connection with the Contractor Taxes, and (ii) Contractor shall, at Contractor's cost and expense, promptly pay or discharge any such lien or encumbrance.

Section 2.18 Credit Support.

Contractor shall provide to Owner and maintain, during the period from the Notice to Proceed Date to the expiration of the Defect Correction Period, a performance bond, in the form attached hereto as Exhibit X, in an amount equal to the Contract Price (the "Credit Support"); provided that such Credit Support shall be issued by a treasury listed surety company or companies with an AM Best Rating of A-VII or better and that are authorized to do business in the Commonwealth of Kentucky.

Section 2.19 Interconnection.

Contractor shall perform all Work necessary to interconnect the Facility with Owner's Interconnection Facilities and other components of such Work as set forth in Exhibit A.

Section 2.20 Incentives

With respect to the Work performed under this Contract, Contractor shall reasonably cooperate with and assist Owner in connection with Owner's requests in connection with its preparation and submittal of documents necessary to participate in any local, state or federal incentive program, including (a) any local, state or federal tax incentive or similar program and (b) any incentive programs related to Environmental Attributes.

Section 2.21 Other Contractor Obligations and Restrictions.

(a) Contractor shall maintain insurance coverage as set forth in Section 17.1.

(b) Contractor shall not establish any commercial activity or issue concessions or Permits of any kind to third parties for establishing commercial activities on the Site or other land owned or controlled by Owner. Contractor shall not allow Contractor Personnel to engage in any commercial activity on the Site (other than the Work).

(c) Contractor shall timely make all payments required to be paid to Owner pursuant to the terms of this Contract.

(d) Contractor shall provide and pay for all temporary utilities (e.g., electricity, water, communication, cable, telephone, waste and sewer), including all connections, necessary for the performance of the Work, including installation, Permit and usage costs.

(e) Contractor shall (i) locate all existing underground utilities including cable, conduit, water pipes and sanitary lines, (ii) protect the same, and (iii) repair any damage to such underground utilities caused by Contractor at its own expense.

(f) When any Work is performed at night or where daylight is obscured, Contractor shall, at its expense, provide artificial light sufficient to permit Work to be carried on efficiently, satisfactorily, and safely without disruption to residents near the Site. During such time periods, access to Site shall also be clearly illuminated to the extent required by Contractor for performance of the Work. All wiring for electrical light and power shall be installed and maintained by Contractor in a safe manner.

(g) Contractor shall provide dust control of the Site, all excavations, material sites, roads and disposal areas within its assigned areas of responsibility and shall take and provide suitable action, Equipment, facilities, and precautions to limit the discharge of contaminants to the levels prescribed by Applicable Laws. Without limiting the generality of the foregoing, Contractor shall comply with the then-effective Best Management Practices Plan.

(h) Contractor shall not make any public announcement, publication, photograph, or other type of communication concerning the Work without Owner's prior written approval. For clarity, this provision shall not be construed to include announcements, publications and communications to prospective subcontractors, suppliers and consultants for the Work.

(i) Subject to Applicable Laws, Contractor shall permit Owner's designated representatives to enter onto the Site with unescorted access to the Work which in no event shall unreasonably interfere with the orderly completion of the Work by Contractor.

(j) No later than sixty (60) days after the date Owner issues the Notice to Proceed, Contractor shall submit to Owner for its review and written approval, a Facility-specific quality control and quality assurance plan and an inspection plan detailing Contractor's Quality Management System and Subcontractor source inspection plan as required by Exhibit U. No later than ninety (90) days after the date Owner issues the Notice to Proceed, Contractor shall submit to Owner for its written approval, detailed construction inspection and test plans and supporting construction procedures as required by Exhibit U. Prior to the commencement of the Work, detailed quality assurance and quality control procedures and plans applicable to the Work shall be issued to Owner in accordance with Exhibit U. Owner's review and approval of Contractor's Quality Management Plan, Subcontractor source inspection plan, detailed construction inspection and test plans and supporting construction procedures, and detailed quality assurance and quality control procedures and plans shall in no way relieve Contractor of its responsibility for performing the Work in compliance with this Contract. As part of the Quality Management Plan, the Subcontractor source inspection plan, detailed construction inspection and test plans and supporting construction procedures, and detailed quality assurance and quality control procedures and plans, Contractor agrees that it shall keep a daily log of inspections performed, and Contractor shall make available at the Site for Owner's, any Financing Party's and Owner's Engineer's review a copy of all such inspections.

(k) As between Owner and Contractor, the title to water, soil, rock, gravel, sand, minerals, timber, and any other materials developed or obtained in the excavation or other operations of Contractor or any Subcontractor and the right to use said materials or dispose of same is hereby expressly reserved by Owner. Contractor may, at the sole discretion of Owner,

be permitted, without charge, to use in the Work any such materials that comply with the requirements of this Contract.

ARTICLE 3
SUBCONTRACTORS

Section 3.1 Subcontractors.

(a) Owner acknowledges and agrees that Contractor may have portions of the Work performed by Subcontractors.

(b) No contractual relationship shall exist between Owner and any Subcontractor with respect to the Work, and no Subcontractor is intended to be or shall be deemed a third party beneficiary of this Contract. Contractor shall be responsible to Owner for the acts and omissions of Subcontractors and of Persons directly or indirectly employed by them, to the same extent as Contractor is responsible to Owner for the acts and omissions of Contractor and its employees. Nothing contained in this Contract shall obligate Owner to pay or otherwise be responsible for the payment of any Subcontractor, except as may be required by Applicable Law. Entry into any Subcontract shall not relieve Contractor of any of its obligations under this Contract, including the obligations to perform the Work in accordance with the EPC Requirements. Owner shall have the right, upon written request, to receive from Contractor a copy of all specifications and warranties for services or Equipment supplied by any Subcontractors.

(c) All Major Subcontracts shall be in writing and provide that the rights and obligations of Contractor, including all warranties and licenses under each such Major Subcontract are assignable to Owner, any Financing Party or any Replacement Contractor, and their respective successors and assigns upon Owner's written request without further consent of such Major Subcontractor or Contractor; provided, that Owner shall not issue such a written request unless this Contract has been terminated pursuant to the terms hereof. Contractor shall use commercially reasonable efforts to cause each Major Subcontract to be consistent with the terms of this Contract and provide that each Major Subcontract shall:

(i) contain provisions that require the Work be performed in accordance with the provisions of Section 2.10;

(ii) require the Subcontractor to carry and maintain insurance coverage in accordance with Prudent Industry Practices, and to file certificates of such coverage with the Contractor;

(iii) require the Subcontractor at all times to maintain discipline, safety and good order at the Site in the performance of its work and that of its personnel, and require that any Subcontractor remove and replace any personnel failing to maintain discipline, safety and good order; *provided*, that in no event shall Contractor be entitled to any Change Order or adjustment to the Contract Price, Project Schedule or Guaranteed Substantial Completion Date for the failure of any Subcontractor personnel to act in compliance with the foregoing;

(iv) require the Subcontractor that would have the capacity to place a lien on any portion of the Work to make timely payments to its laborers and suppliers and to submit certificates and waivers of liens for work completed by it and by its Subcontractors as a condition to payment;

(v) require submission to Contractor or Subcontractor, as the case may be, of applications for payment, together with clearly defined invoices and billings supporting all such applications; and

(vi) require the Subcontractor to acknowledge that documentation delivered and licenses granted under the respective Subcontract shall be conveyed by Contractor to Owner.

(d) All Subcontractors shall be reputable, qualified firms with an established record of successful performance in their respective trades performing identical or substantially similar work. The work of any Subcontractor shall be subject to inspection by Owner or the Financing Parties to the same extent as the Work of Contractor. Contractor shall not engage or hire any consultant or Subcontractor that (i) is listed on any debarment list by a Governmental Authority having jurisdiction over the Facility, (ii) does not hold a valid license to perform the obligations for which it is engaged or Subcontracted (if it is required by Applicable Law or by the Permits to have such license) or (iii) is otherwise not in good standing under Applicable Law.

(e) Contractor shall, at all times, maintain a list of all selected Subcontractors and provide the latest revision of such list to Owner.

(f) Contractor and Owner acknowledge and agree that Contractor shall have the right to obtain Work and/or procure and use Equipment for the Facility from the Subcontractors specified as "pre-approved" vendors of the applicable type of Equipment, as set forth on Exhibit A (the "**Specified Suppliers**"). In the event Contractor intends to engage any additional Major Subcontractor in connection with the Work, including for the provision of any Equipment for the Facility, Contractor shall notify Owner of any such Major Subcontractor with whom Contractor anticipates engaging. Owner shall have the right to review and approve such engagement and the Equipment to be supplied or Work to be performed by them, and, following such Owner approval, Exhibit A shall be deemed to be amended to reflect such additional approved Major Subcontractor as a Specified Supplier. Failure of Owner to accept a proposed Major Subcontractor within five (5) Business Days shall be deemed an approval by Owner of such proposed Major Subcontractor. Review or approval by Owner shall not relieve Contractor of any obligation or liability under this Contract.

(g) Contractor shall furnish Owner with a copy of each Major Subcontract (provided the pricing information contained therein may be redacted from such copies) within ten (10) Business Days after execution thereof. Notwithstanding the above, Owner's receipt and review of any such Major Subcontract shall not relieve Contractor of any obligations under this Contract nor shall such action constitute a waiver of any right or duty afforded Owner under this Contract or approval of or acquiescence in a breach hereunder.

(h) Upon expiration of any applicable or appropriate cure period set forth in the applicable Subcontract, Owner shall be entitled to require Contractor to immediately terminate any Subcontract if the applicable Subcontractor fails to comply in any material respect with the policies and procedures set forth in the Construction Safety Plan, persists in any conduct which is prejudicial to safety, health or the protection of the environment, or fails to perform the Work in accordance with the safety and health rules and standards of Applicable Laws. Contractor agrees that it shall have no right, and hereby waives any such right, to request a Change Order or claim an adjustment in the Contract Price, Project Schedule or Guaranteed Substantial Completion Date arising out of or due to any such termination.

(i) Each Subcontract shall include provisions under which such Subcontractor will agree to the collateral assignment of such Subcontract to Owner and by Owner to the Financing Parties.

ARTICLE 4
OWNER OBLIGATIONS

Section 4.1 Payment.

Owner shall timely pay the Contract Price in accordance with the provisions of ARTICLE 5.

Section 4.2 Permits.

(a) Owner shall timely obtain and maintain in effect (including by timely meeting all application, filing and other reporting requirements) all Owner Permits. Owner shall reasonably cooperate with Contractor in connection with Contractor's efforts to obtain Contractor Permits. To the extent Owner has not obtained any Owner Permits as of the Effective Date, Owner shall obtain such Owner Permits in accordance with the schedule contained in Exhibit E.

(b) If requested by Contractor, Owner shall provide to Contractor within five (5) Business Days after such request copies of all Owner Permits.

Section 4.3 Duty to Cooperate.

Owner shall, throughout the performance of the Work, reasonably cooperate with Contractor and perform its responsibilities, obligations and services under this Contract in a timely manner to facilitate Contractor's timely and efficient performance of the Work and so as not to Delay Contractor's performance of its obligations under this Contract.

Section 4.4 Site Access.

Throughout the period of Contractor's performance of the Work, and subject to all EPC Requirements, Owner shall afford Contractor, and its Subcontractors, consultants and suppliers, and all other Contractor Personnel reasonable access to the Site in order for Contractor to timely and efficiently perform the Work, which access shall be to permit Contractor to progress with construction on a continuous basis without substantial interruption or interference.

Section 4.5 Operator Personnel.

Prior to Substantial Completion, Owner shall retain (through itself or an Affiliate) operating and maintenance personnel sufficient to support Contractor in the performance of its pre-commissioning, Commissioning, start-up, testing and Performance Testing activities pursuant to Section 2.6. For clarity, however, Owner (or its Affiliate) shall provide and pay for all of Owner's (or such Affiliate's) operating and maintenance personnel, including all wages, benefits, taxes and insurance.

Section 4.6 Owner's Construction Site Manager and Project Manager.

Owner shall designate in writing a representative at the Site to act as the Site manager on Owner's behalf ("**Owner's Construction Site Manager**"). The Owner's Construction Site Manager will act as the liaison for Owner's communications with Contractor and the CCM at the Site. Owner shall also designate in writing a representative ("**Owner's Project Manager**"). The Owner's Project Manager will (a) be responsible for facilitating all approvals and certificates due under this Contract to Contractor; (b) have authority to act on behalf of and bind Owner, and (c) have the authority to make decisions and take actions on behalf of Owner at the Site in conjunction with Owner's Construction Site Manager. Owner will provide notice of replacement in Owner's Construction Site Manager or Owner's Project Manager during the term of this Contract.

Section 4.7 Safety.

(a) Upon any noncompliance with the Construction Safety Plan by Owner or any third party for which Owner is responsible, then Contractor shall provide Owner with written notice of such noncompliance and the Parties shall coordinate in good faith to determine a remedy to such noncompliance. If such failure to comply with the Construction Safety Plan is not remedied within thirty (30) days after such written notice from Contractor, then Contractor shall be entitled to the remedies set forth in Section 14.9(a)(iv).

(b) Safety Remedial Measures arising from noncompliance with the Construction Safety Plan by the Owner or any third party for which Owner is responsible, shall entitle the Contractor to an equitable extension of the Project Schedule (including, as applicable, the Milestones and the Guaranteed Substantial Completion Date) and an equitable adjustment to the Contract Price pursuant to a Change Order.

ARTICLE 5
CONTRACT PRICE; PAYMENT

Section 5.1 Contract Price.

As full compensation and consideration for the full and complete performance of all of the Work and all of Contractor's other obligations under this Contract and all costs (including Contractor Taxes) in connection therewith, Owner shall pay to Contractor, and Contractor shall accept an aggregate, fixed fee lump sum amount equal to Sixteen Million Four Hundred Five Thousand One Hundred Thirteen U.S. Dollars and Sixty-Six Cents (U.S. $16,405,113.66), which amount shall include all Taxes (except as provided in Section 2.17), transportation fees, freight,

packing costs, import and custom duties, personnel fees, and all other costs associated with the performance of the Work (the "**Contract Price**"), subject to adjustment only pursuant to ARTICLE 7. The Contract Price shall include the amounts of any allowances for the Work as set forth in the Schedule of Values. Whenever costs are more than or less than the amount identified in the applicable allowance, the Contract Price shall be adjusted accordingly pursuant to a Change Order in accordance with ARTICLE 7. The Parties also acknowledge and agree that the Contract Price for certain specific portions of the Work includes quantities and/or unit prices and that in the event that the quantities differ, the Contract Price shall be modified in accordance with the applicable unit price identified in the Schedule of Values pursuant to a Change Order in accordance with ARTICLE 7.

Section 5.2 Payment of Contract Price.

Subject to the foregoing, the Contract Price shall be paid as provided herein to Contractor on a monthly basis in accordance with the percent of the Work completed and based on the schedule of values attached hereto as Exhibit C (the "**Schedule of Values**"). The Schedule of Values shall be updated as required to account for any Change Orders entered into pursuant to ARTICLE 7.

(a) **Progress Payments; Invoices**

(i) On or before the twenty-eighth (28th) of each Month, Contractor shall prepare and submit to Owner a preliminary Invoice (each, a "**Proposed Monthly Invoice**") setting forth the proposed Progress Payment(s) applicable to the Work achieved by Contractor by the twenty-fifth (25th) of such Month. The Proposed Monthly Invoice shall set forth Contractor's proposed Progress Payment to be reflected in the applicable Invoice. Proposed Monthly Invoice and Invoices shall identify Contractor's estimate of the percent completion of each line item of Work set forth in the Schedule of Values and the amount payable for such line item of Work calculated by multiplying such percent completion of each line item of Work set forth in the Schedule of Values by the aggregate amount of the Contract Price attributable to such line item of Work set forth in the Schedule of Values. The Parties shall promptly meet and confer in an attempt to obtain agreement on the information contained in such Proposed Monthly Invoice. On or before the third (3rd) of the following Month, Contractor shall prepare and submit to Owner its Invoice for Work performed up to the twenty-fifth (25th) of the prior Month. Proposed Monthly Invoice and Invoices may include amounts for deposits and amounts made on account of materials and Equipment delivered and suitably stored at the Site for subsequent incorporation in the Work. If approved in advance by Owner, payment may similarly be made for materials and Equipment suitably stored off the Site at a location agreed upon in writing by the Parties. Payment for materials and Equipment stored on or off the Site shall be conditioned upon compliance by Contractor with procedures reasonably satisfactory to Owner to establish Owner's title to such materials and Equipment in accordance with Section 16.1.

(A) Each Invoice and Proposed Monthly Invoice shall be on the form set out as Exhibit G hereto, note any amounts attributable to any Change Order and be delivered with all supporting documentation substantiating the

completion of the Work invoiced, including the applicable Monthly Progress Reports, any bills of lading and any applicable receipts if required to prove the completion of the applicable Work.

(B) Each Invoice shall be accompanied by: (1) executed interim lien waiver from Contractor, on the form attached as Exhibit H; and (2) Contractor's Interim Claim Waiver and Release in the form attached as Exhibit I.

(C) Each Invoice shall constitute the certification of the Contractor that:

(I) The Work to date is in accordance with the EPC Requirements, is not Defective and that the applicable Work is completed; and

(II) Title to all Equipment invoiced has passed or will pass to Owner in accordance with the terms of the EPC Requirements, free and clear of all claims, liens, encumbrances and security interests upon Contractor's receipt of full payment; and

(III) All Subcontractors have been paid in full or will be paid in accordance with the terms of their Subcontracts from the proceeds of the amount invoiced.

(ii) Within ten (10) days of receipt of an Invoice, Owner and, at Owner's discretion, Owner's Engineer, shall review the Invoice and the applicable portion of the Work and confirm in writing whether the invoiced Work has in fact reached the percentage of completion identified in the Invoice. Owner shall have no obligation to pay the Invoice amount associated with such events until (I) such time as Owner and, if applicable, Owner's Engineer, have confirmed that such Work has in fact reached the percentage of completion identified in the Invoice or (II) if Owner has failed to respond to such Invoice, the fifteenth (15^{th}) date after Owner's receipt thereof, in which case Owner shall be deemed to have confirmed that such Work has in fact reached the percentage of completion identified in the Invoice.

(iii) Owner's confirmation of the Invoice or payment in relation thereto shall not constitute acceptance of the Work associated with such progress or relieve Contractor from its obligations hereunder. Contractor agrees that it shall not include in any Invoice sums attributable to Work that Owner has reasonably rejected.

(iv) Owner will retain ten percent (10%) of each Invoice ("**Retainage**"). No Retainage, however, shall be held on any items of Work specifically designated as relating directly to Work for preconstruction, design, design management or general conditions in the Schedule of Values. Owner shall hold the Retainage as security for the performance of Contractor's obligations under this Contract, and any interest thereon shall accrue for the account of Owner. Owner may use the Retainage to cure a Contractor Event of Default, Delay Liquidated Damages, Performance Liquidated Damages, for payment of unpaid suppliers for Work performed for which Contractor

received payment from Owner and for payments made to remove any liens filed against the Facility, the Site, the Work, the Equipment or any property of Owner by any Subcontractors or any other Person acting through or under any of them for Work performed for which Contractor received payment from Owner, and for any and all other amounts payable to Owner under this Contract.

(b) **Terms of Payment**

Unless the Owner has provided a notice of objection as specified in Section 5.2(a)(ii), Owner shall make payment to Contractor of the amount of such Invoice within thirty (30) days following the date set forth on such Invoice, subject to all other provisions of this Contract including Section 5.3 and Section 5.2(a)(iv). In the event that Owner has provided a notice of objection to all or any part of an Invoice, then Owner shall make payment of the undisputed portion of the Invoice amount, subject to all other provisions of this Contract including Section 5.3 and Section 5.2(a)(iv). All payments made by Owner to Contractor hereunder shall be made by wire transfer in immediately available funds or ACH payment, in either case to the account of Contractor set forth in the applicable Invoice. Any amount of an Invoice in dispute shall be resolved in accordance with ARTICLE 20.

(c) **Final Payment**

Upon Final Completion, Contractor shall submit to Owner a Final Invoice, on the form attached as Exhibit G, for an amount equal to the balance of the Contract Price not previously invoiced in accordance with the Schedule of Values, including any remaining Retainage (such amount for the Work, the "**Final Payment**"). At the time of submission of its Final Invoice, and as a condition precedent to the Final Payment, Contractor shall provide the following information:

(i) an affidavit that there are no claims, obligations, demands, charges, judgments, security interests, bills for Equipment, liens or any other indebtedness outstanding or unsatisfied, including any of the foregoing for labor, services, material, equipment, Taxes or other items performed, furnished or incurred for or in connection with the Work which will in any way materially affect Owner's interests;

(ii) a statement summarizing and reconciling all previous Invoices, payments and Change Orders,

(iii) Final waivers and releases in the forms attached as Exhibits K, L, and M, executed by Contractor and each of its Subcontractors, respectively as applicable; and

(iv) certificates of insurance confirming that required coverages will remain in effect consistent with the requirements of this Contract.

Subject to all other provisions of this Contract including Section 5.3, Owner shall pay the Final Invoice within thirty (30) days after receipt by Owner, provided that Contractor has satisfied the conditions for Final Completion as set forth in Section 9.7.

Section 5.3 Owner's Right to Withhold Payments.

(a) In addition to disputed amounts and any Retainage and in addition to any other rights under this Contract, at law or in equity, Owner may, upon fifteen (15) days prior written notice to Contractor, withhold payment on an Invoice or a portion thereof, or collect on or proceed against the Credit Support, in an amount and to such extent as may be reasonably necessary to protect Owner from loss due to:

(i) The occurrence of a Contractor Event of Default, which is continuing;

(ii) The existence of a third party claim (or there is reasonable evidence indicating the probable filing of such a claim is imminent);

(iii) provided that Owner has satisfied its then-current payment obligations under Section 5.2, Contractor's failure to make payments to any Subcontractor owed in accordance with the respective Subcontract for Work performed by such Subcontractor (but only with respect to payments not in dispute);

(iv) Owner incurring damages caused by Contractor for which Contractor is liable hereunder;

(v) Defective Work that has not been corrected in accordance with this Contract, provided that Owner has satisfied its then-current payment obligations under Section 5.2 with respect to such Defective Work;

(vi) The assessment of any fine or penalty against Owner as a result of Contractor's failure to comply with Applicable Laws;

(vii) Owner paying Contractor pursuant to a preceding Invoice incorrectly or for which there was insufficient or inaccurate supporting information;

(viii) Any stop payment notices, liens or other encumbrances on all or a portion of the Site, the Work or the Facility, which are filed by any Subcontractor or any other Person acting through or under any of them, provided that Owner has made payment to Contractor for such Subcontractor's work and for all undisputed amounts due to Contractor in accordance with the terms of this Contract; or

(ix) Delay Liquidated Damages or Performance Liquidated Damages being payable pursuant to Article 10, unless and to the extent there exists a dispute regarding whether Delay Liquidated Damages are payable by Contractor pursuant to the last sentence of Section 10.3.

(b) Owner shall pay Contractor the amount withheld or collected on Credit Support if Contractor (i) pays, satisfies or discharges the applicable claim of Owner against Contractor under or by virtue of this Contract and provides Owner with reasonable evidence of such payment, satisfaction or discharge, (ii) cures such applicable breaches in the performance of

this Contract and Contractor Events of Default, or (iii) provides Owner with a bank guarantee or bond reasonably satisfactory to Owner in the amount of the withheld payment.

Section 5.4 Payments Not Waiver.

No payment made, or deemed to be made, by Owner or Contractor under this Contract (including the Final Payment) shall constitute a waiver of any claim or right such Party may have at that time or thereafter, including claims regarding unsettled liens, warranty rights, and indemnification obligations of the other Party. All payments shall be subject to correction or adjustment in subsequent payments. No draw against a letter of credit shall constitute an admission that Contractor owes such amounts to Owner.

Section 5.5 Payment of Subcontractors.

Contractor shall promptly pay each Subcontractor the amount to which the Subcontractor is entitled in accordance with Applicable Laws and the terms and conditions set forth in the respective Subcontract.

Section 5.6 Interest and Disputed Invoices.

Any amounts not paid by either Party to the other when due under any provision of this Contract, including the provisions of this Section 5.6, shall bear interest from and including the date payment was originally due through and including the actual date of payment at the Default Rate. If there is a reasonable dispute about any amount invoiced by Contractor, the amount not in dispute shall be paid pursuant to this ARTICLE 5 and any disputed amount that is ultimately determined to have been payable in accordance with this Contract shall be paid with interest at the Default Rate from and including the date the item was payable through and including the actual date of payment.

Section 5.7 Other Payment Provisions.

(a) If an error is made in connection with a payment, and such payment is an overpayment, the overpayment shall be reconciled with the next Monthly Invoice, or if no further Invoices are planned or the amount of such Invoices are not estimated to be of an amount to properly reconcile the error, then the Party receiving such payment in error shall promptly refund the mistaken amount to the paying Party. Without limiting the preceding sentence, and in addition to any other remedy available to Owner under this Contract, (i) if Owner discovers that invoiced Work was not in fact at the percentage complete for which payment was made pursuant to Section 5.2, or that Work associated with an Invoice contained Defective Work, then Owner may, at its sole discretion and upon prior written notice to Contractor, offset the amount of the payment against future payments or collect on, or proceed against, the Credit Support in the amount of the payment until such Work is completed to the percentage complete for which payment was made or correction of the Defective Work is achieved or (ii) if Owner discovers that any amounts paid by it to Contractor in a preceding Month were incorrect or lacked sufficient or accurate supporting information as required by this Contract, then Owner may, at its sole discretion but only after giving prior written notice to Contractor, offset such amounts against future payments collect on, or proceed against, the Credit Support for such amounts until sufficient and accurate supporting information is provided pursuant to Section 5.2(a).

(b) All amounts contained herein are stated, and shall be paid, in U.S. Dollars.

(c) Notwithstanding anything in this Contract to the contrary, amounts included as allowances for are based upon good faith estimates using information available at the time that the Invoice is submitted. All such estimates will be reconciled in subsequent Invoices, and in no event later than the time of submittal of the Final Invoice as agreed upon by Owner and Contractor. The Parties agree that once the reconciliation has been agreed by the Parties, all such amounts shall be deemed final.

ARTICLE 6
COMMENCEMENT OF WORK

Section 6.1 Notice to Proceed.

(a) Unless otherwise specifically set forth in a Limited Notice to Proceed, Contractor shall not commence performance of the Work, or any portion thereof, until Owner issues a written notice to proceed ("**Notice to Proceed**") to Contractor authorizing the same pursuant to the terms and conditions of this Contract. Owner may issue a Notice to Proceed to Contractor, in the form set forth in Exhibit S, at any time after the Effective Date when and if the conditions described in Section 6.1(b) are satisfied or waived by Owner.

(b) The Contractor shall commence the Work under this Contract upon Owner's issuance of the Notice to Proceed (such date, the "**Notice to Proceed Date**"), which may be issued by Owner upon the satisfaction or waiver of all of the conditions precedent set forth in this Section 6.1(b). The "**Conditions to Notice to Proceed**" are as follows:

(i) Receipt by Owner of the Credit Support required in accordance with Section 2.18;

(ii) Owner shall have provided Contractor and all Subcontractors with access to the Site for the performance of the Work as provided in Section 4.4;

(iii) Receipt by Owner of Owner's Engineer's approval of the Facility's final Engineering and Design Documents;

(iv) All Contractor Permits required to begin the Work shall be in full force and effect, provided that this requirement shall be a Condition to Notice to Proceed only if a Limited Notice to Proceed has been issued by Owner for the engineering and design Work necessary to obtain such permits;

(v) All Owner Permits required to begin the Work shall be in full force and effect;

(vi) All conditions precedent required by any Financing Parties to making loans for financing the costs of the Work shall have been satisfied or waived in writing by such Financing Parties;

(vii) Owner has determined, in its sole discretion, that it is in the best interest of Owner to issue the Notice to Proceed; and

(viii) Owner shall have received the insurance certificates required pursuant to Section 17.1.

Section 6.2 Waiver and Satisfaction of Conditions to Notice to Proceed; Failure to Obtain CPCN.

(a) Any Condition to Notice to Proceed may be waived only upon written agreement by both Parties. Each Party shall use commercially reasonable efforts to satisfy each Condition to Notice to Proceed. Each Party shall keep the other Party apprised as to its progress toward satisfying each Condition to Notice to Proceed and any potential delays.

(b) In the event that Owner has not obtained the CPCN prior to March 31, 2017, then either Party shall have the right to terminate this Contract upon thirty (30) days' prior written notice to the other Party. Subject to any obligations of the Parties under any Limited Notice to Proceed issued pursuant to Section 6.3, the Parties shall have no further obligations or liabilities in connection with a termination of this Contract pursuant to this Section 6.2(b).

Section 6.3 Limited Notice to Proceed. At any time prior to the date of issuance of Notice to Proceed, Owner may issue any other limited notice to proceed (each a "**Limited Notice to Proceed**"), in the form set forth in Exhibit T, which shall authorize Contractor to commence performance of a specified portion of the Work. Each such Limited Notice to Proceed shall specify the portion of the Work to which such Limited Notice to Proceed applies. Contractor shall commence performance of the specific portion of the Work set forth in any Limited Notice to Proceed promptly upon receipt of such Limited Notice to Proceed from Owner. To the extent that Owner issues one or more Limited Notices to Proceed consistent with the Project Schedule, Contractor shall perform the Work in accordance with the Project Schedule.

Section 6.4 Acceleration of Work; Recovery Work.

(a) Even if the Work is otherwise in compliance with the Project Schedule, Owner, at its option and expense, may, in accordance with Section 7.2, request that the Contractor accelerate the performance of the Work and that Contractor prepare a written plan to complete all necessary Work to achieve completion of the Milestones included in the Project Schedule by the accelerated date provided by Owner.

(b) If at any time during the performance of the Work there is a Delay with respect to the Project Schedule such that any Milestone or the Substantial Completion is reasonably expected to be delayed beyond the applicable date for such Milestone as set forth in the Project Schedule or the Guaranteed Substantial Completion Date, Owner may require Contractor to prepare a written recovery plan to complete all necessary Work to achieve completion of the remaining Milestones included in the Project Schedule by the dates set forth for such Milestones in the Project Schedule and to achieve Substantial Completion by the Guaranteed Substantial Completion Date ("**Recovery Plan**"). The Recovery Plan shall represent Contractor's best judgment as to how it shall regain compliance with the Project Schedule and shall be prepared in accordance with Prudent Industry Practices and to a similar level of detail as

the Project Schedule. In preparing and executing the Recovery Plan, Contractor shall, according to its reasonable judgment, take steps necessary to regain compliance with the Project Schedule, including, for example, establishing additional shifts, hiring additional manpower, paying or authorizing overtime, providing additional Equipment, and resequencing activities. Contractor shall be entitled to a Change Order related to the Recovery Plan only to the extent the Delay giving rise to the Recovery Plan would otherwise entitle Contractor to a Change Order pursuant to Section 7.3.

Section 6.5 Alternative Project Site.

Contractor and Owner hereby acknowledge and agree that Owner shall have the right, at its sole discretion, to cause the Project to be constructed at the J.K. Smith Power Station, located at 12145 Irvine Road, Winchester, Kentucky 40391, by providing written notice to Contractor prior to commencement of engineering Work, whether pursuant to a Limited Notice to Proceed or the Notice to Proceed. In the event that Owner provides such notice to Contractor prior to commencement of such engineering Work, then Contractor and Owner shall execute a Change Order pursuant to Article 7 to modify the terms and conditions of this Contract to account for such relocation, as necessary, in a manner mutually agreeable to both Parties. Provided (i) there are no material changes to the scope, as provided in Exhibit A, and the Project Schedule and (ii) the general conditions of the property provided at the J.K. Smith Power Station are consistent with the design considerations at the Site, Contractor hereby waives any right to request or claim an adjustment in the Contract Price in connection with such Change Order.

ARTICLE 7
CHANGES

Section 7.1 Change; Change Orders.

A Change shall only be made as a result of an Owner-Directed Change pursuant to Section 7.2 or a Contractor-Required Change pursuant to Section 7.3(a). No Change shall be made except in accordance with a duly issued Change Order executed in writing by both Parties, on the form attached as Exhibit F, in accordance with this ARTICLE 7. Each Change Order shall contain details of the Change, including any adjustments to the Engineering and Design Materials, the Construction Documents, the Facility design, the Contract Price (including any Progress Payments), the Project Schedule, the Guaranteed Substantial Completion Date or any other obligation or potential liability of Contractor hereunder (collectively or individually, the "**Changed Criteria**"). Except for actions pursuant to Section 2.14(f), if Contractor performs or claims to perform any Change prior to authorization by Change Order, all such costs and expenses incurred by Contractor shall be for Contractor's account, unless such costs and expenses are subsequently approved as a Change pursuant to this ARTICLE 7. No course of conduct or dealings between the Parties, nor express or implied acceptance of additions, deletions, suspensions or modifications to this Contract, including any Work, and no claim that Owner has been unjustly enriched by any such addition, deletion, suspension or modification to this Contract, whether or not there is in fact any such unjust enrichment, shall be the basis for any claim for an adjustment in the Contract Price, the Project Schedule, the Guaranteed Substantial Completion Date, the Schedule of Values, any Work, or any other obligations of Contractor under this Contract.

Section 7.2 Owner-Directed Changes.

(a) Owner, at any time prior to Substantial Completion, may request a Change by written notice to Contractor (any such notice, an "**Owner-Directed Change**"). If Owner submits to Contractor an Owner-Directed Change, Contractor shall respond to Owner within five (5) Business Days with a written statement setting forth the Changed Criteria (subject to Section 7.4 and Section 7.5), if any, that would result from such proposed Change. If it is not possible for Contractor to provide all of the information required under this Section 7.2 to be submitted with such written statement within such five (5) Business Day period, Contractor shall provide Owner with as much information as possible as well as a written explanation of the reason that additional time is required. With respect to any information not provided within such five (5) Business Day period, Contractor shall exercise reasonable diligence to provide such information as soon as possible, but in no event later than thirty (30) days following Contractor's receipt of such Owner-Directed Change.

(b) If the Parties agree on Changed Criteria for the proposed Change (or modify such Change so that the Parties agree on such Changed Criteria), the Parties shall execute a Change Order therefor, and such Change Order shall become binding on the Parties and part of this Contract.

(c) If the Parties cannot agree on such Changed Criteria for the proposed Change Order within ten (10) Business Days of Contractor's receipt of the Owner-Directed Change, or if Owner desires that the proposed Change commence immediately without the requirement of an agreed-upon Change Order executed by both Parties as required under Section 7.1, Owner may, by issuance of a unilateral Change Order, require Contractor to commence and perform the Change specified in the unilateral Change Order on the "cost-plus" basis set forth in Section 7.4; *provided, however*, that no unilateral Change Order issued pursuant to this Section 7.2(c) shall result in any fundamental change to the nature of the Project, Facility or Contractor's obligations under this Contract. If the Parties cannot agree on the effect of such unilateral Change Order by the date of Final Completion, then the dispute shall be resolved as provided in ARTICLE 20. Pending resolution of the dispute, Contractor shall perform the Work as specified in such unilateral Change Order and Owner shall continue to pay Contractor in accordance with the terms of this Contract and any previously agreed Change Orders. Notwithstanding anything herein to the contrary, to the extent there is a dispute between the Parties regarding any Work resulting from a unilateral Change Order issued by Owner, Contractor shall not be obligated to perform such Change-related Work to the extent such Change-related Work would require Contractor to incur unpaid costs in excess of $150,000; *provided* that the foregoing shall not relieve Contractor of its obligations to perform Work not related to the applicable unilateral Change Order pursuant to Section 7.6.

Section 7.3 Contractor Changes.

(a) Contractor shall be entitled to a Change Order resulting from the following circumstances (each "**Contractor-Required Change**") with equitable adjustments to Contract Price, the Project Schedule and/or the Guaranteed Substantial Completion Date as follows:

(i) a Force Majeure event, which shall result in an equitable adjustment to the Project Schedule and/or the Guaranteed Substantial Completion Date and/or Contract Price (which cost and time impacts shall be adequately documented and supported by Contractor);

(ii) a suspension of the Work by Owner under Section 14.1 (subject to Section 13); *provided*, that such suspension is not due to a Contractor Event of Default, which shall result in an equitable adjustment to the Contract Price (but only to the extent cost-impacts are unavoidable despite Contractor's mitigation efforts pursuant to Section 14.1(a)(iii)), Project Schedule and/or the Guaranteed Substantial Completion Date (but only to the extent such suspension results in a Delay to the Project Schedule and/or Guaranteed Substantial Completion Date);

(iii) (A) Changes in Law, (B) an Owner-Caused Delay (including increases to Contractor's costs to perform the Work resulting therefrom, which costs shall be adequately documented and supported by Contractor), (C) suspension of the Work in accordance with Section 14.9(a), (D) Safety Remedial Measures arising from noncompliance with the Construction Safety Plan by the Owner or any third party for which Owner is responsible in accordance with Section 4.7(b), or (E) the discovery of any Concealed Condition or Pre-Existing Hazardous Substances, that in each case (I) increases Contractor's actual cost (which costs shall be adequately documented and supported by Contractor) of performance of any requirement under this Contract, and/or (II) results in a Delay, which shall result in an equitable adjustment to the Contract Price, Project Schedule and the Guaranteed Substantial Completion Date, as applicable; or

(iv) an acceleration of the Work by Owner pursuant to Section 6.4 to the extent such acceleration increases Contractor's actual costs to complete the Work.

Such equitable adjustment shall be limited to the extent of any impact on Contractor's performance of the Work, the Contract Price, the Project Schedule and/or the Guaranteed Substantial Completion Date arising out of the events referenced in Section 7.3(a)(i) - (iv), and shall be made in accordance with and subject to the applicable provisions of Section 7.3, Section 7.4, and Section 7.5. In addition, both Owner and Contractor shall use commercially reasonable efforts to mitigate all delays and cost impacts on the Work, and in no event shall Contractor be entitled to any adjustment to the Contract Price, Project Schedule and/or Guaranteed Substantial Completion Date for that portion of cost or delay directly resulting from Contractor's failure to take reasonable actions to mitigate such cost or delay.

(b) Contractor shall promptly give written notice to Owner of any event or circumstance that Contractor believes is or will give rise to a Contractor-Required Change, which shall include detailed information on the event or circumstance that gives rise to a Contractor-Required Change, the proposed Change, the date Contractor first knew of such circumstance, Contractor's reasons for proposing the Change, and all documentation necessary to verify the effects of the proposed Change on the Changed Criteria; *provided, however*, that Contractor shall deliver such notice no later than thirty (30) days following the date Contractor first knew of such circumstance and to the extent that any of the information required to be included in such notice is not available, Contractor shall provide such written notice with such

detail as is then-available and promptly supplement such notice with all required information thereafter.

(c) In the case of any Contractor-Required Change, Contractor shall promptly prepare and submit to Owner an estimate (on a lump sum, fixed-price basis) of the proposed increase or decrease, if any, in the Contract Price in accordance with Section 7.4 and the Schedule of Values, the lengthening or shortening, if any, of the Project Schedule, or the extension of the Guaranteed Substantial Completion Date required to complete the applicable Change and the remaining portion of the Work in accordance with Section 7.5, together with an explanation of the basis for the estimates taking into consideration available mitigation of such impact, and the related amendments to any provision of this Contract.

(d) If Owner agrees that Contractor is entitled to a Change Order for a Contractor-Required Change and agrees with Contractor's statement regarding the effect of the proposed Change on the Changed Criteria, then Contractor shall prepare a Change Order for the Parties to execute, and upon execution thereof, such Change Order shall become binding on the Parties and part of this Contract.

(e) If Owner disputes Contractor's entitlement to a Change Order for a Contractor-Required Change or the proposed terms thereof, then, subject to Section 7.6, the provisions of ARTICLE 20 may be invoked to resolve the dispute.

(f) If the Parties agree that Contractor is entitled to a Change Order for a Contractor-Required Change but cannot agree on the effect of the proposed Change Order on the Changed Criteria within ten (10) Business Days after Owner's receipt of Contractor's written notice and proposed Change Order and all other required information, or if Owner desires that the proposed changed Work set forth in the proposed Change Order commence immediately, then either Party may invoke the provisions of ARTICLE 20 to resolve the dispute or Owner may proceed with a unilateral Change Order as set forth in Section 7.2(c).

Section 7.4 Adjustments to Contract Price.

The price of any Work required or modified by a Change shall be as agreed between the Parties on a lump-sum fixed price basis and shall be for reasonable, additional costs incurred by Contractor for such Change; *provided*, *however*, that if the Parties are unable to agree on a lump-sum, fixed price for such Change within ten (10) days, then upon Owner's direction Contractor shall perform such Change on a "cost-plus basis". For purposes of this Section 7.4, "cost-plus basis" shall mean and be limited to the following: (A) costs of direct labor directly for performing the Change, including social security, and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance; (B) costs of Subcontractors, materials, supplies and Equipment, including cost of transportation and storage, whether incorporated or consumed, in all cases directly involved with the Change; (C) rental costs of machinery and Equipment, exclusive of hand tools, whether rented from the Contractor or others and directly involved with the Change; (D) costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; (E) additional costs of supervision and field office personnel directly attributable to the Change; plus (F) a reasonable amount for overhead, general administration and expense, and profit consistent with Contractor's

ordinary practice and procedures regarding allocation of such costs but in no case exceeding ten percent (10%). Contractor shall, in connection with such "cost-plus" performance of Work, provide to Owner (1) the relevant cost information regarding the portion of the Contract Price that is affected by the Change; (2) Subcontractor pricing for the cost of Equipment modified by the Change; (3) estimated quantities of Equipment, materials, and labor modified by the Change; and (4) other relevant information concerning other factors affecting costs and price.

Section 7.5 Adjustments to Schedule.

Adjustments to the Project Schedule and/or Guaranteed Substantial Completion Date as a result of a Change shall be equal to the Delay, subject to adjustments to the Work to mitigate the Delay.

Section 7.6 Continuation of Work Pending Resolution of Dispute.

In the event of a dispute in connection with a Change, during all periods prior to the resolution of the dispute Contractor shall perform the Work (including, subject to Section 7.3(c), such Work subject to the Change) and may invoice Owner (with each Invoice) and Owner shall pay the cost of performing the Change on a cost-plus basis in accordance with Section 7.4.

Section 7.7 Other Provisions Unaffected.

Except to the extent the Parties specifically modify any of the provisions of this Contract as part of an executed Change Order, all provisions of this Contract shall apply to all Changes.

Section 7.8 Minor Changes; Changes to Project Schedule.

Contractor may make minor changes in the Work that are in compliance with its obligations under Section 2.10 and do not involve an adjustment in the Contract Price and/or Guaranteed Substantial Completion Date. Contractor may make sequencing changes to the Project Schedule; *provided*, that Contractor shall (a) not have the right to make unilateral changes to the Guaranteed Substantial Completion Date and (b) promptly notify Owner of any changes to the Project Schedule.

Section 7.9 Accord and Satisfaction.

Except as otherwise identified in any Change Order, agreement on any Change Order shall constitute a final settlement and an accord and satisfaction of all increases or decreases to the Contract Price and all extensions to the Project Schedule and/or Guaranteed Substantial Completion Date relating to or arising out of the Change that is the subject of the Change Order, including but not limited to all claims for direct and indirect costs, impacts, overtime, accelerations, inefficiencies, congestion, trade stacking, delays, interference, lost productivity, additional work, and the effect or accumulation of the Changed work on any other work or activities. Accordingly, Contractor expressly waives and releases any and all right to make a claim or demand or to take any action or proceeding against Owner for any other consequences arising out of, relating to, or resulting from such Change reflected in such Change Order, whether the consequences result directly or indirectly from such Change, including any claim or demand for damages due to delay, disruption, hindrance, impact, interference, inefficiencies or

extra work arising out of, resulting from, or related to, such Change (including any claims or demands that any Change Order or number of Change Orders, individually or in the aggregate, have impacted the unchanged Work).

ARTICLE 8
COMMISSIONING AND PERFORMANCE TEST

Section 8.1 Notice of Commissioning and Performance Test.

(a) At least ten (10) Business Days prior to commencing any Commissioning activities (including any Commissioning Test) or performing the Performance Test, as applicable, Contractor shall deliver to Owner, and Owner's Engineer, a written notice specifying a date for commencement of the initial Commissioning Test or initial Performance Test. In the event any re-test of the Commissioning Test and/or Performance Test is required, the Parties shall coordinate in respect of the timing of the performance of such re-test; *provided*, that Contractor shall in all cases satisfy its obligations under Section 8.1(b).

(b) Contractor shall perform all Commissioning activities (including any Commissioning Test) and the Performance Test in the presence of Owner or Owner's Engineer, so long as they attend on the specified date, until the Facility has achieved Substantial Completion.

Section 8.2 Commissioning Procedures.

Contractor shall develop its commissioning test procedures, which shall detail all inspections, safety and quality checks, steps, components, start-ups and tests necessary for commissioning the Facility and any components thereof in a manner consistent with the commissioning test requirements set forth in Exhibit N (the "**Commissioning Requirements**"). Contractor shall provide its proposed commissioning test procedures to Owner at least thirty (30) days prior to the date on which Contractor intends to perform a complete commissioning test of the Facility (collectively, the "**Commissioning Test**"), which shall be subject to Owner's acceptance, not to be unreasonably withheld. After the proposed commissioning test procedures have been accepted by Owner (as approved by Owner and Owner's Engineer, the "**Commissioning Procedures**") they shall not be revised by Contractor without Owner's prior written consent; *provided, however*, that such consent shall not be unreasonably withheld. Contractor will perform all items required by the Commissioning Procedures, including the Commissioning Test, in accordance with the EPC Requirements, Prudent Industry Practice and all Equipment specifications including the Manufacturer's Warranties. Contractor shall maintain complete and reasonably detailed records of all Commissioning activities (including all Commissioning Tests), and deliver a Commissioning report (in a format reasonably acceptable to Owner) to Owner within fifteen (15) days following Commissioning completion.

Section 8.3 Performance Test Procedures.

(b) Contractor shall develop its performance test procedures, which shall detail all steps, components and tests necessary for performance testing of the Facility in a manner consistent with the performance test requirements set forth in Exhibit O (the "**Performance Test Requirements**"). Contractor shall provide its proposed performance test procedures to Owner at

least thirty (30) days prior to the date on which Contractor intends to perform a complete performance test of the Facility (collectively, the "**Performance Test**"), which shall be subject to Owner's acceptance, not to be unreasonably withheld. After the proposed performance test procedures have been accepted by Owner (as approved by Owner and Owner's Engineer, the "**Performance Test Procedures**") they shall not be revised by Contractor without Owner's prior written consent; *provided, however,* that such consent shall not be unreasonably withheld. The Performance Test shall be performed by Contractor in order to demonstrate if the Facility meets or exceeds the Guaranteed Facility Percentage, and shall include, or reference the methodologies for, calculating the Performance Test results in accordance with the Performance Test Procedures, including the tolerances and correction curves to be applied to the Performance Test results. Contractor shall maintain complete and reasonably detailed records of the Performance Test, and deliver copies of such records to Owner upon the successful completion of the Performance Test. Contractor shall provide a Performance Test report to Owner within fifteen (15) days following such successful completion.

(c) Contractor shall perform the Performance Test in accordance with the Performance Test Procedures and the EPC Requirements. During the Performance Test, Contractor shall provide all consumables, skilled labor, licensed operators and such other materials or services necessary for the completion of the Performance Test. If the Performance Test reveals that the Facility does not meet or exceed the Guaranteed Facility Percentage, Contractor shall be required to remedy such performance shortfall at its own cost and to repeat the Performance Test in accordance with Section 10.2. At such time as the Performance Tests demonstrate that the Facility meets or exceeds the Guaranteed Facility Percentage, Contractor shall certify same to Owner in a written notice signed by Contractor, that includes all Performance Test results as required under this Section 8.3.

Section 8.4 Output During Testing.

At all times when Contractor conducts start-up, testing, or other operations of the Facility, Contractor shall dispose of all waste produced by the Facility as the result of such testing, and Owner may arrange for the disposition of any usable output of the Facility in such manner as Owner shall determine. Any output of the Facility at any time, and the proceeds from the sale thereof, shall be the property of Owner.

ARTICLE 9
COMPLETION AND ACCEPTANCE OF THE WORK

Section 9.1 Mechanical Completion.

Contractor shall have achieved "**Mechanical Completion**" when each of the following conditions, which shall be performed or satisfied in sequential order, has been met in respect of the Facility:

(a) Contractor has properly completed all Work necessary for starting the Facility, including completion of (i) the design, engineering, procurement and construction of the Facility and (ii) the construction and installation of all Equipment that comprise the Facility, in each case in accordance with the EPC Requirements and the Equipment specifications, except

for non-essential items of Work that would not prevent the Facility from being legally, safely and reliably placed into commercial operation, which shall be set forth on the Punch-List;

(b) Contractor has completed and properly installed all inverters and ancillary equipment (including all switchgear and transformers) in accordance with the EPC Requirements;

(c) Contractor has completed and properly installed the racking system and all panels (including wiring and grounding) for the Facility in accordance with the Scope of Work, including without limitation, the Owner-Supplied Equipment in accordance with the EPC Requirements;

(d) Contractor has completed and properly installed all AC and DC wiring, all equipment, wiring, controls, and safety systems have been connected and all instruments and relays have been installed and are functional as to the extent permissible prior to interconnection and in accordance with the Scope of Work;

(e) All required protective and control features are installed in accordance with the Scope of Work;

(f) Contractor has completed all Equipment testing in accordance with the EPC Requirements and the results of such testing have been accepted by Owner in writing (such acceptance not to be unreasonably withheld);

(g) Contractor has completed the SCADA or DAS system, including weather stations, in accordance with the EPC Requirements;

(h) The Facility is capable and fit for commencing start-up and implementation of the Commissioning Procedures (including the Commissioning Test) and the Performance Test Procedures (including the Performance Test) without damage to the Facility or any property or injury to any Person;

(i) All Contractor Permits required to be obtained by Contractor in connection with the Work or with respect to the Facility by the date of Mechanical Completion under this Contract have been obtained and are in full force and effect; and

(j) Contractor has performed all other obligations required to be performed by it prior to or at Mechanical Completion in accordance with the EPC Requirements.

Section 9.2 Notice and Report of Mechanical Completion.

(a) When Contractor believes that it has achieved the requirements set forth in Section 9.1, Contractor shall deliver a written notice of such determination ("**Notice of Mechanical Completion**") to Owner. The Notice of Mechanical Completion shall contain a report with sufficient detail to enable Owner to determine whether the Facility has achieved Mechanical Completion, and Contractor shall provide all other supporting documentation reasonably requested by Owner to determine whether the Facility has achieved Mechanical Completion. In addition, upon request by Owner, Contractor shall provide reasonable access to

the Site, the Facility, and all other Work so that Owner or Owner's Engineer (and, if requested, the Financing Parties), at Owner's or, as applicable, the Financing Parties' sole cost, may conduct such investigations and inspections as are reasonably needed.

(b) Within ten (10) Business Days of receipt of the Notice of Mechanical Completion, Owner shall either (i) notify Contractor that Mechanical Completion has been achieved, or (ii) notify Contractor that Mechanical Completion was not achieved, stating the reasons therefor in reasonable detail and with supporting documentation. If Owner certifies that Mechanical Completion has been achieved, the date of such certificate shall be deemed the date that Mechanical Completion was actually achieved for the Facility pursuant to the Notice of Mechanical Completion. If Owner notifies Contractor that Mechanical Completion has not been achieved, Contractor will promptly undertake such action or work as necessary to achieve Mechanical Completion in accordance with Section 9.1 and shall then issue another Notice of Mechanical Completion to Owner pursuant to clause (a) stating that Contractor believes that such requirements have been achieved. Such procedure shall be repeated until Mechanical Completion is achieved in accordance with Section 9.1. If Owner fails to notify Contractor that either (A) Mechanical Completion has been achieved or (B) Mechanical Completion has not been achieved, in each case within ten (10) Business Days of Owner's receipt of the Notice of Mechanical Completion, then Owner shall be deemed to have certified that Mechanical Completion has been achieved. Neither Owner's certification of Contractor achieving Mechanical Completion nor Owner's written listing of its exceptions to the achievement of Mechanical Completion shall constitute a waiver of any requirements, obligations, warranties, or guarantees of the Contract, or constitute acceptance of any Defects or deficiencies in the Work.

Section 9.3 Substantial Completion.

Contractor shall have achieved "**Substantial Completion**" when each of the following conditions, which shall be performed or satisfied in sequential order, has been met in respect of the Facility:

(a) Mechanical Completion shall have occurred;

(b) Contractor shall have successfully completed Commissioning (including successful completion of the Commissioning Test pursuant to Section 8.2);

(c) Contractor shall have successfully completed Performance Testing (including successful completion of the Performance Test pursuant to Section 8.3);

(d) Except for the Punch-List, the Work required to be furnished by Contractor has been properly provided, assembled, installed, constructed, correctly adjusted, tested, and otherwise incorporated into the Facility (including all Work to be performed after Commissioning and Performance Testing), consistent with the EPC Requirements;

(e) The Facility is ready for routine starting and continuous operation and capable of being operated in accordance with the EPC Requirements;

(f) Contractor has satisfied all EPC Requirements to allow all Applicable Permits necessary for operation to be issued to and received by Owner;

(g) The final Punch-List for the Work has been prepared by Contractor and delivered to Owner and Owner's Engineer (and is acceptable to both Owner and Owner's Engineer) and Contractor has certified that it has no knowledge of any incomplete Work or deficiencies or Defects in the Facility, except as set forth in the Punch-List;

(h) Contractor has delivered to Owner stamped as-built Drawings of the Facility in accordance with the EPC Requirements;

(i) delivery to Owner of stamped as-built civil and electrical drawings of the Facility, including confirmation of the Final Design Size, that shall be sufficient in detail for Owner to file an incentive-related application with the United States Department of Treasury;

(j) All Contractor Permits required to be obtained by Contractor in connection with the Work or with respect to the Facility by the date of Substantial Completion under this Contract have been obtained and are in full force and effect;

(k) All deliverables, including all final Project Documents and assignments of warranties pursuant to Section 11.5(a), that are to be delivered to Owner by Contractor on or before Substantial Completion pursuant to this Contract have been completed and delivered to Owner in the form and substance required by this Contract and Contractor has delivered to Owner effective waivers and releases of Contractor's and Subcontractor's liens through such date (which waivers and releases may be conditioned upon payments due by Owner hereunder);

(l) Owner has received current executed waivers and releases from the Contractor as required under this Contract, on the forms required pursuant to ARTICLE 5, as applicable;

(m) Any undisputed Delay Liquidated Damages, together with interest thereon, if applicable, due to Owner have been paid in full;

(n) Contractor shall have installed, tested and calibrated any metering devices in accordance with the Scope of Work, and such metering devices shall be in good operating order for their intended purpose;

(o) Contractor has completed training Owner's personnel in accordance with Section 2.6(c); and

(p) Contractor has performed all other obligations required under this Contract to be performed by it prior to or at Substantial Completion in accordance with the EPC Requirements.

Section 9.4 Notice and Report of Substantial Completion.

(a) When Contractor believes that it has achieved the requirements set forth in Section 9.3, Contractor shall deliver a written notice of such determination ("**Notice of Substantial Completion**") to Owner. The Notice of Substantial Completion shall contain a report with sufficient detail to enable Owner to determine whether the Facility has achieved Substantial Completion, and Contractor shall provide all other supporting documentation

reasonably requested by Owner to determine whether the Facility has achieved Substantial Completion. In addition, upon request by Owner, Contractor shall provide reasonable access to the Site, the Facility, and all other Work so that Owner or Owner's Engineer (and, if requested, the Financing Parties), at Owner's or, as applicable, the Financing Parties' sole cost, may conduct such investigations and inspections as are reasonably needed.

(b) Within ten (10) Business Days of receipt of the Notice of Substantial Completion, Owner shall either (i) notify Contractor that Substantial Completion has been achieved, or (ii) notify Contractor that Substantial Completion was not achieved, stating the reasons therefore in reasonable detail and with supporting documentation. If Owner certifies that Substantial Completion has been met, the date of such certificate shall be deemed the date that Substantial Completion was actually achieved for the Facility pursuant to the Notice of Substantial Completion. If Owner notifies Contractor that Substantial Completion has not been met, Contractor will promptly undertake such action or work as necessary to achieve Substantial Completion in accordance with Section 9.4 and shall then issue another Notice of Substantial Completion to Owner pursuant to clause (a) stating that Contractor believes that such requirements have been achieved. Such procedure shall be repeated until Substantial Completion is achieved in accordance with Section 9.4(a). If Owner fails to notify Contractor that either (A) Substantial Completion has been achieved or (B) Substantial Completion has not been achieved, in each case within ten (10) Business Days of Owner's receipt of the Notice of Substantial Completion, then Owner shall be deemed to have certified that Substantial Completion has been achieved. Neither Owner's certification of Contractor achieving Substantial Completion nor Owner's written listing of its exceptions to the achievement of Substantial Completion shall constitute a waiver of any requirements, obligations, warranties, or guarantees of the Contract, or constitute acceptance of any Defects or deficiencies in the Work.

Section 9.5 Transfer of Possession and Control of the Facility to Owner.

Upon Substantial Completion, title to the portions of the Facility not owned by Owner shall be conveyed by Contractor to Owner free and clear of any and all liens or encumbrances (other than liens or encumbrances in connection with Owner's failure to pay undisputed amounts previously due and payable hereunder), and Owner shall assume care, custody and control of the Facility and risk of loss of the same.

Section 9.6 Punch-List.

(a) Not less than fifteen (15) days prior to Contractor's submission to Owner of a Notice of Substantial Completion, Owner and Contractor shall inspect the Facility and Contractor shall prepare a list of Work to be completed ("**Punch-List**"). Contractor shall provide the Punch-List to Owner together with an estimate of the time and cost to complete or correct each item on the proposed Punch-List for review. Owner shall review and comment on the draft Punch-List not later than five (5) Business Days after receipt from Contractor; *provided, however*, that if Owner does not provide Contractor with such comments within such five (5) Business Day period, the Punch-List provided by Contractor will be deemed final. Not later than five (5) Business Days after Contractor's receipt of such comments, if any, Contractor shall issue a revised Punch-List to Owner that reasonably takes into account or responds to Owner's comments to the draft Punch-List, and such Punch-List shall be deemed final; *provided,*

however, that Owner may dispute such final Punch-List in accordance with ARTICLE 20. Contractor shall be solely responsible for completing the items on the Punch-List prior to Final Completion.

(b) Promptly after the Punch-List for the Facility becomes final in accordance with Section 9.6(a), Contractor and Owner shall agree upon a schedule for Contractor's completion of such Punch-List, which schedule shall provide that Contractor shall complete the Punch-List within thirty (30) days following Substantial Completion or such longer period as is reasonably necessary for the completion of any item of Work on the Punch-List as mutually agreed upon by the Parties. Owner shall provide Contractor and Subcontractors, as applicable, reasonable access to the Facility to perform such Work in accordance with the agreed schedule to the extent that such access does not unreasonably interfere with the operations of the Facility, and Contractor shall be granted a day-for-day extension of the period for completing the Punch-List as described in this Section 9.6(b) for any delays caused by Owner's failure to provide access to the Facility necessary to complete the Punch-List. Upon completion of the Punch-List for the Facility to the reasonable satisfaction of Owner, and compliance by Contractor with the requirements for Final Completion pursuant to Section 9.7, Owner shall release to Contractor the amounts withheld pursuant to Section 5.3(a).

Section 9.7 Final Completion.

Contractor shall have achieved "**Final Completion**" when each of the following conditions, which shall be performed or satisfied in sequential order, has been met in respect of the Facility:

(a) Substantial Completion has occurred;

(b) all of the Work shall be complete, including all items on the Punch-List;

(c) Contractor shall have delivered to the Owner all final releases and waivers to be provided by Contractor and all Subcontractors performing the Work as required pursuant to Section 5.2(c)(iii);

(d) Contractor shall have delivered to the Owner stamped final as-built Drawings of the Facility;

(e) all of the documentation and records listed on Exhibit R shall have been delivered to Owner;

(f) the Facility has been constructed in accordance with the EPC Requirements;

(g) all Contractor Permits required to be obtained by Contractor in connection with the Work or with respect to the Facility by the date of Final Completion under this Contract have been obtained and are in full force and effect;

(h) all Contractor Equipment and all of Contractor's supplies, personnel, debris, rubbish, and foreign material have been removed from the Site and other areas disturbed by the Work;

(i) Contractor has paid to Owner all undisputed damages (including Delay Liquidated Damages) due pursuant to this Contract and other payments due and payable hereunder, including, without limitation, any Delay Liquidated Damages, together with interest thereon if applicable;

(j) Contractor shall have delivered all reports, contracts, certificates and other items required to be delivered to Owner prior to or on the date of Final Completion under this Section 9.7;

(k) Contractor has issued and delivered a Notice of Final Completion to Owner; and

(l) All of Contractor's other obligations under this Contract required to be performed on or prior to Final Completion, except for any such obligations that survive the termination of this Contract or that are, by their express terms, not to be performed until after Final Completion, have been completely and satisfactorily performed in accordance with the EPC Requirements.

Section 9.8 Notice and Report of Final Completion.

(a) When Contractor believes that it has achieved Final Completion, Contractor shall deliver a written notice of such determination ("**Notice of Final Completion**") to Owner. The Notice of Final Completion shall contain a report with sufficient detail to enable Owner to determine the achievement by Contractor of Final Completion, including the Punch-List items, and such other information as Owner may reasonably require to determine whether Final Completion has been achieved.

(b) Within ten (10) Business Days of receipt of the Notice of Final Completion, Owner shall either (i) deliver to Contractor a written certification stating that it has achieved Final Completion, or (ii) notify Contractor in writing that Final Completion has not been achieved, stating the reasons therefor in reasonable detail and with supporting documentation. If Owner certifies that Final Completion has been met, the date of such certificate shall be deemed the date that Final Completion was actually achieved for the Facility pursuant to the Notice of Final Completion. If Owner notifies Contractor that Final Completion has not been met, Contractor will promptly undertake such action or work as necessary to achieve Final Completion and shall then issue another Notice of Final Completion to Owner stating that Contractor believes that Final Completion has been achieved. Such procedure shall be repeated until Final Completion is achieved, provided that the third rejection by Owner of a Notice of Final Completion and all such rejections thereafter shall be automatically and immediately subjected to the dispute resolution provisions of ARTICLE 20. If Owner fails to notify Contractor that either (A) Final Completion has been met or (B) Final Completion has not been achieved, in each case within ten (10) Business Days of Owner's receipt of the Notice of Final Completion, then Contractor shall be entitled to a day-for-day extension of the Project

Schedule, including the Final Completion Date. Neither Owner's certification of Contractor achieving Final Completion nor Owner's written listing of its exceptions to the achievement of Final Completion shall constitute a waiver of any requirements, obligations, warranties, or guarantees of the Contract, or constitute acceptance of any Defects or deficiencies in the Work.

Section 9.9 Final Completion Date.

Final Completion shall occur no later than thirty (30) days after Substantial Completion, subject to extension as expressly permitted by a Change Order pursuant to Section 7.3 or as otherwise agreed to by the Parties pursuant to Section 9.6(b).

ARTICLE 10
DELAY LIQUIDATED DAMAGES

Section 10.1 Delay Liquidated Damages.

If Substantial Completion for the Facility does not occur on or before the Guaranteed Substantial Completion Date (after any adjustment is made to such date as permitted under Section 2.8(a) that affects the Project Schedule), Contractor shall pay Owner as liquidated damages, and not as a penalty, the amount set forth in Exhibit P for each day following the Guaranteed Substantial Completion Date that Substantial Completion is not achieved ("**Delay Liquidated Damages**"). The payment or non-payment of Delay Liquidated Damages shall not affect the Guaranteed Substantial Completion Date. Subject to Section 5.3, Owner shall be entitled to withhold from any payment otherwise due to Contractor the amount of Delay Liquidated Damages that have accrued at the time such payment would otherwise be due and payable. In the event that Owner has not withheld sufficient funds from Contractor to satisfy the total amount of Delay Liquidated Damages that Contractor owes to Owner, the undisputed remaining amount(s) due shall be paid by Contractor within thirty (30) days after Owner delivers to Contractor an invoice for such Delay Liquidated Damages. The aggregate amount of Delay Liquidated Damages payable pursuant to this Contract shall not exceed Seven Hundred Fifty Thousand Dollars ($750,000) (the "**Delay LD Cap**").

Section 10.2 Performance Liquidated Damages

If the Performance Criteria determined in accordance with the Performance Tests is less than the Guaranteed Facility Percentage on or before the Guaranteed Substantial Completion Date, then Contractor shall take commercially reasonable steps to attempt to remedy any performance shortfalls, including the installation of additional Equipment at the Site in a manner consistent with the EPC Requirements, and to repeat the Performance Tests as necessary before the Delay LD Cap has been reached, so long as Contractor pays to Owner the applicable Delay Liquidated Damages during such period (such period, the "**Cure Period**"). If Contractor fails to remedy the performance shortfalls within the Cure Period and the Performance Criteria determined in accordance with the Performance Tests is less than the Guaranteed Facility Percentage but meets or exceeds the Minimum Facility Percentage, as demonstrated during the Performance Tests performed by Contractor in accordance with this Contract, then, subject to Section 5.3, Contractor shall pay Owner the amount determined in accordance with Exhibit P (the "**Performance Liquidated Damages**"). Contractor shall provide Owner with the

Performance Liquidated Damages calculation and shall include all supporting documentation for the calculations. Owner shall have five (5) Business Days to review the Performance Test report and Performance Liquidated Damages calculation. The amount due therein, if any, shall be payable by Contractor as a condition to achieving Substantial Completion. The aggregate amount of Performance Liquidated Damages payable pursuant to this Contract shall not exceed ten percent (10%) of the Contract Price (the "**Performance LD Cap**"). Performance Liquidated Damages paid by Contractor shall be deemed to adjust the Guaranteed Facility Percentage to the extent actually paid by Contractor pursuant to this Section 10.2.

Section 10.3 Liquidated Damages Not Penalty.

The Parties acknowledge and agree that because of the unique nature of the Facility, it is difficult or impossible to determine with precision the amount of damages that would or might be incurred by Owner as a result of Contractor's failure to achieve Substantial Completion by the Guaranteed Substantial Completion Date. Except as provided in Section 10.2 and Sections 14.8(a) and (b), the Parties agree that the Delay Liquidated Damages and Performance Liquidated Damages provided herein are reasonable compensation to Owner for any such event. The Parties agree that the (a) Delay Liquidated Damages shall be the sole and exclusive liability of Contractor, and the sole and exclusive remedy of Owner for Contractor's delay, including but not limited to its failure to achieve Substantial Completion by the Guaranteed Substantial Completion Date and (b) Performance Liquidated Damages shall be the sole and exclusive liability of Contractor, and the sole and exclusive remedy of Owner for Contractor's failure to achieve the Guaranteed Facility Percentage. It is understood and agreed by the Parties that: (i) Owner shall be damaged by failure of Contractor to meet such obligation; (ii) it would be impracticable or extremely difficult to fix the actual damages resulting therefrom; (iii) any sums which would be payable under this Contract that are in the nature of liquidated damages are not a penalty, and are fair and reasonable; (iv) such payments represent a reasonable estimate of fair compensation for the losses that may reasonably be anticipated from such failure; (v) any liquidated damages resulting from Contractor's failure to achieve Substantial Completion by the Guaranteed Substantial Completion Date or failure to achieve the Guaranteed Facility Percentage shall not be deemed an adjustment to the Contract Price or otherwise diminish the value of the Facility; (vi) all Delay Liquidated Damages have been calculated by reference to losses and costs that Owner might reasonably be anticipated to suffer in the event that Contractor fails to achieve Substantial Completion by the Guaranteed Substantial Completion Date; and (vii) the Parties are estopped from contesting the validity or enforceability of the Delay Liquidated Damages or Performance Liquidated Damages on the basis that the Delay Liquidated Damages or Performance Liquidated Damages constitute a penalty or are otherwise unenforceable or invalid. Contractor has reviewed the Delay Liquidated Damages and Performance Liquidated Damages amounts as stated herein, and has had a full and fair opportunity to inquire into and be informed as to the method of the calculation of the stated amounts of Delay Liquidated Damages and Performance Liquidated Damages. Contractor hereby waives all right and ability to challenge or dispute the amounts of such Delay Liquidated Damages or Performance Liquidated Damages, which Contractor agrees are fully enforceable. This Section 10.3 shall not preclude Contractor from contesting whether it is responsible for Delays giving rise to Owner's claims for Delay Liquidated Damages.

ARTICLE 11
WARRANTIES ON WORK AND EQUIPMENT

Section 11.1 Warranties.

(a) The warranties set forth in this ARTICLE 11 are, collectively, the "**Warranty**", or "**Warranties**". Any Work, or component thereof, that does not conform with any Warranty is defective ("**Defective**") and contains a defect ("**Defect**").

(b) Contractor hereby warrants (the "**Facility Warranty**") that the Work, including the Equipment and each component thereof, shall be:

(i) of the kind and quality required pursuant to, and otherwise in accordance with, this Contract;

(ii) free from Defects, including deficiencies in design, engineering, materials (and the selection thereof) and workmanship with respect to the EPC Requirements;

(iii) provided Owner has satisfied its then-current payment obligations under Section 5.2, shall be free from encumbrances to title, whether by liens, security interests or otherwise;

(iv) installed and tested, in accordance with Contractor's obligations under this Contract and in accordance with the applicable Equipment specifications, including all Manufacturer's Warranties;

(v) new, complete, and in accordance with this Contract; and

(vi) with respect to Equipment or any sub-component of Equipment, unless otherwise specifically agreed in writing by Change Order, composed and made of only proven technology, of a type in commercial operation at the Effective Date of this Contract, with conditions substantially similar to those contained herein; *provided* that Owner's approval for Contractor to use any Equipment not in compliance with this subsection shall not relieve Contractor of any of its obligations under this Contract except with respect to Contractor's obligation to obtain such approval from Owner.

(c) Contractor hereby warrants that the Facility shall be capable of meeting the Guaranteed Facility Percentage (as may be adjusted pursuant to Contractor's payment of Performance Liquidated Damages pursuant to Section 10.2) during the Defect Correction Period.

(d) In addition to the Facility Warranty set forth in Section 11.1(b), Contractor shall, without additional cost to Owner, take commercially reasonable efforts to obtain and provide Owner with the warranties from each Subcontractor that meet or exceed the requirements set forth on Exhibit Z; *provided*, *however*, that Contractor shall not in any way be relieved of its responsibilities and liabilities to Owner under this Contract, regardless of whether such warranties meet the requirements of this Contract. Contractor shall remain fully responsible and liable to Owner for the Facility Warranty and Corrective Work obligations and liabilities

under this Contract for all Work. Contractor shall provide Owner with warranties from the manufacturers of the inverters, photovoltaic panels, and racking systems (collectively the "**Manufacturer's Warranties**") meeting, at a minimum, the standards set forth on Exhibit Z, and Contractor shall provide copies of such Manufacturer's Warranties to Owner prior to the issuance of Notice to Proceed. Contractor shall review all Manufacturer's Warranties and shall perform its responsibilities (including the performance of the Work) so that such Manufacturer's Warranties remain in full force and effect and are enforceable by Contractor, and after assignment by Contractor to Owner at Substantial Completion, by Owner, in accordance with their respective terms. Contractor shall ensure that all Manufacturer's Warranties run to the benefit of Owner and Contractor. All Manufacturer's Warranties shall be in such form as to permit direct enforcement by Contractor or Owner against any such party whose warranty is called for. Owner and Contractor agree that: (i) Contractor's Warranty, as provided under this Section 11.1 shall apply to all Work regardless of the provisions of any Manufacturer's Warranties and any other warranties from Subcontractors, and the Manufacturer's Warranties and any other warranties from Subcontractors shall be in addition to, and not a limitation of, the Facility Warranty; *provided, however*, that Owner shall not have any right to collect under the Facility Warranty and any Manufacturers' Warranties for the same issues and in any such case, subject to this Section 11.1 and Section 11.5(a), coverage by such Manufacturers' Warranties shall be considered primary to that of the Facility Warranty; (ii) Contractor is jointly and severally liable with such Subcontractor with respect to such Manufacturer's Warranties and any other warranties from Subcontractors; and (iii) service of notice on Contractor that there has been a breach of a Manufacturer's Warranties or any other warranties from Subcontractors shall be sufficient to invoke the terms of the instrument.

(e) NOTWITHSTANDING ANYTHING HEREIN TO THE CONTRARY, THE WARRANTY PROVIDED IN SECTION 11.1 IS THE EXCLUSIVE WARRANTY PROVIDED BY CONTRACTOR. ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE, ARE DISCLAIMED TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW.

Section 11.2 Inspection; Repair of Defects.

(a) Prior to Substantial Completion, all Work shall be subject to reasonable inspection by Owner, the Financing Parties and either of their representatives at all times to determine whether the Work conforms to the requirements of this Contract, and Owner shall have the right to be present at all tests and inspections, wherever located and at any stage of completion, including at the fabrication sites of Contractor or any Subcontractor upon reasonable advance notice by Owner and/or the Financing Parties, as applicable with respect to locations other than the Site. Contractor shall furnish Owner, the Financing Parties and either of their representatives with access to all locations where Work is in progress, including locations not on the Site. If, in the reasonable judgment of Owner, any Work is Defective, Owner shall provide written notice to Contractor identifying and describing with reasonable specificity that portion of Work that Owner believes is Defective with supporting documentation. Upon receipt of such written notice, Contractor shall, at its own expense, promptly correct such Defective Work, whether by repair, replacement or otherwise. Subject to Contractor's right to pursue a Dispute under ARTICLE 20, the decision of Owner shall be conclusive as to whether the Work is

conforming or Defective; *provided, however*, that Contractor shall have the right, in its reasonable judgment and sole discretion, to determine the appropriate course of action to correct such Defective Work; *provided, further* that Contractor shall act in good faith to consider the comments of Owner in all such matters. If it is later determined that the Work was not Defective, then Owner shall reimburse Contractor for all costs directly incurred in connection with such corrective action (whether repair, replacement or otherwise), and a Change Order shall be issued for such amount and shall address any impact the corrective action may have had on the Project Schedule. If Contractor fails, after a reasonable period of time not to exceed one (1) week, to take corrective action regarding any Defective Work, or to commence to take such corrective action regarding any Defective Work and thereafter continue to proceed diligently to complete the same, then Owner, after providing three (3) days' notice to Contractor may take corrective action for such Defective Work and the expense thereof shall be paid by Contractor; provided, however, if the Defective Work materially affects the operation or use of the Facility after it has achieved Mechanical Completion, or presents an imminent threat to the safety or health of any Person, then Contractor shall commence to take corrective action in accordance with this Section 11.2 regarding the Defective Work within twenty-four (24) hours after receipt of notice of such Defective Work, and thereafter continue to proceed diligently to complete the same, or Owner may take such corrective action and the expense thereof shall be paid by Contractor. Owner's or the Financing Parties' right to conduct inspections under this Section 11.2 shall not obligate Owner or the Financing Parties to do so.

(i) Neither the exercise of Owner or the Financing Parties of any such right, nor any failure on the part of Owner or the Financing Parties to discover or reject Defective Work shall be construed to imply an acceptance of such Defective Work or a waiver of such Defect.

(ii) The cost of uncovering, disassembling, dismantling or making safe finished Work for the purpose of inspection, and reassembling such portions (and any Delay associated therewith) shall be borne by Owner if such Work is found to conform with the requirements of this Contract and by Contractor if such Work is found to be Defective.

(b) For the period commencing on Substantial Completion and ending twenty-four (24) months after Final Completion (as may be extended hereunder, the "**Defect Correction Period**"), if any Work, including Equipment and each component thereof, is found to be Defective, Contractor shall, at its sole cost and expense, promptly and on an expedited basis correct such Defective Work, whether by repair, replacement or as otherwise agreed by the Parties, which shall be inclusive of any and all obligations in connection with such repair, replacement or other action, such as the cost of uncovering, disassembling, dismantling or making safe finished Work, and reassembling such Work, storage, labor, Taxes, transportation and expediting costs and any other costs necessary to fully correct the Work (collectively, the "**Corrective Work**"). Owner shall provide Contractor with access to the Facility, and will de-energize the applicable Equipment, sufficient for Contractor to perform its Corrective Work, so long as such activities do not unreasonably interfere with the construction or operation of the Facility and subject to any reasonable security or safety requirements of Owner. In the event Contractor utilizes spare parts owned by Owner in the course of performing the Corrective Work, Contractor shall supply Owner free of charge with new spare parts equivalent in quality

and quantity to all such spare parts used by Contractor as soon as reasonably possible following the utilization of such spare parts. If Contractor fails, after a reasonable period of time not to exceed one (1) week, to take corrective action regarding any Defective Work, or to commence to take corrective action regarding any Defective Work and thereafter continue to proceed diligently to complete the same, then Owner, after providing written notice to Contractor may take corrective action regarding such Defective Work and the expense thereof shall be paid by Contractor; *provided*, *however*, if such Defective Work materially affects the operation or use of the Facility, then Contractor shall commence to take correction action regarding such Defective Work within two (2) business days after receipt of notice of such Defective Work, and thereafter continue to proceed diligently to complete the same, or Owner may take such corrective action regarding such Defective Work and the expense thereof shall be paid by Contractor. In addition, Contractor shall, at Contractor's expense, promptly perform such tests as Owner may reasonably require in order to demonstrate the cure of such Defective Work as the result of Contractor's repair or replacement as aforesaid. If at any time during the Defect Correction Period (other than in connection with demonstrating that an independently identified Defect has been cured) Owner requests verification that the Facility remains capable of meeting the Guaranteed Facility Percentage (as such may be adjusted by the payment of Performance Liquidated Damages pursuant to Section 10.2), the costs, including overhead, for Performance Tests performed on the Facility shall be borne by Owner if the Facility is found to meet the Guaranteed Facility Percentage and by Contractor if the Facility is found to not meet the Guaranteed Facility Percentage (as such may be adjusted by the payment of Performance Liquidated Damages pursuant to Section 10.2).

(c) All Corrective Work shall be performed subject to the same terms and conditions under this Contract as the original Work is required to be performed. Any change to parts or Equipment that would alter the requirements of this Contract may be made only with prior written approval of Owner.

(d) Nothing contained in this ARTICLE 11 shall be construed to establish a period of limitation with respect to any obligations which Contractor might have under this Contract. Establishment of the Defect Correction Period relates only to the specific obligation of Contractor to perform Corrective Work, and has no relationship to the time within which the obligation to comply with this Contract may be sought to be enforced, nor to the time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations other than specifically to perform Corrective Work.

Section 11.3 Warranty Period Extension.

With respect to any Corrective Work performed, the Defect Correction Period for such Corrective Work shall continue until the later of (a) the expiration of the original Defect Correction Period and (b) twelve (12) months after such Corrective Work was performed.

Section 11.4 Extension for Total Shutdown.

If, during the Defect Correction Period, the Facility is shut down (other than for the purpose of scheduled or routine maintenance) and such shutdown is caused by a Defect, then the

Defect Correction Period will be extended by a reasonable period equal to the duration of the shutdown required to repair such Defect.

Section 11.5 Assignment of Warranties.

(a) Upon Substantial Completion, Contractor shall assign all Manufacturer's Warranties to Owner and if applicable, collaterally assign to the Financing Parties. Contractor shall reasonably cooperate with Owner and the Financing Parties, including by providing supporting documentation or clarifications to Owner and Financing Parties, at their expense, to enforce any such manufacturer warranties during the term of such warranties. In furtherance of the foregoing, Contractor shall procure written consents to assignments of such manufacturer warranties described in the preceding sentence from any such suppliers or Subcontractors as may be reasonably requested by Owner or as may be required by such suppliers or Subcontractors. Notwithstanding the assignment of the Manufacturer's Warranties to Owner at Substantial Completion, Contractor shall continue to enforce all Manufacturer's Warranties on behalf of Owner until the expiration of the Defect Correction Period unless otherwise indicated in writing by Owner.

(b) Nothing in ARTICLE 11 is intended to limit any Manufacturer's Warranty which provides Owner with greater warranty rights than set forth in this ARTICLE 11 or the Project Documents.

(c) The Warranties made in this Contract shall be for the benefit of Owner and its successors and assigns and the respective successors and assigns of any of them, and are fully transferable and assignable.

ARTICLE 12
REPRESENTATIONS AND WARRANTIES

Section 12.1 Representations and Warranties.

(a) Contractor hereby represents and warrants to Owner as follows:

(i) Due Organization of Contractor. Contractor is a corporation duly organized, validly existing and in good standing under the laws of the State of Delaware and has the requisite power and authority to own and operate its business and properties and to carry on its business as such business is now being conducted. Contractor is duly qualified to do business in the State of Kentucky and in any other jurisdiction in which the transaction of its business makes such qualification necessary.

(ii) Due Authorization of Contractor; Binding Obligation. Contractor has full power and authority to execute and deliver this Contract and to perform its obligations hereunder, and the execution, delivery and performance of this Contract by Contractor have been duly authorized by the necessary action on the part of Contractor; this Contract has been duly executed and delivered by Contractor and is the valid and binding obligation of Contractor enforceable in accordance with its terms.

(iii) No Violation of Law; Litigation. Contractor is not in violation of any Applicable Law which violations, individually or in the aggregate, would affect its performance of any obligation under this Contract or Owner's rights under this Contract. There is no litigation nor are there any arbitration proceedings by or before any arbitrators, court or other Governmental Authority now pending or threatened in writing against it which, if adversely determined, could reasonably be expected to have a material adverse effect on its ability to perform all its obligations under this Contract.

(iv) Non-Contravention. The execution, delivery and performance of this Contract by Contractor and the consummation of the transactions contemplated hereby do not and will not contravene the organizational documents of Contractor and do not and will not conflict with or result in a breach of or default under any indenture, mortgage, lease, agreement, instrument, judgment, decree, order or ruling to which Contractor is a party or by which it or any of its properties is bound or affected.

(v) Regulatory Approvals. All governmental or other authorizations, approvals, orders or consents required in connection with the execution and delivery of this Contract by Contractor have been obtained.

(vi) Financial Solvency. Contractor is financially solvent, able to pay all debts as they mature and possesses sufficient working capital to complete the Work and perform its obligations hereunder. The Person, guaranteeing the obligations of Contractor pursuant to Section 2.18, is financially solvent, able to pay all debts as they mature, and possesses sufficient working capital to perform the guarantee required thereunder.

(b) Owner hereby represents and warrants to Contractor as follows:

(i) Due Organization of Owner. Owner is a rural electric cooperative duly organized, validly existing and in good standing under the laws of the State of Kentucky and has the requisite power and authority to own and operate its business and properties and to carry on its business as such business is now being conducted. Owner is duly qualified to do business in the State of Kentucky and in any other jurisdiction in which the transaction of its business makes such qualification necessary.

(ii) Due Authorization of Owner; Binding Obligation. Owner has full power and authority to execute and deliver this Contract and to perform its obligations hereunder, and the execution, delivery and performance of this Contract by Owner have been duly authorized by the necessary corporate actions on the part of Owner; this Contract has been duly executed and delivered by Owner and is the valid and binding obligation of Owner enforceable in accordance with its terms.

(iii) No Violation of Law; Litigation. Owner is not in violation of any Applicable Law which violations, individually or in the aggregate, would affect its performance of any obligation under this Contract or Contractor's rights under this Contract. There is no litigation nor are there any arbitration proceedings by or before any arbitrators, court or other Governmental Authority now pending or threatened against it

in writing which, if adversely determined, could reasonably be expected to have a material adverse effect on its ability to perform all its obligations under this Contract.

(iv) Non-Contravention. The execution, delivery and performance of this Contract by Owner and the consummation of the transactions contemplated hereby do not and will not contravene the organizational documents of Owner and do not and will not conflict with or result in a breach of or default under any indenture, mortgage, lease, agreement, instrument, judgment, decree, order or ruling to which Owner is a party or by which it or any of its properties is bound or affected.

(v) Financial Solvency. Owner is financially solvent, able to pay all debts as they mature and possesses sufficient working capital to fully and timely pay for the Work and perform its obligations hereunder and, able to pay its debts as they mature.

ARTICLE 13
WORK STOPPAGES

Section 13.1 Owner's Right to Stop Work for Cause. If (a) Contractor fails to correct Defective Work in accordance with Section 11.2, (b) Contractor's actions materially fail to comply with the EPC Requirements, (c) Contractor, Contractor Personnel or Contractor's Subcontractors are negligent in the performance of the Work, or (d) the activities of Contractor, Contractor Personnel or Contractor's Subcontractors reasonably appear to Owner to cause or threaten to cause danger to life or damage to property, then Owner may direct Contractor to stop performance of the Work by written notice (except in the case of subclause (d), in which case notice from Owner may be verbal and immediate) until the cause giving rise to such notice has been eliminated; *provided, however,* that the right of Owner to stop Contractor's performance will not give rise to any duty or payment on the part of Owner. In the event of any such stop order, Contractor shall take all actions required pursuant to Section 14.1, and Contractor will not be entitled to any Change Order or adjustment to the Contract Price, Project Schedule or Guaranteed Substantial Completion Date.

Section 13.2 Work Stoppages Directed by Governmental Authorities.

(a) If a Governmental Authority lawfully directs Owner or Contractor to stop performance of the Work and the event giving rise to such direction from such Governmental Authority is due to any action or inaction of Contractor, then such cessation of the Work shall treated as though Owner had exercised its right to stop the Work pursuant to Section 13.1.

(b) If a Governmental Authority lawfully directs Owner or Contractor to stop performance of the Work and the event giving rise to such direction from such Governmental Authority is due to any action or inaction of Owner, then such cessation of Work shall be treated as an Owner-Caused Delay.

(c) If a Governmental Authority lawfully directs Owner or Contractor to stop performance of the Work and the event giving rise to such direction from such Governmental Authority is a Force Majeure event, then such cessation of Work shall be treated as though it was caused directly by such Force Majeure event.

ARTICLE 14
TERMINATION AND SUSPENSION

Section 14.1 Owner's Right to Suspend Work for Convenience.

(a) Owner may at any time and from time to time by five (5) days' written notice to Contractor suspend (and later reinstate) the Work without terminating this Contract. If Owner suspends the Work pursuant to this Section 14.1, then Contractor shall:

(i) suspend all further Work related to the portion of the Work that is suspended, except such Work as Owner may specify;

(ii) protect and secure the Work against any deterioration, loss, or damage;

(iii) take commercially reasonable efforts to mitigate any reasonably foreseeable cost-impacts; and

(iv) unless otherwise instructed by Owner, during any such suspension maintain its staff and labor on or near the Site and otherwise be ready to proceed expeditiously with the Work upon receipt of Owner's further instructions.

(b) Subject to the terms of ARTICLE 13, Contractor shall be entitled to a Change Order in accordance with Section 7.3(a)(ii).

(c) Upon receipt of notice to resume suspended Work, Contractor shall promptly resume performance of the Work to the extent required in the notice. If Owner does not notify Contractor to resume the Work within one hundred twenty (120) days after it has suspended the Work pursuant to this Section 14.1, then Contractor may terminate the Contract, and such termination shall be deemed a termination for the convenience of Owner pursuant to Section 14.3.

Section 14.2 Certain Payment Upon Owner's Suspension.

Owner shall pay Contractor for any actual costs and charges reasonably incurred as a result of such suspension on a Monthly basis, including any reasonable suspension charges, demobilization and remobilization expenses, and other payments due to the Subcontractors. Contractor shall mitigate such costs and charges to the extent reasonably possible.

Section 14.3 Owner's Right to Termination for Convenience.

(a) Owner shall have the right to terminate this Contract in whole or in part, for its sole convenience at any time by giving ten (10) Business Days' prior written notice thereof (the "**Termination Notice**") to Contractor. Without limiting the generality of the foregoing, Owner shall have the right to terminate this Contract under this Section 14.3 prior to the Notice to Proceed Date.

(b) If Owner elects to terminate this Contract pursuant to this Section 14.3, then:

(i) Contractor shall take whatever steps are reasonably necessary to minimize the costs associated with such termination and, at Owner's request and expense, perform the following services, as applicable:

(A) cease all applicable Work, except such Work as Owner may specify in the Termination Notice and for the sole purpose of reasonably protecting that part of the Work already executed;

(B) place no further orders for Subcontracts, Equipment, or any other items or services except as may be necessary for completion of such portion of the Work as is not terminated;

(C) promptly assist Owner in preparing an inventory of all Equipment in use or in storage at, or off, the Site;

(D) promptly make every reasonable effort to procure cancellation of all Subcontracts and rental agreements to the extent they relate to the performance of the Work that is terminated;

(E) provided Owner has satisfied its then-current payment obligations under Section 5.2, transfer or assign, as applicable, to Owner, without any right to additional compensation:

(I) all Work Product;

(II) unencumbered and lien-free title to all Work, including Equipment and components thereof, not already owned by Owner, provided that Owner has paid to Contractor the portion of the Contract Price that covers such Work;

(III) to the extent assignable or transferable, all Applicable Permits, if any, then held by Contractor pertaining to the Facility;

(IV) all Manufacturer's Warranties attributable to any Equipment described in Section 14.3(b)(E)(II) to the extent not already assigned to Owner in accordance with this Contract; and

(F) assist Owner in the maintenance, protection, and disposition of Work in progress;

(G) thereafter execute only that portion of the Work not terminated (if any) and that portion of the Work as may be necessary to preserve and protect Work already in progress and to protect Equipment at the Site or in transit thereto; and

(H) remove from the Site all of Contractor's tools and, as Owner may request, Contractor's debris and rubbish.

(c) If Owner terminates this Contract pursuant to Section 14.3 and proceeds with the Project, upon payment by Owner of the Termination Payment described in Section 14.4, Contractor shall provide Owner, any Replacement Contractor or any Financing Party (and their respective successors and assigns), at Contractor's expense, and to the extent not otherwise having been granted and conveyed pursuant to Section 16.4, with an irrevocable, royalty-free license to use any and all intellectual property and other patented and/or proprietary information that Contractor has rights to use (including any Contractor's Intellectual Property or Third Party Proprietary Work Product), if any, which Owner deems necessary to possess and use the Work, the Scope of Work, the Project Documents and any other documentation delivered hereunder and to complete, own, operate and maintain the Facility, and the provisions of Section 16.4(d) shall apply to Owner's use of such intellectual property and information.

Section 14.4 Termination Payment Upon Termination for Convenience.

(a) Amount of Termination Payment

(i) If Owner elects to terminate this Contract under Section 14.3, Owner shall pay to Contractor a termination payment (the "**Termination Payment**"). Payment of the Termination Payment shall be the sole and exclusive liability of Owner, and the sole and exclusive remedy of Contractor, with respect to termination of this Contract pursuant to Section 14.3.

(ii) The Termination Payment shall consist of:

(A) For all Work completed prior to the effective date of termination, any applicable Progress Payments for such Work for which Contractor has not received payment;

(B) For any Work that was in progress on the effective date of termination, an aggregate amount equal to the applicable line item for such Work set forth in the Schedule of Values multiplied by the percentage of such Work completed on the effective date of termination;

(C) Any other amounts due to Contractor, but not yet paid, prior to the effective date of termination less any amounts payable by Contractor to Owner as of the effective date of the termination;

(D) To the extent applicable, any cancellation costs payable to a Subcontractor under the terms of the applicable Subcontract between Contractor and such Subcontractor; and

(E) Direct, out of pocket costs reasonably incurred by Contractor (I) in the performance of the items enumerated in Section 14.3(b) and (II) in connection with demobilization;

(iii) The Termination Payment shall in no event include, and Contractor not be entitled to receive, any amount for unabsorbed overhead, contingency, risk or anticipatory profit.

(b) In the event of any termination of this Contract by Owner pursuant to Section 14.3, Contractor shall take commercially reasonable efforts to mitigate any reasonably foreseeable costs set forth in Section 14.4(a)(ii)(D) and Section 14.4(a)(ii)(E) above.

(c) In the event that Owner terminates this Contract for its convenience after the Guaranteed Substantial Completion Date has passed (subject to extension of the Guaranteed Substantial Completion Date to the extent permitted pursuant to Sections 7.2 and 7.3) and Contractor has not timely achieved Substantial Completion by the date of such termination, then Owner shall not be liable to Contractor for, and Contractor shall not make any claim against Owner or its Affiliates with respect to, the costs set forth in Section 14.4(a)(ii)(D) and Section 14.4(a)(ii)(E) in connection with such termination.

Section 14.5 Deductions from Termination Payment.

Owner shall not be required to pay any portion of the Termination Payment, or (because of subsequently discovered evidence or subsequent observations) may make a demand for repayment of any portion of the Termination Payment previously made to Contractor, to the extent of amounts due or costs incurred in respect of:

(a) liens filed against the Facility, the Site, the Work, the Equipment, or any portion thereof, by Subcontractors or any other Person entitled to payment from Contractor or a Subcontractor, *provided*, that Owner has paid all amounts due hereunder to Contractor in respect of such claim;

(b) failure or refusal of Contractor to make proper payments to any Subcontractor when due, *provided*, that Owner has paid all amounts due hereunder to Contractor in respect of such payment; and

(c) fines, penalties, sanctions or warning issued by any Governmental Authority due to Contractor's breach or violation of any of its obligations under Section 2.10.

Section 14.6 Verification of the Termination Payment.

Contractor shall, within forty-five (45) days of any termination of this Contract pursuant to Section 14.3, submit to Owner invoices and other documentation as is sufficient to enable Owner to verify the amount of Contractor's costs in the performance of the Work so that Owner and Contractor may determine the amount of the Termination Payment.

Section 14.7 Payment of the Termination Payment.

Owner shall pay the Termination Payment to Contractor within thirty (30) days of Owner's receipt of the Contractor's submission of information under Section 14.6 and Contractor's completion of the requirements of Section 14.3(b).

Section 14.8 Termination Upon Contractor's Breach.

(a) For purposes hereof, a "**Contractor Event of Default**" will be deemed to have occurred if:

(i) Any representation or warranty made by Contractor herein is false in any material respect when made or Contractor fails to perform in any material respect any of its covenants or agreements contained in this Contract (other than such covenants or agreements specifically addressed in other provisions of this Section 14.8(a)) and such false representation or warranty or failure of performance is not corrected or cured within thirty (30) days after receipt of written notice to Contractor; *provided*, that if such false representation or warranty or failure of performance is not capable of cure or correction within such thirty (30) day period, then such period shall be deemed extended up to an additional thirty (30) days and Contractor shall be deemed to have cured such false representation or warranty or failure to perform, if Contractor commences and diligently pursues such cure or correction and effects such cure or correction within such additional thirty (30) days;

(ii) Contractor abandons the Work for more than ten (10) Business Days;

(iii) Contractor assigns or attempts to assign its rights or obligations under this Contract in contravention of Section 23.2;

(iv) Contractor fails to maintain the Credit Support as required hereunder;

(v) Contractor is insolvent, a proceeding is instituted against Contractor seeking to adjudicate Contractor as bankrupt or insolvent or Contractor makes a general assignment for the benefit of its creditors, has a trustee or receiver appointed for its property, or files a petition to take advantage of any insolvency laws, unless, in the case of a petition filed against Contractor, it is dismissed within ninety (90) days;

(vi) either (A) the Delay LD Cap has been reached or (B) the Performance LD Cap has been reached;

(vii) on or before the expiration of the Cure Period, Contractor fails to demonstrate, pursuant to the Performance Test conducted in accordance with Section 8.3, that the Performance Criteria has met or exceeded the Minimum Facility Percentage;

(viii) Contractor fails to maintain any insurance coverages required under Section 17.1;

(ix) Contractor fails, violates or refuses to comply with any Applicable Laws or Applicable Permits and such failure, violation or refusal is not corrected or cured within thirty (30) days after receipt of written notice to Contractor;

(x) Contractor fails to make payment of any undisputed amounts due to Owner when due and payable and such failure is not corrected or cured within ten (10) days after receipt of written notice to Contractor;

(xi) provided that Owner has satisfied its then-current payment obligations under Section 5.2, Contractor fails to make payments to any Subcontractor owed in accordance with the respective Subcontract for Work performed by such Subcontractor (but only with respect to payments not in dispute) and such failure is not corrected or cured within thirty (30) days after receipt of written notice to Contractor; or

(xii) Contractor fails to bond against or remove any liens filed against the Facility, the Site, the Work, the Equipment or any property of Owner by any of its Subcontractors after Contractor has received payment in full in connection with the claims which have been filed and such failure is not corrected or cured within thirty (30) days after receipt of written notice to Contractor.

(b) Consequences of Contractor Event of Default

(i) Upon the occurrence of any Contractor Event of Default that is not cured by Contractor within the applicable cure period, Owner may, without prejudice to any other right or remedy that it may have, terminate this Contract by written notice to Contractor.

(ii) If Owner terminates this Contract due to a Contractor Event of Default, Contractor shall take the actions set forth in Section 14.3(b) and Section 14.3(c) at Contractor's expense (including those actions set forth in Section 14.3(b)(i)).

(iii) If Owner elects to terminate this Contract pursuant to this Section 14.8(b), then Owner may employ, but shall not be obligated to employ, any other Person ("**Replacement Contractor**") to finish the Work, and all Subcontracts shall be assigned to Owner or to such Replacement Contractor by whatever method Owner may reasonably request. In such event, Owner may make such expenditures as in Owner's reasonable judgment would accomplish the timely completion of the Facility. Owner may, but shall not be required, to modify the scope of the Work, but Owner shall be under no obligation to modify the scope of the Work or to complete the Facility. Contractor, if so requested by Owner, shall provide Owner, any Replacement Contractor or any Financing Party (and their successors and assigns), at Contractor's expense, and to the extent not otherwise having been granted and conveyed pursuant to Section 16.4, with an irrevocable, royalty-free license to use any and all intellectual property and other patented and/or proprietary information that Contractor has rights to use (including any Contractor's Intellectual Property or Third Party Proprietary Work Product), if any, which Owner reasonably deems necessary to possess and use the Work, the Scope of Work, the Project Documents and any other documentation delivered hereunder and to complete, own, operate and maintain the Facility. Upon such termination, Contractor shall not be entitled to receive any further payments under this Contract except as provided in Section 14.8(b)(iv).

(iv) In the event this Contract is terminated in connection with a Contractor Event of Default and the Work is completed, then:

(A) Excluding all damages, costs, losses and expenses expressly waived pursuant to Section 19.1, if the damages, costs, losses and expenses recoverable under this Contract incurred by Owner, including all total reasonable and necessary documented expenses incurred by Owner in connection with the completion of the Facility in accordance with the requirements of Section 2.10 (including all documented reasonable amounts charged by any Replacement Contractor to finish the Facility), Delay Liquidated Damages, any cost of financing or interest on such expense from the date such expense was incurred by Owner at the Default Rate, all fines, penalties and sanctions imposed by reason of Contractor's breach or violation of any EPC Requirements and payment for costs and expense incident to correction or remediation of any condition at the Site resulting from such breach or violation (the "**Cost to Complete**"), exceed the balance of the Contract Price remaining unpaid at the time of termination (the "**Balance of Contract Price**"), then Contractor shall be liable for such excess costs and shall pay to Owner upon Owner's presentation of a written demand for the amount of such excess costs; *provided*, that Contractor may dispute such excess costs by invoking the dispute resolution provisions of ARTICLE 20. In connection with the written demand for such excess costs, Owner shall promptly provide Contractor with reasonable supporting documentation and information evidencing the Cost to Complete. Any undisputed sums due to Contractor from Owner accruing prior to the date of termination shall be deducted from any damages amounts required to be paid by Contractor; and

(B) If the Cost to Complete is less than the Balance of Contract Price, then Contractor shall be entitled at Final Completion to an aggregate amount equal to the excess, if any, of:

(I) The sum of (a) any unpaid portion of the Contract Price attributable to the Work performed by Contractor prior to the date of termination, (b) the value of any unused or partially used materials on the Site furnished by Contractor to which Owner takes title and have not already been paid for as part of the Contract Price, and (c) any other amounts due and payable to Contractor hereunder as of the date of termination, less

(II) Owner's damages, costs, losses, fees and expenses (including reasonable attorneys' fees) not otherwise waived herein incurred in connection with the Contractor Event of Default and termination of this Contract, (any such excess of (A) over (B) being the "**Termination Amount**"). The Termination Amount shall not exceed the amount by which the Balance of Contract Price is greater than the Cost to Complete. Payment by the Contractor to Owner of Delay Liquidated Damages pursuant to Section 10.1 shall not reduce the Termination Amount nor excuse Contractor from its obligation to pay the Delay

Liquidated Damages hereunder. For the avoidance of doubt, Delay Liquidated Damages shall not be included within the defined term "Termination Amount".

(c) In the event of a Contractor Event of Default, and in addition to the remedies provided above, Owner shall be entitled to pursue all rights and remedies available at law or in equity, including damages, costs, fees and expenses, in each case incurred in connection with the occurrence of the Contractor Event of Default or the exercise of Owner's remedies, whether or not Owner terminates this Contract by reason of any such Contractor Event of Default.

(d) Notwithstanding anything in this Section 14.8 to the contrary, any termination of this Contract based on the Contractor Event of Default set forth in Section 14.8(a)(vi) shall be treated as a termination for Owner's convenience as set forth in Section 14.3; *provided, however*, that Owner shall not be liable to Contractor for the costs set forth in Section 14.4(a)(ii)(D) and Section 14.4(a)(ii)(E) in connection with such termination.

Section 14.9 Termination Upon Owner's Breach.

(a) Contractor's Right to Suspend and Terminate

(i) If Owner fails to make payment of any undisputed amounts when due and payable, then, upon twenty (20) days' written notice to Owner and any Financing Party, Contractor may suspend the Work as an Owner-Caused Delay and if such failure to pay has not been cured within such twenty (20) day period then Contractor may, upon an additional twenty (20) days' written notice to Owner and any Financing Party, terminate this Contract if such failure to pay has not been cured within such additional twenty (20) day period.

(ii) If Owner is insolvent or if any proceeding is instituted against it seeking to adjudicate Owner as bankrupt or insolvent, makes a general assignment for the benefit of its creditors, has a trustee or receiver appointed for its property, or files a petition to take advantage of any debtor's act, then Contractor may, upon thirty (30) days' notice to Owner and any Financing Party, terminate this Contract.

(iii) If any representation or warranty made by Owner herein is false or misleading in any material respect when made or Owner fails in any material respect to perform any of its obligations contained in this Contract (other than such covenants or agreements specifically addressed in other provisions of this Section 14.9(a)) and such false representation or warranty or failure of performance is not corrected or cured within thirty (30) days after notice to Owner, then Contractor may, upon thirty (30) days' notice to Owner and any Financing Party, terminate this Contract; *provided, however*, that if such false representation or warranty or failure of performance is not capable of cure or correction within such thirty (30) day period, then such period shall be deemed extended up to an additional thirty (30) days so long as Owner commences and diligently pursues such cure or correction.

(iv) If Owner or any third party for which Owner is responsible fails to comply with the Construction Safety Plan and such non-compliance is not remedied in accordance with Section 4.7, then Contractor may, upon thirty (30) days' notice to Owner, suspend and/or terminate this Contract.

(b) Consequences of Termination

If Contractor terminates this Contract pursuant to Section 14.9, Owner shall pay to Contractor an amount equal to the Termination Payment, and Owner's payment of the Termination Payment shall be the sole and exclusive liability of Owner, and the sole and exclusive remedy of Contractor, with respect to termination of this Contract pursuant to this Section 14.9.

Section 14.10 Warranty Upon Termination.

In the event of any termination of this Contract, the Defect Correction Period for the portion of the Work then completed shall commence upon such termination and continue for a period of twenty-four (24) months after the date of such termination.

ARTICLE 15
FORCE MAJEURE

Section 15.1 Force Majeure.

As used in this Contract, an event of "Force Majeure" shall mean any circumstance not within the reasonable control, directly or indirectly, of the Party affected, but only if and to the extent that (a) despite the exercise of due diligence, such circumstance, or the impact thereof, cannot, through commercially reasonable efforts, be or be caused to be prevented, avoided or removed by the affected Party, (b) such event is not due to the affected Party's negligence, intentional misconduct or any failure of such Party to perform any of its obligations under this Contract, and (c) the affected Party has taken commercially reasonable precautions and exercised due care to avoid the effect of such event and to mitigate the consequences thereof. Subject expressly to the foregoing conditions, Force Majeure may include the following, including the after-effects directly caused by the occurrence thereof:

(a) war, riot, sabotage, acts of a public enemy, terrorist acts or other civil disturbance;

(b) extreme weather conditions or natural phenomena, including floods, explosions or fires arising from natural causes, earthquakes, tornados, typhoons, tsunami, hurricanes, landslides, volcanic eruptions, range or forest fires, and unsafe or hazardous conditions arising from such extreme weather conditions or natural phenomena;

(c) strikes, walkouts, lockouts or similar industrial or labor actions (including disruptive union activity meant to force the use of union work force) or disputes, provided, however that strikes, walkouts, lockouts or similar industrial or labor actions or disputes threatened, conducted or initiated by or against any Contractor Personnel or arising as a result of

any Contractor Personnel's failure to comply with or enter into a collective bargaining agreement shall expressly not be an event of Force Majeure;

(d) terrorism or acts of the public enemy, vandalism or other public disorder or civil disturbance, insurrections, riots, war, hostilities, sabotage, ionizing radiation or radioactive contamination, embargo, blockade, epidemic, quarantine, unusual impediment or delay in deliveries, transportation, utilities, computers, equipment, communication and other facilities (to the extent such unusual impediment or delay was itself due to an event of Force Majeure);

(e) a taking by eminent domain, act or failure to act of any Governmental Authorities or casualty requiring reconstruction or repair to the Work or Project or any parts thereof; and

(f) unusually inclement weather (including but not limited to rain, hail, sleet, snow and ice), (including the after-effects directly caused by the occurrence thereof) which are different from those that are reasonably expected to be encountered as of the effective date of this Contract as determined by the Agricultural Weather Information Service's ten year monthly weather average, for precipitation greater than or equal to 0.10" in any given day, applicable to the Site.

Section 15.2 Burden of Proof; Exclusions from Force Majeure.

(a) The burden of proof as to whether a Force Majeure event has occurred shall be upon the Party claiming a Force Majeure event.

(b) Notwithstanding anything in this Contract to the contrary, none of the following events shall be considered Force Majeure unless the Party claiming Force Majeure can reasonably demonstrate that the event meets the requirements of Section 15.1(a) through Section 15.1(c): the inability of Contractor to use Equipment due to its design, construction, operation or maintenance or the failure by Contractor to obtain on a timely basis or to maintain any Applicable Permit. Also notwithstanding anything in this Contract to the contrary, the term Force Majeure does not include (i) the inability of Contractor to procure Equipment or any component parts therefor or the failure of any Equipment or component thereof unless such inability or failure is itself excused by reason of independently identifiable event of Force Majeure, (ii) any acts or omissions of any third party, including any vendor, materialman, customer, or supplier of Contractor, unless such acts or omissions are themselves excused by reason of independently identifiable event of Force Majeure; (iii) the failure to abide by Prudent Industry Practices, (iv) a Party's lack of funding or financial capability; (v) changes in market conditions that affect the cost of supplies, energy, capacity or related credits or incentives to the extent not caused by a Force Majeure; (vi) weather events such as rain, heat, or snow that a Party could reasonably anticipate as being likely in any given period of time at the Site; or (vii) economic hardship.

Section 15.3 Excused Performance.

If either Party is rendered wholly or partly unable to perform its obligations under this Contract because of a Force Majeure event, that Party will be excused from whatever

performance is affected by the Force Majeure event to the extent so affected; *provided, however*, that Contractor shall only be entitled to a Change Order adjusting the Contract Price, Project Schedule and/or the Guaranteed Substantial Completion Date for such Force Majeure event in accordance with Section 7.3(a) and Contractor shall endeavor to continue to perform its obligations under this Contract so far as reasonably practicable.

Section 15.4 Effect of Force Majeure.

In the event of a delay in performance excusable under this Article, the Party affected by such event of Force Majeure shall:

(a) expeditiously take action to correct or cure the event or condition excusing performance;

(b) use its commercially reasonable efforts to provide prompt notice of becoming aware of such event or condition to the other Party of the occurrence of the event or condition giving an estimation of its expected duration, the cost of any remedial action, and the probable impact on the performance of its obligations hereunder; and

(c) use its commercially reasonable efforts to provide prompt notice, to the other Party of the cessation of the event or condition giving rise to its excuse from performance.

ARTICLE 16
TITLE AND RISK OF LOSS

Section 16.1 Title.

Title to the Equipment and all other materials, supplies and machinery used in connection with the Work that is or may become a part of the Facility shall vest in Owner upon Owner's satisfaction of its then-current payment obligations under Section 5.2 with respect to such Equipment or other items.

Section 16.2 Risk of Loss.

Notwithstanding the passage of title to Owner in accordance with Section 16.1, Contractor shall have the full responsibility for care, custody, and control of the Facility and any component thereof and shall bear the risk of loss of and damage to the Facility, any Equipment or other item of Work that is lost, damaged, or destroyed prior to Substantial Completion (whether or not yet delivered to the Site or incorporated into the Facility), subject to Contractor's right to make a claim under the Builder's All Risk Policy. Owner shall be responsible for providing the Builder's All Risk Policy in accordance with Exhibit Q and paying all amounts attributable to deductibles or self-insured retentions. Each Party shall cooperate with one another in making any claims under such policy. Under no circumstance shall this Section 16.2 be interpreted to relieve Contractor of its obligations or liabilities under this Contract, including its obligations with respect to Defective Work and Corrective Work.

Section 16.3 No Liens or Encumbrances. Contractor warrants and guarantees that legal title to, and the ownership of license to, the Work (including, without limitation, the

Facility and the Equipment, operation and maintenance manuals, services, materials and supplies provided pursuant to this Contract) shall pass to Owner, free and clear of any and all liens, once and provided that Owner has satisfied its then-current payment obligations under Section 5.2 with respect to the applicable portion of the Work.

Section 16.4 Intellectual Property.

(a) Contractor shall retain ownership of all Work Product and, upon Owner's satisfaction of its then-current payment obligations under Section 5.2 with respect to such Work Product, as applicable, Contractor shall be deemed to grant Owner and its Affiliates an irrevocable, perpetual and royalty-free license (including with right to assign its rights without consent to any owner of any portion of the Facility or any purchaser of an interest in all or part of the Facility) to use, disclose, modify and copy such Work Product for any purpose relating to the Facility. All Subcontracts shall contain provisions consistent with this Section 16.4(a).

(b) Contractor shall retain ownership of all proprietary intellectual property rights owned and developed by Contractor outside this Contract, or any other agreements between the Parties (or their Affiliates) related to the Facility (hereinafter referred to as "**Contractor's Intellectual Property**"), regardless of whether such Contractor's Intellectual Property is included in the Work Product, and nothing in this Section 16.4 shall result in a transfer of ownership of any Contractor's Intellectual Property or the proprietary intellectual property owned and developed by Contractor's Equipment Subcontractors for any project other than the Facility ("**Third Party Proprietary Work Product**"). With respect to such Contractor's Intellectual Property and Third Party Proprietary Work Product relating to the Work or the Facility, Contractor hereby grants Owner and its Affiliates an irrevocable, perpetual and royalty-free license (including with right to assign its rights without consent to any owner of any portion of the Facility or any purchaser of an interest in all or part of the Facility) to use, disclose, modify and copy such Contractor's Intellectual Property and Third Party Proprietary Work Product for any purpose relating to the Facility. All Subcontracts shall contain provisions consistent with this Section 16.4(b).

(c) Contractor hereby grants to Owner a non-exclusive license to reproduce the documents described in Section 16.4(a) and Section 16.4(b) for purposes relating directly to the Facility, for Owner's archival records, and for the Owner's reproduction of Drawings and photographs for the Owner's marketing materials. Owner shall obtain Contractor's approval prior to publication of any marketing materials which include reference to Contractor.

(d) Contractor hereby, on behalf of itself and its Affiliates, grants to Owner an irrevocable, perpetual and royalty-free license to use, modify and copy the Work Product, for any other project, except for any of the following which may be in such Work Product: (i) any of Contractor's Intellectual Property; (ii) any Third Party Proprietary Work Product; or (iii) any proprietary intellectual property rights developed during the performance of this Contract which was derived in whole or part by participation of Contractor or any of its Subcontractors. As a condition of using on another project any Work Product which Owner has a license under this Section 16.4(d), Owner shall remove from the Work Product any reference to the Contractor or any of its Subcontractors. The foregoing license and rights to use any Work Product granted to Owner shall be subject to any limitations imposed on Owner by third parties which have any

ownership interest in such Work Product or any proprietary intellectual property embedded therein, and Owner shall indemnify, defend and hold the Contractor Indemnitees harmless with respect to any claims, damages, losses, liabilities or other causes of action which relate to Owner's use of any Work Product for any project other than the Facility.

(e) If Owner subsequently reproduces Facility-related documents or creates, or causes others to create, a derivative work based upon Facility-related documents created by Contractor, or if Owner continues to use the documents for the Facility following any termination of this Contract, Owner shall remove or completely obliterate the original professional names, seals, logos, and other indications on the documents of the identity of Contractor and its Subcontractors and consultants.

(f) All written materials, plans, drafts, specifications, computer files or other documents (if any) prepared or furnished by Owner, its Affiliates or any of Owner's other consultants or contractors shall at all times remain the property of Owner, and Contractor shall not make use of any such documents or other media for any other project or for any other purpose than as set forth herein. All such documents and other media, including all copies thereof, shall be returned to Owner upon the earlier of Substantial Completion and termination of this Contract, except that Contractor may, subject to its confidentiality obligations as set forth in this Contract, retain one record set of such documents or other media.

(g) Contractor warrants that the Work performed and Owner's use of the Work Product, Contractor's Intellectual Property, Third Party Proprietary Work Product and all other technology, Drawings, designs, details, databases, data, software and property delivered by Contractor hereunder shall not constitute an infringement of any trademark, patent or copyright or misappropriation or misuse of any trade secret.

ARTICLE 17
INSURANCE

Section 17.1 Contractor's Insurance.

As of the Effective Date and continuing through the earlier of (a) the date of Final Completion and (b) the date of termination of this Contract, Contractor shall, at its cost and expense, obtain and maintain, and, as applicable, cause its Subcontractors to obtain and maintain, in force insurance policies providing the coverage of the types and in the amounts as required in Exhibit Q.

Section 17.2 Certificates.

Contractor shall, no later than the Effective Date deliver to Owner certificates of insurance evidencing compliance with the requirements of Section 17.1.

Section 17.3 Failure to Obtain Insurance.

If Owner is damaged by the failure of Contractor to maintain the insurance coverages required hereunder, Contractor shall bear all costs properly attributable thereto, including any attorneys' fees incurred by Owner. In the event that Contractor fails to procure and/or maintain

insurance as required by this Contract, Owner shall have the right (at Contractor's sole cost) to procure and maintain such coverage. Owner's cost to procure and maintain such insurance, if not paid by Contractor, may, at Owner's sole option, be netted against the Contract Price.

Section 17.4 No Effect on Liability.

Contractor furnishing certain minimum insurance coverages as required herein is not to be interpreted as in any way limiting the liability of Contractor. Notwithstanding anything in this Contract to the contrary, the occurrence of any of the following shall in no way relieve Contractor from any of its obligations under this Contract: (a) failure by Contractor to secure or maintain the insurance coverage required hereunder; (b) failure by Contractor to comply fully with any of the insurance provisions of this Contract; (c) failure by Contractor to secure such endorsements on the policies as may be necessary to carry out the terms and provisions of this Contract; (d) the insolvency, bankruptcy or failure of any insurance company providing insurance to Contractor; (e) failure of any insurance company to pay any claim accruing under its policy; or (f) losses by Contractor or any of its Subcontractors not covered by insurance policies.

ARTICLE 18
INDEMNIFICATION

Section 18.1 General Indemnity. Contractor shall indemnify, hold harmless and defend Owner Indemnitees from and against any and all Losses incurred by any Owner Indemnitee or asserted by any third party against any Owner Indemnitee to the extent caused by (a) any violation of any Applicable Laws or Permits to be complied with by Contractor hereunder; (b) any Taxes imposed on or attributable to acts or omissions of Contractor for which Contractor is responsible under this Contract; (c) workers' compensation claims filed by any Contractor Personnel, regardless of negligence of Owner or any Owner Indemnitee contributing to such Losses; (d) all fines, assessments and penalties issued by any Governmental Authority that directly arise out of or result from the failure of the Project or any portion thereof, as designed, constructed and completed by Contractor or any Subcontractor, to be capable of operating in compliance with all Applicable Laws or the conditions or provisions of all Permits, in each case, as in effect as of the Substantial Completion date; or (e) all claims by any Governmental Authority claiming Taxes based on gross receipts, other than sales and use taxes, or on income of Contractor, any of its Subcontractors, or any of their respective agents or employees with respect to any payment for the Work made to or earned by Contractor, any of its Subcontractors, or any of their respective agents or employees under this Contract; in each of the foregoing cases (other than clause (c)) except to the extent caused by or arising from the negligence, willful misconduct or breach or violation of Applicable Law of such Owner Indemnitee not attributable to Contractor or any Affiliate or Subcontractor of Contractor.

Section 18.2 Indemnification for Bodily Injury and Property Damage.

(a) By Contractor. Contractor shall indemnify, hold harmless and defend Owner Indemnitees from and against any Losses on account of any claim by a third party for bodily injury or property damage against the Owner Indemnitee, but only to the extent caused by the negligence or willful misconduct of Contractor, Contractor Personnel, or anyone for whom

Contractor is responsible, in connection with the performance of their respective undertakings in accordance with this Contract.

(b) By Owner. Owner shall indemnify, hold harmless and defend Contractor from and against any Losses on account of any claim by a third party for bodily injury or property damage against Contractor, but only to the extent caused by the negligence or willful misconduct of Owner or any third party for which Owner is responsible (to the extent such third party is on the Site); *provided, however*, Owner shall indemnify and hold harmless Contractor from workers' compensation claims filed by any employees or agents of Owner, regardless of negligence of Owner or any Owner Indemnitee contributing to such Losses.

Section 18.3 Contractor's Infringement Indemnity.

(a) Contractor shall indemnify, hold harmless and defend Owner Indemnitees from and against any and all Losses to the extent based on any suit, claim or proceeding that the Work or the Work Product, or any part thereof, constitutes infringement of any patent or copyright, now or hereafter issued. Contractor agrees to keep Owner informed of all developments in the defense of such actions.

(b) If Owner is enjoined from the operation or use of the Work or Work Product, or any part thereof, as the result of any patent or copyright suit, claim, or proceeding, based on any claim that the Work or the Work Product, or any part thereof, constitutes infringement of any patent or copyright, now or hereafter issued, then Contractor shall at its sole expense take reasonable steps to procure the right to operate or use the Work or Work Product, as applicable. If Contractor cannot so procure such right within a reasonable time, Contractor shall promptly, at Owner's option and at Contractor's expense:

(i) Modify the Work or Work Product so as to avoid infringement of any such patent or copyright, or

(ii) Replace said Work or Work Product with Work or Work Product that do not infringe or violate any such patent or copyright.

(c) The defense, indemnification, and hold harmless obligations of Contractor shall not extend or apply to any suit, claim or proceeding based on infringement or violation of a patent or copyright (i) relating to a particular process or particular manufacturer specified by Owner and not offered or recommended by Contractor to Owner or (ii) arising from modifications to the Work or Work Product by Owner or its agents after completion or delivery of the Work or Work Product.

Section 18.4 Lien Indemnification.

Except to the extent arising as a result of Owner having defaulted on its payment obligations under this Contract, Contractor shall indemnify, defend and hold harmless Owner Indemnitees from any claims or mechanic's liens brought against Owner or against the Facility in connection with the failure of Contractor, any Subcontractor, or anyone else acting under their direction and control or on their behalf in connection with performance of the Work or in connection with any curative action under any warranty, to pay for any services, materials, labor,

Equipment, taxes or other items or obligations furnished or incurred for or in connection with the Work. Within fifteen (15) days of receiving written notice from Owner that such a claim or mechanic's lien has been filed, Contractor shall commence to take the steps necessary to discharge said claim or lien, including, if necessary, the furnishing of a mechanic's lien bond. If Contractor fails to do so, Owner will have the right to discharge the claim or lien and hold Contractor liable for costs and expenses incurred, including attorneys' fees.

ARTICLE 19
CONSEQUENTIAL DAMAGES

Section 19.1 Waiver of Consequential Damages.

Except as expressly provided in this Contract or this ARTICLE 19, in no event shall either Party (or their Subcontractors, employees and Affiliates) be liable to the other Party (or its Subcontractors, employees and Affiliates) for special, incidental, indirect, consequential and punitive damages, arising out of or in connection with the performance of the Work or this Contract whether arising before or after the expiration or earlier termination of this Contract and whether or not any such liability is claimed in contract (including breach), warranty (including breach), law, equity, tort or otherwise, and this limitation shall apply irrespective of negligence, fault, duty to warn, or strict liability of contract or other person releases and, regardless of whether or not such damages were foreseeable and regardless of whether either party was advised of the possibility of such damages. Such waiver includes but is not limited to, all:

(a) damages incurred by Owner for losses of use, income, profit, opportunities, revenue, project funding, grants, depreciation, tax benefits, financing, business and reputation, for extended or increased interest expenses, insurance premiums, deductibles or expenses, overhead costs, carrying costs, cost of capital, taxes, or write-downs, and for loss of management or employee productivity or of the services of such persons, or claims of a party's customers; and

(b) damages incurred by Contractor for principal office expenses, however excluding the compensation of personnel stationed there that are staffed on the Project, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from this Contract.

Furthermore, the Parties hereby expressly agree that the following shall not be deemed to be special, incidental or consequential damages: (i) any claims of third parties for which Contractor has an indemnification obligation under ARTICLE 18; (ii) Delay Liquidated Damages; (iii) Performance Liquidated Damages; or (iv) any costs or expenses incurred by Contractor in the performance of its warranty obligations hereunder.

Section 19.2 Contractor Aggregate Liability.

Contractor shall not be liable under this Contract for cumulative aggregate amounts in excess of the aggregate Contract Price ("**Contractor Liability Limit**") arising from Contractor's performance or non-performance of this Contract; *provided that*, notwithstanding the foregoing, the Contractor Liability Limit shall not (i) apply to Contractor's indemnification obligations under this Contract with respect to any reasonable claims brought by a third party; (ii) apply to

Contractor's obligation to deliver full legal title to and ownership of all or any portion of the Work and the Facility as required under this Contract; (iv) include the payment of proceeds (exclusive of any deductibles) under any insurance policy required to be provided by Contractor or any of its Subcontractors under this Contract; (v) include amounts paid by Contractor for Delay Liquidated Damages or Performance Liquidated Damages; or (vi) apply in the event of fraud, gross negligence or willful misconduct of any Contractor Indemnifying Party. In no event shall the Contractor Liability Limit be in any way deemed to limit Contractor's obligation to perform all Work required to achieve Substantial Completion and Final Completion and the costs incurred by Contractor in performing the Work shall not be counted against the Contractor Liability Limit. For purposes of this Section 19.2, "third party" means any Person other than Contractor, Owner, a Financing Party, or their respective Affiliates.

ARTICLE 20
DISPUTE RESOLUTION

Section 20.1 Applicability of Resolution Procedures.

Except for matters requiring immediate injunctive relief, all claims, disputes, controversies, disagreements, grievances or other matters (of any and every kind or type, whether based on contract, tort, statute, regulation or otherwise) in question between the Parties arising out of or relating in any way to this Contract (including the construction, validity, interpretation, termination, enforceability or breach of this Contract) ("**Disputes**") will be resolved pursuant to this ARTICLE 20. In no event shall this Article be construed to limit either Party's right to take any action under this Contract, including Owner's rights in connection with a Contractor Event of Default.

Section 20.2 Dispute Avoidance and Resolution.

The Parties shall communicate regularly with each other at all times so as to avoid or minimize Disputes. If Disputes do arise, Contractor and Owner each commit to resolving such Disputes in an amicable, professional and expeditious manner so as to avoid unnecessary losses, delays and disruptions to the Work. Contractor and Owner will first attempt to resolve Disputes at the field level through discussions between CCM and Owner's Authorized Representative.

Section 20.3 Management Discussions.

If the Parties are unable to resolve a Dispute arising under this Contract after engaging in the procedures set forth in Section 20.2, then within three (3) Business Days after notice from one Party to the other, such Dispute will be submitted promptly to the senior executive officers of the Parties, who will meet, in person or by telephone, not later than ten (10) days after the date such Dispute was submitted to them. In the event that the officers cannot resolve the Dispute within five (5) Business Days after the matter is submitted to them, then, unless otherwise agreed, either Party may pursue litigation as set forth in Section 20.4.

Section 20.4 Litigation.

In the event that the Dispute is not resolved by senior executive officers within the time period set forth in Section 20.3, then the Parties agree that such Dispute shall be decided by

litigation pursuant to this Section 20.4. Each Party (i) irrevocably submits to the exclusive jurisdiction of any Federal court or Kentucky state court sitting in Clark County, Kentucky or Fayette County, Kentucky in any Dispute arising under or relating to this Contract, (ii) agrees that all claims in such action may be decided in such court, (iii) waives, to the fullest extent it may effectively do so, the defense of inconvenient forum, (iv) consents to the service of process by mail in accordance with the notice provisions of this Contract, and (v) agrees not to arbitrate, or abate to arbitration, any Dispute arising under this Contract. A final judgment, including all rights of appeal, in any such action shall be conclusive and may be enforced in other jurisdiction. Nothing herein shall affect the right of any Party to serve legal process in any manner permitted by Applicable Laws or affect its right to bring any action that does not arise out of or relate to this Contract in any other court of competent jurisdiction. **EACH OF THE PARTIES HEREBY KNOWINGLY, VOLUNTARILY, AND UNCONDITIONALLY WAIVES, TO THE FULLEST EXTENT PERMITTED BY LAW, ANY AND ALL RIGHTS IT MAY HAVE TO A TRIAL BY JURY WITH RESPECT TO ANY DISPUTE BETWEEN THE PARTIES OR WITH RESPECT TO ANY LITIGATION ARISING UNDER OR IN CONNECTION WITH THIS CONTRACT.**

Section 20.5 Obligations Continue.

The pendency of a Dispute shall not in and of itself relieve either Party of its duty to perform under the Contract. Notwithstanding any Dispute between Owner and Contractor, there shall be no interruption of the Work by the Contractor. Contractor expressly agrees to perform the Work and follow any written directive of Owner concerning the Work notwithstanding the existence of any Disputes, and Contractor agrees that any refusal by it to proceed shall constitute a material breach and Contractor Event of Default. Owner shall continue to make payment of all undisputed amounts to Contractor pending the final resolution of any Dispute between Contractor and Owner.

Section 20.6 Injunctive Relief.

Notwithstanding anything in this Contract to the contrary, nothing in this Contract is intended to, nor shall it, prevent the Parties from seeking injunctive relief at any time as may be available under law or in equity.

ARTICLE 21
RECORDS AND AUDITS

Section 21.1 Books and Records.

(a) Contractor shall keep full and detailed books, construction logs, records, daily reports, accounts, schedules, payroll records, receipts, statements, electronic files, correspondence and other pertinent documents as may be necessary for proper management under this Contract or as required under Applicable Law or this Contract ("**Books and Records**"). Contractor shall maintain all such Books and Records in accordance with generally accepted accounting principles applicable in the United States and shall retain all such Books and Records for a minimum period of three (3) years after Final Completion, or such greater period of time as may be required under Applicable Law.

(b) Upon reasonable notice, Owner, a Financing Party, and any of their respective representatives, including Owner's Engineer, shall have the right to audit or to have audited Contractor's Books and Records with respect to (i) any Project Documents, Drawings, Specifications or other technical documents required under this Contract to be prepared, delivered or maintained by Contractor or any of its Subcontractors; (ii) any documents relating to safety, security, quality or Permits relating to this Contract; (iii) any amounts billed under Change Orders or otherwise on a cost-plus basis; *provided*, *however*, that such parties shall not have the right to audit or have audited Contractor's Books and Records in connection with the internal composition of any compensation that is fixed in amount hereunder (including the composition of any markups, unit rates or fixed percentages or multipliers specified in this Contract). When requested by Owner, Contractor shall provide the auditors with reasonable access to all such Books and Records during normal business hours, and Contractor Personnel shall cooperate with the auditors to effectuate the audit or audits hereunder. Contractor shall bear, at its own cost and expense, all costs incurred by it in assisting Owner with audits performed pursuant to this Section 21.1. Contractor shall include audit provisions substantially similar to this Section 21.1 in all Major Subcontracts. The restrictions in this Section 21.1 to the audit rights of Owner, a Financing Party or Owner's Engineer shall not control over any rights such parties have under Applicable Law, in discovery in any litigation arising out of ARTICLE 20 or in any litigation or arbitration against any guarantor.

Section 21.2 Cost Allocation and Tax Records.

Within a reasonable period of time following a request therefor, Contractor shall provide Owner with any information regarding quantities, descriptions and Contractor's prices to Owner for any Equipment installed on or ordered for the Facility and any other information, including Books and Records, as Owner may deem reasonably necessary in connection with the preparation of Owner's tax returns, any tax incentives or other program administered by a Governmental Authority or other tax documentation. Contractor shall require that its Subcontracts effect the provisions of this Section 21.2 so that documentation supporting the information provided pursuant to this Section 21.2 is available for tax audit or other tax-related purposes and to support any application for any grant or other incentive for which the Facility may be eligible. Without limitation of the foregoing, Contractor agrees to cooperate with Owner in connection with establishing the eligibility of the Work and the Facility or portions thereof for any tax credit, tax incentive, or grant in lieu thereof, including by providing all documentation and information reasonably within its possession or to which it has access, required to establish such eligibility. Each Party shall reasonably cooperate with the other Party in connection with (i) the reporting of any taxes payable with respect to the Work; and (ii) any assessment, demand or inquiry of Governmental Authority, refund claim or proceeding relating to taxes potentially payable with respect to the Work.

Section 21.3 Notice of Document Destruction.

Prior to the expiration of the applicable document retention period, each Party, shall have the right to request from the other Party, at the requesting Party's sole cost and expense, the opportunity to make copies of all documentation or information required to be retained under this Contract. Upon expiration of the applicable document retention period, the retaining Party shall have the right to destroy any such documentation or information; *provided, however*, that no

such destruction shall occur until after the resolution of any request by the non-retaining Party to make copies of such documentation and/or information under this Section 21.3.

ARTICLE 22
CONFIDENTIALITY

Section 22.1 Confidentiality.

(a) Contractor shall keep confidential any and all Confidential Information provided by Owner or its Representatives (as defined below) in connection with this Contract. The term "**Confidential Information**" means any and all information furnished by Owner or its Representatives (as defined below) regarding Owner's or its Affiliates' properties, employees, finances, businesses, operations, assets and financial affairs that is non-public, confidential or proprietary in nature, whether furnished before or after the Effective Date, whether oral, written or electronic, and regardless of the manner in which it is furnished. Confidential Information includes (i) all data, reports, interpretations, forecasts and records containing or otherwise reflecting Confidential Information concerning Owner or its Affiliates, as applicable, in each case, whether prepared by Owner or others, and any summaries or other documents created by either Party or their Representatives which refer to, relate to, discuss, constitute, or embody all or any portion of Owner's Confidential Information. Owner shall not be obligated to specifically identify any information or materials as to which the protection is desired by notice or other action. Confidential Information does not include information which (A) is or becomes publicly available through no act of Contractor in violation of this Contract, (B) is approved for release by written authorization of Owner, (C) is or becomes available to Contractor on a non-confidential basis prior to its disclosure by Owner or its Representatives, or (D) was independently developed by Contractor without use of Owner's Confidential Information. As used in this Section 22.1, the term "**Representatives**" of a Party means such Party's and its Affiliates' officers, directors, members, managers, partners, principals, agents, employees, contractors, representatives and advisors (including, for example, attorneys, accountants, underwriters, lenders, and consultants) and, in the case of Owner, the Financing Parties, who, in each case, need to know the Confidential Information in connection with Contractor's performance of the Work. This Contract, any Exhibits hereto, any Change Orders, any Work Product, and the Proposal shall not be deemed Confidential Information.

(b) Except as otherwise permitted by this Contract, Contractor shall not (i) distribute or disclose to any third party any of Owner's Confidential Information, (ii) permit any third party to have access to such Confidential Information, or (iii) use such Confidential Information for any purpose other than for the purpose of performing the Work.

(c) Notwithstanding anything to the contrary in this Contract, Contractor may (i) disclose Confidential Information to its Representatives, provided each such Representative first agrees in writing to keep such information confidential in accordance with this Contract; and (ii) disclose Confidential Information reasonably required to be disclosed to prospective Subcontractors in the bidding of portions of the Work; *provided*, that Contractor includes in all bid solicitation packages a statement that all prospective bidders are obligated to keep all Confidential Information provided by Contractor confidential. Contractor shall notify Owner immediately following discovery of any unauthorized disclosure of Confidential Information by

Contractor or its Representatives. Contractor shall be responsible for any breach of the terms of this Section 22.1(c) by Contractor or any one or more of its Representatives.

(d) If either Contractor or its Representatives is required by Applicable Laws or pursuant to the rules of, or a listing agreement with, any national securities exchange or Governmental Authority, or is requested in any judicial or administrative proceeding to disclose any of Owner's Confidential Information or other information governed by this Section 22.1, then Contractor shall use commercially reasonable efforts to avoid and, if not avoidable, to minimize disclosure of such Confidential Information or information, as applicable, and to the extent permitted by law, give Owner prompt notice of such requirement or request so that Owner may seek an appropriate protective order, including any appeals at the expense of Owner. If, in the absence of a protective order, Contractor reasonably determines that it is nonetheless required to disclose the Confidential Information or information, as applicable, then Contractor may disclose such Confidential Information or information, as applicable, without liability hereunder, provided that Contractor promptly (i) notifies, to the extent permitted by Applicable Laws, Owner of any such disclosure, (ii) uses reasonable efforts to ensure that all Confidential Information and other information, as applicable, that is so disclosed will be accorded confidential treatment, and (iii) furnishes only that portion of the Confidential Information or other information, as applicable, which it is advised by counsel is legally required.

(e) Contractor acknowledges that Owner's Confidential Information (including tangible copies and computerized or electronic versions thereof) is and at all times remains the sole and exclusive property of Owner and Owner has the exclusive right, title, and interest to its Confidential Information. No right or license, by implication or otherwise, is granted by either Party as a result of disclosure of Confidential Information under this Contract.

(f) Each document generated by the Parties with respect to this Contract, including this Contract, may be imaged and stored electronically and (i) such imaged documents may be introduced as evidence in any proceeding as if such were original business records, and (ii) neither Party shall contest the admissibility of such imaged documents as evidence in any proceeding.

(g) The Parties agree that money damages are not a sufficient remedy for any breach of this Section 22.1, and that Owner shall be entitled to injunctive or other equitable relief to remedy or prevent any breach or threatened breach of this Contract, in each case without the necessity to post a bond or other security. Such remedy shall not be the exclusive remedy for any breach of this Section 22.1, but shall be in addition to all other rights and remedies available at law or in equity or otherwise under this Contract. In the event of litigation relating to this Contract, if a court of competent jurisdiction determines that Contractor has breached this Contract, Contractor shall be liable to Owner for the amount of the reasonable legal fees incurred in connection with such litigation, including any appeal therefrom.

(h) Contractor shall include in each Subcontract a provision requiring each Subcontractor to adhere to the requirements of this Section 22.1.

(i) Notwithstanding anything herein to the contrary, either Party may retain such Confidential Information as it is (or its Affiliates are) required to retain by law or for regulatory, administrative, policy or compliance purposes (including any such information contained in board, executive or investment committee papers). Any such retained Confidential Information will remain subject to the terms of this Contract.

ARTICLE 23
MISCELLANEOUS

Section 23.1 Authorized Representative.

Owner shall appoint an Authorized Representative and notify Contractor in writing of such representative's name, address, electronic email address, facsimile and telephone number within thirty (30) days of the Effective Date. Owner may, at any time, change the designation of its Authorized Representative, *provided*, Owner shall promptly notify Contractor in writing of such change. Such Authorized Representative shall be authorized to administer, but not modify or amend, this Contract on behalf of Owner and agree upon procedures and provide such information as is necessary for coordinating the efforts of the Parties. In order to secure effective cooperation and to deal on a prompt and orderly basis with the various scheduling and administrative issues which may arise in connection with the rights and obligations of the Parties hereunder, such Authorized Representative and the CCM shall reasonably and continuously cooperate and communicate with one another until the achievement of Final Completion.

Section 23.2 Assignments; Assigns.

(a) Except as set forth in this Section 23.2 and in Section 23.3, this Contract may be assigned only with the prior written consent of the other Party, such consent not to be unreasonably withheld.

(b) Owner may assign this Contract and any rights or obligations hereunder (including, without, limitation, those rights of the Owner under Section 16.4) to any Affiliate or any successor owner of the Facility, upon notice to, but without the consent of, Contractor; *provided, however*, such Affiliate or successor owner assumes, by written agreement, this Contract and all of Owner's obligations hereunder and subject to such entity's provision of evidence of satisfactory funding or financial arrangements to Contractor's reasonable satisfaction. Owner shall be released from liability hereunder upon the assumption of this Contract by such Affiliate or successor owner to the extent of such assumption.

(c) Owner may collaterally assign this Contract and any rights or obligations hereunder to any Financing Party as collateral security. In connection with any such collateral assignment, and upon request of Owner, Contractor agrees to cooperate with any Financing Party (i) to supply such information and documentation, (ii) to grant such written consents to the assignment of this Contract, (iii) to execute such amendments to this Contract as any Financing Party may require to the extent that the requested changes do not adversely affect the rights, obligations and liability limitations of Contractor hereunder and Contractor's entitlement to payment in accordance with this Contract, and (iv) to take such action or execute such documentation as any Financing Party shall reasonably require.

(d) This Contract shall be binding on, and inure to the benefit of, the Parties and their successors and permitted assigns.

Section 23.3 Financing Party Requirements.

Contractor acknowledges that Owner may borrow certain funds from the Financing Parties for the construction of the Facility and that, as a condition to making loans to Owner, the Financing Parties may from time to time require certain documents from, and agreements by, Contractor and its Subcontractors. In connection therewith, Contractor agrees to furnish to the Financing Parties, and to cause its Subcontractors to furnish to the Financing Parties, at Owner's sole cost and expense, such written information, certificates, waivers and releases, affidavits, customary consents to assignment of this Contract and other like documents as the Financing Parties may reasonably request (provided that Contractor shall not be required to agree to any material change to the terms and conditions of this Contract). In addition, to the extent payment is on a cost-plus basis, Contractor agrees to furnish to the Financing Parties copies of invoices and receipts from Subcontractors as may be reasonably required by the Financing Parties. In addition, Contractor agrees to consider, in good faith, acceptance and approval of all revisions or amendments to the Contract which are reasonably requested by the Financing Parties in order to facilitate financial closing, provided that such revisions or amendments are of a nature typically obtained by financing parties in non-recourse financing and do not reduce the Contract Price and do not materially change the terms and conditions of this Contract. At Owner's request and cost, Contractor shall cooperate with any independent engineer and technical advisor of the Financing Parties.

Section 23.4 Governing Law.

This Contract shall in all respects be governed by and construed in accordance with the laws of the State of Kentucky, without giving effect to any choice of law rules thereof which may direct the application of the laws of another jurisdiction.

Section 23.5 Severability.

If any provision of this Contract shall be held void, voidable, invalid or inoperative, no other provision of this Contract shall be affected as a result thereof, and, accordingly, the remaining provisions of this Contract shall remain in full force and effect as though such void, voidable, invalid or inoperative provision had not been contained herein; provided that in lieu of such void, voidable, invalid or inoperative provision, there will be added automatically as a part of this Contract a valid provision as similar in terms to such invalid provision as may be possible.

Section 23.6 Notices.

All notices permitted or required to be given under this Contract shall be in writing and shall be sent by personal delivery or courier service (such as FedEx or UPS) to the other Party at the address set forth below. Writing shall not include electronic mail, unless receipt is acknowledged by recipient.

If to Owner:

East Kentucky Power Cooperative Inc.
4775 Lexington Road
PO Box 707
Winchester, KY 40392
Attention: David Crews

with a copy to:

East Kentucky Power Cooperative Inc.
4775 Lexington Road
PO Box 707
Winchester, KY 40392
Attention: General Counsel

If to Contractor:

Lendlease (US) Public Partnerships LLC
909 Lake Carolyn Parkway, Suite 260
Irving, TX 75039
Attention: Ben Symons, Senior Vice President

with a copy to:

Lendlease Energy Development LLC
909 Lake Carolyn Parkway, Suite 260
Irving, TX 75039
Attention: Ross Metersky, Project Development Director

with a copy to:

Lendlease (US) Construction Holdings Inc.
200 Park Avenue, 9th Floor
New York, NY 10166
Attention: Thomas V. Giordano,
Senior Vice President and General Counsel

If such notice constitutes service of process, in addition to the forgoing addresses, such notice shall also be provided to the following:

Lendlease (US) Public Partnerships LLC
c/o CT Corporation System
111 Eighth Avenue
New York, NY 10011

Notices, addressed in compliance with the foregoing, shall be deemed received: (i) on the day on which such notice is delivered personally or (ii) the following Business Day if deposited with a recognized overnight carrier. Each Party shall have the right to change the place to which notice shall be sent or delivered or to specify one additional address to which copies of

notices may be sent, in either case by similar notice sent or delivered in like manner to the other Party.

Section 23.7 No Waiver of Rights.

Except as may be specifically agreed in writing, the failure of Owner or Contractor to insist in any one or more instances upon the strict performance of any one or more of the provisions of this Contract or to exercise any right herein contained or provided hereunder, shall not be construed as, or constitute in any way, a waiver, modification or relinquishment of the performance of such provision or right(s), or of the right to subsequently demand such strict performance or exercise such right(s), and such rights shall continue unchanged and remain in full force and effect. Electronic mail shall be considered a "writing" for purposes hereof.

Section 23.8 No Liability for Review.

No review and approval by Owner of any agreement, document, instrument, Drawing, Specifications, or design proposed by Contractor nor any inspection carried out by Owner pursuant to this Contract shall relieve Contractor from any liability that it would otherwise have had for its negligence in the preparation of such agreement, document, instrument, Drawing, Specification, or design or the carrying out of such works or failure to comply with the Applicable Laws with respect thereto, or to satisfy Contractor's obligations under this Contract nor shall Owner be liable to Contractor by reason of its review or approval of an agreement, document, instrument, Drawing, Specification, or design or such inspection.

Section 23.9 Duties and Remedies Limited.

The remedies of Owner and the liabilities of Contractor for damages hereunder are exclusive and limited, to the extent a remedy is expressly set forth in this Contract. Subject to the express limitations, waivers and releases set forth in this Contract, each Party shall be free to pursue all its rights at law or in equity or otherwise to enforce its remedies under the Contract.

Section 23.10 Entire Contract.

This Contract and its Exhibits, which are incorporated herein, contain the entire agreement between the Parties with respect to the subject matter hereof, and supersedes any and all prior and contemporaneous written and oral agreements, proposals, negotiations, understandings and representations pertaining to the subject matter hereof. There are no other oral understandings, terms or conditions, and neither Party has relied upon any representation, express or implied, not contained in this Contract. General or special conditions included in any of Contractor's price lists, invoices, tickets, receipts or other such documents presented to Owner shall have no applicability to Owner with respect to this Contract.

Section 23.11 Amendments.

Except for any Change directed by Owner pursuant to Section 7.2, no amendments or modifications of this Contract shall be valid unless evidenced in writing and signed by a duly authorized representative of the Party against which enforcement is sought.

Section 23.12 Survival.

Cancellation, expiration or earlier termination of this Contract shall not relieve the Parties of obligations that by their nature are intended to survive such cancellation, expiration or termination, and the following provisions shall explicitly survive termination of this Contract and the occurrence of Final Completion for the respective time periods set forth in such respective provisions: ARTICLE 1, ARTICLE 5, ARTICLE 10, ARTICLE 11, ARTICLE 12, ARTICLE 14, ARTICLE 16, ARTICLE 18, ARTICLE 19 , ARTICLE 20, ARTICLE 21, ARTICLE 22 and ARTICLE 23.

Section 23.13 No Third Party Rights.

This Contract and all rights hereunder are intended for the sole benefit of the Parties and, to the extent expressly provided, for the benefit of the Owner Indemnitees, and shall not imply or create any rights on the part of, or obligations to, any other Person.

Section 23.14 Owner's Obligations Non-Recourse.

The Parties acknowledge that each Party has entered into this Contract entirely on its own behalf, and not on behalf of its Affiliates and that such Party shall not have any recourse against any of the other Party's Affiliates, members, partners, parents, joint ventures, officers or directors for any reason.

Section 23.15 Relationship of the Parties.

Nothing in this Contract shall be deemed to constitute either Party a partner, agent or legal representative of the other Party, or to create any joint venture, partnership or fiduciary relationship between the Parties. Contractor is and shall remain an independent contractor in the performance of this Contract, maintaining complete control of its personnel, workers, Subcontractors and operations required for performance of the Work. Any provisions of this Contract that may appear to give Owner or the Authorized Representative the right to direct or control Contractor as to details of performing the Work, or to exercise any measure of control over the Work, shall be deemed to mean that Contractor shall follow the desires of Owner or the Authorized Representative in the results of the Work only and not in the means by which the Work is to be accomplished, and Contractor shall have the complete right, obligation and authoritative control over the Work as to the manner, means or details as to how to perform the Work. Nothing herein shall be interpreted to create a master-servant or principal-agent relationship between Contractor, or any of its Subcontractors, and Owner. Nevertheless, Contractor shall strictly comply with all provisions, terms and conditions of this Contract, and the fact that Contractor is an independent contractor does not relieve it from its responsibility to fully, completely, timely and safely perform the Work in strict compliance with this Contract.

Section 23.16 Counterparts.

This Contract may be executed in two or more counterparts, including by facsimile and electronic transmission, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

Section 23.17 Further Assurances.

Contractor and Owner agree to provide such information, execute and deliver any such instruments and documents and to take such other actions as may be necessary or reasonably requested by the other Party that are not inconsistent with the provisions of this Contract and that do not involve the assumptions of obligations greater than those provided for in this Contract, in order to give full effect to this Contract and to carry out the intent of this Contract.

Section 23.18 Priority.

The documents that form this Contract are listed below in order of priority, with the document having the highest priority listed first and the one with the lowest priority listed last. In the event of any conflict or inconsistency between a provision in one document and a provision in another document, the document with the higher priority shall control. In the event of a conflict or inconsistency between provisions contained within the same document, then the provision that requires the highest standard of performance on the part of Contractor shall control. This Contract is composed of the following documents, which are listed in priority:

(a) Change Orders or written amendments to this Contract;

(b) this Contract; and

(c) Exhibits to this Contract.

Section 23.19 Foreign Corrupt Practices Act. With respect to the performance of the Work, each Party shall, and shall cause each of its contractors (or, in the case of Contractor, its Subcontractors), and the agents and employees of each of them to, comply with all provisions of the Foreign Corrupt Practices Act of the United States (15 U.S.C. § 78dd-1 and 2), as amended (or, if such act is not applicable to a Person, to act in such manner that would comply with the provisions of such act were it applicable to such Person). Neither Party shall take any action that could result in the other Party or any of its Affiliates becoming subject to any action, penalty or loss of benefits under such Act and shall not make, direct or indirect payments of a corrupt nature, to employees, agents or public employees of a government, or candidates or active members of political parties, in order to obtain or maintain business.

Section 23.20 Escrow Waiver. The Parties agree to waive the escrow provisions of K.R.S. 371.160 if and to the extent such provisions apply to this Contract.

Section 23.21 Nondiscrimination. At all times while Contractor is performing the Work, Contractor must comply with federal law regarding equal employment opportunity. Unless otherwise exempted by rules, regulations or orders of the Secretary of Labor, Contractor agrees that, to the extent applicable, the following clauses are hereby incorporated by reference into the Project Documents, and the Contractor agrees to comply with the requirements of each of the following clauses:

(a) the equal opportunity clause of Executive Order 11246, as amended, and set forth in 41 C.F.R. §§ 60-1.4(a) and 60-1.4(b);

(b) the equal opportunity clause for workers with disabilities, pursuant to the Department of Labor's regulations under Section 503 of the Rehabilitation Act of 1973, as amended, as set forth in 41 C.F.R. § 60-741.5(a);

(c) the equal opportunity clause for certain protected veterans, pursuant to the Department of Labor's regulations under Section 402 of the Vietnam Era Veterans' Readjustment Assistance Act of 1974, as amended, and set forth in 41 C.F.R. § 60-300.5(a);

(d) the notification requirements to employees regarding their rights under federal labor laws pursuant to Executive Order 13496 and 29 C.F.R. Part 471, Appendix A to Subpart A; and

(e) all applicable rules and related implementing regulations for the above.

Section 23.22 Application of Nondiscrimination Requirements to Subcontractors. Contractor shall require that all Subcontractors comply with the provisions set forth or described in Section 23.21(a) through (e) above, unless exempted by any applicable rules, regulations or orders. Further, Contractor shall include the provisions set forth or described in Section 23.21(a) through (e) above in every Subcontract, unless exempted by any applicable rules, regulations or orders (including, with respect to Section 23.21(a), the rules, regulations and orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246, dated September 24, 1965), so that such provisions shall be binding upon each Subcontractor performing any portion of the Work. Contractor shall take such action with respect to any Subcontract as the agency administering the regulation that requires such provisions may direct

as a means of enforcing such provisions, including sanctions for non-compliance. In the event that Contractor becomes involved in, or is threatened with, litigation with a Subcontractor as a result of such direction by the agency, Contractor may request the United States to enter into such litigation to protect the interests of the United States.

Section 23.23 Compensation; No Kickbacks. Contractor must comply, and must ensure that its Subcontractors comply, with Title 18 U.S.C. § 874, 40 U.S.C. § 3145, and the regulations issued pursuant thereto, which prohibit kickbacks from public works employees under penalties of law.

Section 23.24 Debarment And Suspension. Contractor represents and warrants that neither it nor any of its "principals" (as defined in 2 C.F.R. Part 417) is presently debarred, suspended, proposed for debarment, voluntarily excluded or declared ineligible by any Federal department or agency from participation in any "covered transaction" (as defined in 2 C.F.R. Part 417). Contractor agrees to comply with Subpart C [Responsibilities of Participants Regarding Transactions] of 2 C.F.R. Part 417 in connection with the performance of this Contract. Contractor further agrees to cause each party performing services or providing goods (a) which relate to the performance of this Contract and (b) the payments for which are expected to equal or exceed $25,000 (or such other amount as is specified from time to time in 7 C.F.R. Part 417.220) to provide a representation and warranty and agreement substantially identical to the representation and warranty and agreement in the first two sentences of this Section 23.24.

Section 23.25 Prevailing Wage Requirements. Contractor shall at all times comply with federal and state prevailing wage laws, including the Davis-Bacon Act (subchapter IV of Chapter 31 of Title 40 U.S.C.) and all regulations of the Department of Labor set forth in 29 C.F.R. Parts 1, 3 and 5 (including those set forth on Exhibit HH attached hereto), and Contractor shall require its Subcontractors to comply with the same.

[Signature pages follow]

IN WITNESS WHEREOF, the Parties, intending to be legally bound, have caused this Contract to be executed by their duly authorized officers.

East Kentucky Power Cooperative, Inc.

By: _____

Name: Anthony S. Campbell

Title: President and CEO

Date: _____

Lendlease (US) Public Partnerships LLC

By: _____

Name: Ben Symons

Title: Senior Vice President

Date: 6/27/16

[Signature Page to Turnkey Engineering, Procurement and Construction Agreement]

EXHIBIT A

SCOPE OF WORK

8.5 MW_{AC} PHOTOVOLTAIC SOLAR PROJECT

TABLE OF CONTENTS

1.0 GENERAL

1.1 Definitions

A. "AC" or "ac" shall mean alternating current.

B. "AC System Losses" shall mean the heating loss (I^2R) through the AC cabling and magnetization and winding losses associated with the inverter step-up transformers and is exclusive of auxiliary loads.

C. "AGREEMENT" shall mean the Turnkey Engineering, Procurement and Construction Agreement between OWNER and CONTRACTOR.

D. "ARRAY" shall mean a collection of solar modules connected in series, all tying into one Power Conversion Station (PCS).

E. "AUXILARY LOADS" shall mean power consumption activities not directly associated with power generation or transmission losses. These include, but are not limited to HVAC losses and SCADA system power.

F. "DC" or "dc" shall mean direct current.

G. "DCS" means distributed control system.

H. "EXCLUDED AREA" shall mean an area designated by OWNER in writing in or through which CONTRACTOR is not allowed to place equipment or route cabling, either above or below grade.

I. "FTB" shall mean Fluidized Thermal Backfill.

J. "GRC" shall mean Galvanized Rigid Conduit.

K. "HZ" shall mean hertz.

L. "INTERCONNECTION POLE" shall mean the OWNER-provided pole which serves as Point of Common Coupling.

M. "INVERTER ENCLOSURE" shall mean the housing/structure/shelter containing the static power inverters.

N. "kV" shall mean kilovolts.

O. "kW" shall mean a measure of instantaneous power as measured in kilo-Watts. If not specified in particular it shall be assumed to be in Alternating Current (AC).

P. "kWH" shall mean kilo-Watt-hours. If not specified in particular it shall be assumed to be in Alternating Current (AC).

Q. "Materials" shall mean products that must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form parts of the Work.

R. "PCC" or "Point of Common Coupling" shall mean the physical point at OWNER Primary Meter at which the electrical interconnection is made

between the PROJECT and OWNER's electrical grid as indicated in the AGREEMENT.

S. "PCS" shall mean the Power Conversion Station consisting of the power inverter, inverter step-up transformer, cabling, and grounding system.

T. "PV" shall mean photovoltaic.

U. "RTU" shall mean remote terminal unit.

V. "SCADA System" shall mean the Supervisory Control and Data Acquisition system, and shall include all monitoring/control hardware and software, field instrumentation and communication devices.

W. "STC" shall mean standards test conditions, which is 1000 watts per square meter insolation, 25ºC module temperature, 1.5 AM (air mass).

X. "THD" shall mean Total Harmonic Distortion.

Y. "Turn Over" shall mean the transfer of care, custody and control of the PROJECT from CONTRACTOR to OWNER.

Capitalized terms not otherwise defined above or elsewhere in this Exhibit A shall have the meaning given such terms in the AGREEMENT.

1.2 CONTRACTOR Scope of Work Overview

A. CONTRACTOR shall furnish a combination of fixed-tilt ground-mounted and single-axis tracker, utility-scale PROJECT for OWNER at the specified ENERGY PRODUCTION defined in the AGREEMENT.

B. The PROJECT shall be capable of operating in accordance with this "Scope of Work" and associated Exhibits and Attachments. The Work shall include all Equipment, Materials and systems required to produce and deliver solar energy from the solar PV modules to the Electric Metering Device(s) or PCC. CONTRACTOR shall design and construct the PROJECT in accordance with this Specification, the Indicative array layout Sheet 1.0 dated 5/13/16 "Placement Study" attached as Exhibit B, and the indicative "Single Line Diagram" Sheets 1.0 and 2.0 dated 6/2/16. Scope of Work shall consist of, but not be limited to the following:

1. Specify, furnish and install the Equipment and Materials required for a complete installation which shall include, but not be limited to PV modules, structural support systems, PV module string DC wiring, DC combiner boxes, inverters, medium voltage step-up transformers, SCADA system and ancillary hardware required to connect and operate listed equipment.

2. PROJECT design engineering and drawing packages for construction permitting, installation and "as-built" documentation.

3. PROJECT construction including all site/civil work, structural, electrical, mechanical and monitoring/control systems.

4. PROJECT and construction management, including quality assurance/quality control, site safety, site material control and management of all subcontractors.

5. PROJECT Turn Over including OWNER's training and PROJECT operations and maintenance documentation.

6. Project commissioning and testing in accordance with Exhibits N and O.

C. CONTRACTOR shall provide new, unused and undamaged Equipment and Materials. Refurbished Equipment and Materials shall not be acceptable.

D. CONTRACTOR shall provide all design documentation required to support OWNER's activities and responsibilities interfacing with CONTRACTOR on the PROJECT.

E. CONTRACTOR shall obtain all permits required to build and operate the PROJECT, except those to be provided by Owner as identified in Exhibit E. For clarity, Contractor Permits shall not include zoning permits.

F. CONTRACTOR shall be responsible for coordinating with OWNER for deliveries and Site security and activities which shall be subject to PROJECT safety standards.

G. Temporary Facilities

1. CONTRACTOR shall be responsible for establishing and maintaining worker welfare area, and other construction office for the duration of the construction and commissioning portion of the PROJECT.

2. CONTRACTOR shall provide temporary sanitary facilities consisting of above ground Porta-John type facilities. One such unit shall be dedicated for OWNER's use, if OWNER office does not include a sanitary facility.

3. CONTRACTOR shall maintain on-site dumpsters and personnel to maintain a clean and rubbish free work site.

I. CONTRACTOR shall be responsible for design and implementation of dust suppression and erosion control measures.

J. CONTRACTOR shall be responsible for storm-water quality requirements or retention basin requirements during construction as dictated by applicable law. If required, permanent storm-water quality requirements and retention/detention ponds and drainage ditches shall be installed in accordance with local, state, and federal requirements.

K. CONTRACTOR shall provide engineering studies as necessary to ensure system safety and functionality, refer to Exhibit CC. These engineering studies shall be made available to OWNER for review.

L. CONTRACTOR shall Turn Over the PROJECT to OWNER at Substantial Completion according to the requirements set forth herein.

1.3 OWNER Provided Facilities and Services

A. OWNER will provide a fully functional interconnection. OWNER will be responsible for all work associated with the interconnection from and after the INTERCONNECTION POLE, including installation of the OWNER's metering and circuit protection. CONTRACTOR shall be responsible for connecting the PROJECT, including the solar field collection system, to the INTERCONNECTION POLE.

B. OWNER will provide a boundary and topographical site survey of the existing site conditions and Site via an AutoCad dwg file.

C. Title Report

D. Environmental and archaeological studies and reports

E. Wetland delineation

F. OWNER will provide the applicable environmental permits as outlined in Exhibit E.

G. OWNER will furnish and install a fiber optic communications line to the PCC. OWNER shall connect the fiber optic to any Equipment provided by CONTRACTOR that will be monitored and controlled for the PROJECT.

1.4 Site and Environmental Criteria

A. PROJECT design shall be based upon the design conditions listed below and in accordance with the Kentucky State Building Code, 2013 Edition. In the event of discrepancies, the more stringent design constraint shall govern:

Table 1-1
Existing Site Design Conditions

Project Location	Approximately ¼ mile north of EKPC Lexington Rd, Winchester, KY (Clark County)
Minimum/Maximum Dry Bulb Temperature/Wet Bulb Temperature	Dry bulb temperature – Extreme Annual Mean Max: 35.1°C Dry bulb temperature – Extreme Annual Mean Min: -17.5°C Wet bulb temperature – hottest month 0.4%: 25.2°C (ASHRAE Fundamentals; Lexington / Blue Gras KY)
Maximum Relative Humidity	Humidity ratio – median of extreme highs: 147 gr/lb (NOAA; Engineering Weather Data; Louisville/Standiford KY)
Average Elevation	950 feet above mean sea level (USGS 7.5' Quad) Ranges from 9 ft to 990 ft.
Environmental Conditions	Wetlands and ponds throughout Site. Owner to provide surveyed coordinates to Contractor for boundaries.
Site Road Access	Site immediately adjacent to Interstate 64 but no direct access from the Interstate. Access is available from Lexington Road (Highway 60) via the existing EKPC driveway.

<table>
<tr><td>Seismic Criteria</td><td>Ss = 0.197
S1 = 0.090
Modules and Racking, Risk Category I
Inverters/XFMR, Risk Category II</td></tr>
<tr><td>Wind Design</td><td>Modules and Racking , Risk Category I map, 105 mph
Inverters/XFMR, Risk Category II map, 115 mph
Assume Exposure Category C</td></tr>
<tr><td>Snow/Ice Load</td><td>Ground Snow, 15 psf (Consideration shall be made related to clearance from bottom of panel to ensure that ground snow depth plus sliding snow does not also cause damming). A minimum lowest panel height above existing grade to be 18 inches.
0.75 inches of Ice with 30mph wind</td></tr>
<tr><td>Frost Depth</td><td>18 inches below grade</td></tr>
<tr><td>Risk Category</td><td>Panels: Risk Category I
Substation structures, Inverters/XFMR: Risk Category II</td></tr>
<tr><td>Storm water velocity and depth</td><td>Site generally flows from north to south. There is not a significant upstream watershed based on USGS 7.5’ Quad, however, the interstate drainage swale may outfall to the pond within the site during large storm events. Channelized flow from offsite and onsite areas occurs in southwest portion of the Site.</td></tr>
<tr><td>Precipitation</td><td>Average Annual: 45.21 inches; Min. Annual: 2.9 inches; Approximate Rainfall Depths: (from US Department of Commerce/US Weather Bureau – Technical Paper 40)
<table>
<tr><th>Duration</th><th>100-Year Return Period</th><th>25-Year Return Period</th><th>10-Year Return Period</th></tr>
<tr><td>1 hour</td><td>2.83 inches</td><td>2.32 inches</td><td>2.04 inches</td></tr>
<tr><td>6 hour</td><td>4.35 inches</td><td>3.61 inches</td><td>3.20 inches</td></tr>
<tr><td>24 hour</td><td>6.04 inches</td><td>5.00 inches</td><td>4.26 inches</td></tr>
</table></td></tr>
<tr><td>100 yr / 24 hr Rainfall</td><td>6.59 in (NOAA Atlas 14)</td></tr>
<tr><td>Design Maximum Rainfall Rate</td><td>100-year</td></tr>
<tr><td>Wetlands</td><td>Wetlands are shown on the Site map near the ponds and pond outfalls to Hancock Creek within the Site per Exhibit B.</td></tr>
<tr><td>Floodplains</td><td>No floodplains are located within the site area.</td></tr>
<tr><td>Existing Site/ Grade</td><td>Refer to Owner provided topographical map.</td></tr>
<tr><td>Subsurface Soil Conditions</td><td>Refer to USDA Soil Survey, see Exhibit A Attachment 1. Also, refer to Owner provided Geotechnical Survey / Report.</td></tr>
</table>

1.5 Design Criteria

A. PROJECT and individual components shall have a minimum design life of 25 years.

B. PROJECT shall be designed for fully automatic operation.

C. PROJECT ENERGY PRODUCTION shall be as specified in the AGREEMENT.

D. PROJECT electrical design will be in compliance with applicable codes and standards listed under section 1.7 unless otherwise noted.

E. PROJECT system shall be designed as to maximize OWNER annual energy production.

F. PROJECT system shall be designed to operate grid-tied to the EKPC distribution system. The PROJECT will be configured to provide grid support (see section 1.6 Operating Criteria).

G. During engineering design, CONTRACTOR shall work with OWNER when determining all signage, labeling and nomenclature.

1.6 Operating Criteria

A. DC grid voltage: 1500 Volts DC (or lower), grounded or floating, ungrounded.

B. AC grid voltage: 12.5 kV, 60 HZ, 3 phase

C. DC & AC electrical systems under 1000 V shall be radially configured. Medium voltage AC systems shall be loop configured. No redundancy is required.

D. Convenience Power: 120 VAC at each Inverter Station

E. Instrumentation voltage: 24 volts DC or 125VDC

F. Communications network: Ethernet via direct buried fiber optic or CAT-5 in conduit within the arrays and overhead to the substation via the OPGW if applicable.

G. PROJECT system will provide the following grid support functionality:

1. Remote controlled Power Factor adjustment (Minimum 0.95 leading/lagging at full rated power, measured at POCC)
2. Remote controlled power reduction
3. No-load VAR support (aka “Q at night”)
4. Programmable dynamic grid support (frequency-dependent voltage support, reactive power-dependent voltage support)
5. Low Voltage Ride Through (LVRT)

1.7 Codes, Regulations and Standards

A. In the event that any Applicable Law or industry standard does not govern specific features of any item of EQUIPMENT and MATERIALS, temporary Work or system, CONTRACTOR or Original Equipment Manufacturer (OEM) standards shall be applied, with OWNER’s approval. Where local codes or

ordinances will have an impact on the design of the PROJECT, OWNER and CONTRACTOR shall jointly address these with the local Governmental Authorities having jurisdiction.

B. Listed herein are the principal codes and standards applicable in the design, fabrication and installation of the PROJECT; these are not intended to be all inclusive. Where local codes or ordinances will have an impact on the design, CONTRACTOR shall be responsible for meeting the codes or obtaining variances from local Governmental Authorities having jurisdiction.

C. CONTRACTOR shall design and construct the PROJECT in accordance with the latest editions of the following standards, as applicable:

1. ACI - American Concrete Institute
2. AISC - American Institute of Steel Construction
3. ANSI - American National Standards Institute
4. AHI – Air-Conditioning, Heating and Refrigeration Institute
5. AISI – American Iron and Steel Institute
6. ASCE – American Society of Civil Engineers
7. ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers
8. ASME – American Society of Mechanical Engineers
9. ASTM - American Society for Testing and Materials
10. FM – Factory Manual
11. KBC - Kentucky Building Code
12. ICEA - Insulated Cable Engineers Association
13. IEC - International Electrotechnical Commission
14. IEEE - Institute of Electrical and Electronics Engineers
15. PCS – Instrumentation Society of America
16. ISO – International Standards Organization
17. NOAA – National Oceanic and Atmospheric Administration
18. NEC – 2014 National Electrical Code
19. NEMA - National Electrical Manufacturers Association
20. NESC - National Electrical Safety Code
21. NETA - 2005 National Electrical Testing Association
22. NFPA – National Fire Protection Association
23. NIST – National Institute of Standards and Technology
24. OSHA - Occupational Safety and Health Act

25. TUV SUD America
26. UL – Underwriters' Laboratories

In the case where standards have conflicting requirements, OWNER and CONTRACTOR will develop a mutual agreement of the prevailing standards.

2.0 SPECIAL CONDITIONS

2.1 Construction Water

A. CONTRACTOR will be allowed to fill water trucks with reasonable amounts of water from a designated fire hydrant located on the real property described in the ALTA Survey OWNER shall make such designation within 30 days after issuing NOTICE TO PROCEED to CONTRACTOR. CONTRACTOR shall use a back flow preventer when filling the water trucks. No permanent taps into any existing water pipelines will be permitted.

B. If additional water is needed, CONTRACTOR shall be responsible for securing additional water sources and hauling water to the Site.

2.2 Special Site Conditions

A. CONTRACTOR Site layout and design shall account for all existing easements and environmental features, including but not limited to existing gas line easements, archaeological site, wetlands, septic leach fields, creek, etc as disclosed by Owner or reflected on the Site plan attached as Exhibit B.

B. CONTRACTOR shall not be responsible for capacity limits of existing creek crossing for vehicle and delivery loads. Load Limit is 30 Tons for the existing creek crossing / bridge.

3.0 EQUIPMENT AND MATERIALS

3.1 CONTRACTOR shall furnish all EQUIPMENT AND MATERIALS as required to construct a fully functioning PROJECT. Minimum requirements for major equipment are described herein:

3.2 PV Modules

A. Technology: Only Silicon Multi-Crystalline or Mono-Crystalline; or Thin Film technologies with proven commercial reliability are acceptable. CONTRACTOR to state what PV module technology will be utilized, for OWNER review and approval.

B. Module Performance Data: Provide nominal module power rating at standard test conditions (STC) for modules to be used in solar arrays, and their power rating tolerance. CONTRACTOR to provide I-V curves for different insolation values for proposed modules and their electrical and physical characteristics.

C. Cable leads with locking multi-contact connectors (MC4 type or equal).

D. Certified for reliability and safety according to UL or IEC 61646 and TUV Safety Class II.

E. Manufacturing certified to ISO9001:2000 and ISO 9001 quality and ISO14001:2004 environmental standards.

F. Modules shall be UL listed at time of installation.

G. The following suppliers have been deemed "pre-approved" by OWNER:

1. Canadian Solar, Inc.
2. First Solar
3. Hanwha Q Cells
4. JA solar
5. Jinko Solar
6. Kyocera Solar, Inc.
7. Solar World
8. SunPower
9. Trina Solar

3.3 Module Support Structure

A. The PV module support structures shall be designed and constructed to provide a stable support system for the PV modules that will remain effective throughout the design life of the PROJECT.

B. An allowance is included in Exhibit C for the foundations, which shall be driven galvanized or equivalent corrosion-resistant steel members, mini-cast augured piles or equivalent. CONTRACTOR shall perform tests at the Site to determine the appropriate piles referenced above to be used for the Project to be mutually agreed upon by CONTRACTOR and OWNER prior to the commencement of such tests.

C. CONTRACTOR shall provide a corrosion study. Corrosion resistance for foundations shall be as required by the findings of the Geotechnical Report and corrosion study, to maintain integrity for design life of the PROJECT.

D. PV module support sub-structure frame may be corrosion-resistant steel or extruded aluminum.

E. Mounting hardware shall include corrosion resistant clips and fasteners.

F. Cathodic protection to be evaluated by CONTRACTOR to verify soil conditions are compatible with the PV module support structures.

G. The support structure shall minimize deflections to prevent PV module and electrical system damage and shall not exceed allowable limits provided by the

manufacturer and the 2013 Kentucky Building Code and ASCE-7 2010 (or latest edition).

H. The PV module support system shall be designed and constructed to withstand environmental conditions and applied loads for the design life of the PROJECT.

I. The following fixed-tilt racking suppliers have been deemed “pre-approved” by OWNER:

1. Applied Energy Technologies (AET)
2. Hilti
3. Legrand
4. Schuff Steel
5. Schletter
6. Solar Flexrack
7. SunLink
8. Unirac

J. The following single axis tracking suppliers have been deemed “pre-approved” by OWNER:

1. Array Technologies (ATI)
2. First Solar
3. NEXTracker
4. Solar Flexrack
5. SunLink
6. SunPower

3.4 DC Wiring

A. Harnesses or cabling shall be rated to withstand sunlight and heat as defined per Table 1-1 and NEC requirements.

B. Locking multi-contact connectors shall mate with PV module terminations.

C. Harnesses and cabling shall be UL Listed.

3.5 DC Fused Combiner Boxes

A. Enclosure shall be rated NEMA 4 with continuous hinge single door with minimum three point latch.

B. Factory assembled back panel complete with 1000 VDC finger safe fuse holders for positive conductors, power distribution blocks, labeling and signage.

3.6 Power Conversion Stations (PCS)

A. Each PCS shall consist of a minimum of 500 kWac of inverter and inverter step up transformer capacity (for fixed-tilt system; tracking system may be smaller), 1500 VDC cabling, 600 VAC cabling, grounding system.

B. Inverters

1. Environmental ratings: Per Table 1-1.
2. Nameplate: Minimum 500 kWAC.
3. Power factor of 0.99 or greater up to 20% above rated power.
4. Maximum power point (MPP) control: Inverter shall have MPP control to maximize power output in dynamic response to operating output current and voltage of arrays. The MPP voltage window shall allow for automatic start-up and prevent shut down at high voltages.
5. Current harmonics: <5% THD.
6. Inverter cooling system shall be integral to unit and not be susceptible to particle contamination and require minimal maintenance.
7. Inverters that are used with systems having ungrounded PV Arrays shall be provided with ground isolation detection devices.
8. Inverters shall be provided with a screen/interface to allow for the operator to monitor and control.
9. California Energy Commission weighted efficiency (or conforming to the guidelines in "Performance Test Protocol for Evaluating Inverters Used in Grid-Connected Photovoltaic Systems" by Sandia National Laboratories): >97% without medium voltage step-up transformer.
10. AC output shall not reduce power output below level governed by available DC power at any value below its nameplate, and below inverter maximum operating temperature.
11. Inverter(s) shall be operated by CONTRACTOR in accordance with OEM recommendations. Any deviation shall be authorized in writing from the OEM but not before notification and acceptance by OWNER.
12. CONTRACTOR shall endeavor to provide a UL Listed inverter assembly. However, OWNER recognizes that completed assemblies may not carry a UL Listing.
13. Inverter shall be designed to IEEE-519 standards.
14. Self-protective features and self-diagnostic features shall employ, at minimum, the following protection functions:
    a. Over-voltage.
    b. Under-voltage.
    c. AC over-frequency.
    d. AC under-frequency.

e. Over-current.

f. Over temperature.

g. Anti-islanding (except as allowed by grid management functions).

h. Out-of-phase reclosing block function.

i. DC and AC disconnects (unless provided in separate enclosure on PCS).

j. Surge suppression on DC input and AC output.

15. The following inverter suppliers have been deemed “pre-approved” by OWNER:

a. ABB

b. Bonfiglioli

c. Eaton

d. General Electric (only units in production since 2012)

e. Ingeteam

f. Power Electronics

g. SMA

h. Schneider Electric

i. Solectria

j. TMEIC

3.7 Inverter Step-up Transformers

A. Oil filled transformers are preferred but not required. Dry type shall be considered acceptable.

B. The transformers shall conform to the following standards:

1. C2, "ANSI National Electrical Safety Code"

2. C57.12.00 “IEEE Standard General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.”

3. C57.12.26, "IEEE Standard for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for use with separable Insulated High-Voltage Connectors (34,500 GrdY/19,920 Volts and Below, 2500 kVA and Smaller)"

4. C57.12.28, "IEEE Standard for Pad-Mounted Equipment – Enclosure Integrity"

5. C57.12.37, "IEEE Standard for the Electronic Reporting of Distribution Transformer Test Data"

6. C57.12.90, "IEEE Standard Test Code for Liquid-Immersed Distribution, Power and Regulating Transformers"
7. C57.106, "IEEE Guide for Acceptance and Maintenance of Insulating Oil in Equipment"
8. IEEE 386, "IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems above 600 V"
9. Department of Energy, 10 CFR Part 431, Distribution Transformers Energy Conservation Standards
10. FM Approved and UL classified.
11. NFPA 850, “Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations.”

C. Service Conditions

1. Temperature rise to conform to ANSI C57.12.00 Article 5.11.
2. Winding insulation: maximum 65°C average winding temperature rise and maximum 80°C hot spot conductor temperature rise above average ambient air temperature of 30°C.

D. Ratings

1. 1000 kVA and over, impedance 5.0% (minimum) plus/minus 2.5% at a power factor of 80%, cooling class = ONAN and nameplate kVA.
2. 500 KVA and below, impedance 2.50% (maximum) plus/minus 2.5% at a power factor of 80%, cooling class = ONAN and nameplate kVA.
3. BIL ratings: Transformer 95 kV secondary 30 kV primary; High Voltage Bushings – 95 kV.
4. Primary voltage: Between (200 and 480 V) DELTA or as matched to selected inverter.
5. Secondary Voltage: 12.5 kV WYE with elbow arrestors.

E. Construction

1. Compartmental pad-mount design with dead front.
2. High Voltage (HV) Bushings and Terminals
    a. Transformers shall be supplied with externally clamped 200 amp or 600 bushing wells manufactured by Elastimold, ABB, Cooper Power or approved equal.
    b. Bushing wells shall be removable to allow replacement without opening the tank.
    c. Bushing wells shall have copper or aluminum conductors and removable studs.

d. Bushing wells shall be shipped without inserts and with dust caps installed.

e. Bail tabs on HV bushing wells or on well retaining clamps are NOT acceptable. For a 200 amp application, clamping studs/bolts shall allow for the installation of Feed-Through bushing inserts without interference.

f. The manufacturer's name and date of manufacture (month & year) shall be permanently marked on the front of the bushing. This information shall be visible after installation.

g. The bushings shall have Hl, H2, & H3 (for Radial Feed), or H1A, H2A, H3A, H1B, H2B, &H3B (for Loop Feed) phase designation legibly marked adjacent to each bushing with a nameplate of corrosion resistant material, decal or stencil.

3. Low Voltage (LV) Bushings and Terminals

a. Four low voltage externally clamped spade connectors or bushings with spades attached shall be provided. All four LV terminals shall include tinned copper or tinned aluminum spades.

b. Each low voltage spade connector shall be provided with a cantilever support attached to the end of the spade and anchored to the transformer.

c. Each low voltage bushing shall have a corrosion resistant nameplate, decal, or stencil with the appropriate phase designation (HOXO, XO, Xl, X2, X3) located adjacent to the corresponding bushing.

d. Spade bushings suitable for connecting cables of the size, type and number per phase.

F. Nameplate

1. Nameplates shall provide all information, Nameplate B (for less than 750kVA) or C (for 750 -1000kVA) per IEEE C57.12.00.

2. The nameplate shall indicate "Filled with Non-PCB Mineral Oil That Contained Less Than 2 PPM PCB at Time of Manufacture".

3. The nameplates shall be attached to the transformer tank in a location that would be not be obstructed by the installations of conductors. The nameplate may be attached to the transformer door if the style and serial number is included on a tank nameplate.

4. The nameplate connection diagram shall indicate the bayonet fuse size, manufacturer name and catalog number and the partial range CL fuse catalog number.

5. The manufacturer's recommended maximum safe transformer tilt from side to side and front to back shall be provided on the transformer nameplate; designs shall allow for up to a 5-degree tilt minimum.

G. Overcurrent Protection

1. The transformer primary shall include a loadbreak bayonet fuse holder (manufactured by ABB or Cooper Power) with expulsion fuse link in series with a partial range under-oil current-limiting (Cl) fuse.
2. The fusing is intended to protect the transformer from violent tank rupture. The manufacturer shall design the tank and core-coil assembly to achieve this protection based on the specified fusing.
3. On all units, minimum impedance shall be coordinated with the specified fusing to avoid damage/melting of partial range under-oil current-limiting fuses for any fault at the secondary terminals when supplied by an infinite source on the LV side.
4. A drip tray shall be provided under the bayonet fuse holder to catch oil during field operations; a clip-on drip tray is acceptable.

H. Accessories

1. No load tap changer with high voltage taps: (2) 2.5% above and (2) 2.5% below nominal position – fully rated.
2. A pressure relief valve (PRV) with the following characteristics shall be provided.
    a. Opening and closing will be per ANSI standards
    b. Minimum discharge of 50 SCFM @ 15 psig.
    c. Shall be Qualitrol #202-032-01, Tomeo #1750K-5 or approved equal.
    d. PRV and tank withstand ratings shall be coordinated with overcurrent protection to minimize the likelihood of tank rupture in the event of an internal arcing fault.
3. A bottom one-inch drain/filter valve with sampling device shall be provided in the HV cable compartment at one side to avoid interference with installed cables.
4. A top one-inch filling port with plug shall be located in the transformer tank.
5. A magnetically operated, dial type oil level gauge shall be located on the tank wall of the LV cable compartment.
6. Provision for a pressure/vacuum gauge shall be located in the LV cable compartment or external cabinet.
7. A dial type top-oil temperature gauge with a resettable maximum temperature indicator shall be located in the LV cable compartment.
8. Alarm contacts shall be provided for transformer oil level, oil temperature, and tank pressure.

I. Cabinet/Tank

1. Color shall be Olive Green Munsell 7GY3.29j1.5, or Owner approved other, unless specified otherwise.
2. Manufacturer shall provide written field maintenance procedures for each coating.
3. Cabinet door hinge pins and barrels shall be captive and made of stainless steel.
4. Doors shall maintain proper alignment during shipment and installation; if necessary, temporary braces shall be installed.
5. Cabinet doors shall be full height for worker access to HV and LV cables and accessories, or shall be hinged to open up.
6. All compartment and barrier doors shall be equipped with captive stops for holding each door in a 90-degree open position.
7. The door sill height shall be twelve inches maximum.
8. Cabinet door shall be able to be secured in the closed position with a short-shank (approximately 1") padlock installed over a penta-head bolt assembly, which shall be captive and field replaceable.
9. The door to the high voltage compartment shall be secured by one or more captive penta-head bolts that are accessible after the low voltage door is opened.
10. The high voltage and low voltage terminating compartments shall be separated by a minimum 13 gauge mild steel barrier.
11. The tank shall be a welded design with a bolted handhole or a bolted tank lid. Bolted tank lid designs will not require a bolted handhole if the following requirements are met:
    a. The bolted lid design meets the requirements for cabinet security as defined in IEEE C57.12.28.
    b. The bolted cover can be removed without removing or disturbing the door/cabinet assembly of the primary and secondary compartments.
    c. The handhole or tank lid shall be bolted and gasketed with bolts that are not accessible from the outside of the transformer. The handhole shall be of sufficient size and located to allow for internal inspections.

J. Core/Coil

1. Secondary "strip" windings shall be edge treated to eliminate sharp rough edges that may damage the insulation material in contact with the winding.
2. All insulating paper used as layer insulation in transformer coils shall be coated on both sides with a thermosetting adhesive and properly cured

prior to impregnation with oil to form an effective bond, both turn-to-turn and layer-to-layer.

3. A four or five-legged core assembly shall be provided -no exceptions.

K. Oil Quality

1. 3.5.12.1 Certified test reports for oil samples are not required but it is the manufacturer's responsibility to ensure transformer oil meets or exceeds the requirements of IEEE C57.106.

2. Oil shall be non-PCB with PCB content of less than 2 PPM.

3. Transformer-mounting pad design shall reside in curbing for secondary containment of oil. Containment shall be designed for 110% of transformer oil capacity plus the volume of water associated with a 100yr-24 hr storm over the area of the containment in accordance with NFPA 850. CONTRACTOR shall perform a Fire Report for determination of additional transformer containment requirements. Design shall be reviewed and accepted by OWNER. See Exhibit A – Attachment 2 for EKPC containment standard.

L. Testing

1. Production Tests

a. A production line impulse test shall be performed on each transformer in accordance with IEEE C57.12.90

b. In addition to the routine tests required by IEEE C57.12.00, the following tests shall be performed on all transformers:

i. Resistance measurements shall be made on all windings at the rated voltage tap.

ii. Impedance voltage and load losses shall be measured at rated current and rated frequency on the rated voltage tap.

iii. Each transformer tank shall be pressure tested with a minimum 5 PSIG to assure no oil/gas leaks occur.

2. Design Tests

a. Transformer designs shall be tested in accordance with IEEE C57.12.00, Table 19.

3. Certified Test Reports

a. The manufacturer shall provide the extended data set electronically (.PDF Format) per IEEE 1388 Tables 1 and 2 with losses @ 85°C and mass in pounds.

b. Information shall be provided electronically in .pdf format. All data for a transformer shipment shall be provided in one file.

c. The test data file shall be delivered via email attachment to OWNER.

M. Performance Requirements

1. Expected useful service life shall be a minimum of 20 years when fully loaded to ANSI limits.

2. The failure rate over the useful service life shall not exceed 0.1% per year.

3. Core Design: At 110% of the highest rated voltage, the transformer core design shall be such that it is not in magnetic saturation. For verification the manufacturer shall provide the core saturation curve (exciting current versus exciting voltage) for core designs. This information shall be provided with the approval Drawings.

N. Certifications

1. The following certifications and compliance letter shall be submitted and on file with OWNER to qualify as a Specified Supplier for distribution transformers covered by this specification.

2. The manufacturer shall provide new certifications of the following when transformer design is changed or when applicable specifications or standards are revised.

   a. Oil is non-PCB and has a PCB content of less than 2 PPM.

   b. Transformer design has passed all the design tests as listed in Table 19 of IEEE C57.12.00.

   c. Paint and enclosure conforms to ANSI C57.12.28.

   d. Insulating oil conforms to all requirements of IEEE C57.106.

   e. Transformer design meets all the applicable requirements of IEEE C57.12.26.

   f. Core designs provided to OWNER have been tested per ANSI and meet overvoltage saturation requirements referenced in this specification.

   g. Letter of Compliance indicating the manufacturer can provide distribution transformers that meet all the requirements of this specification.

3. Drawings

   a. Approval drawings of the transformer must be submitted and approved by OWNER.

   b. Final drawings of transformer shall conform to Exhibit AA.

   c. Complete drawings shall be resubmitted if manufacturer significantly changes the design or whenever a revised specification is issued. Significant changes would include outside dimensions, new materials, and revisions of applicable standards.

O. The following Inverter Step-up Transformer suppliers have been deemed “approved” by OWNER:

1. CG Global
2. Cooper Power Systems
3. General Electric (from North America facility only)
4. Pacific Crest Transformers
5. Schneider Electric
6. Siemens

3.8 PROJECT SCADA (Supervisory Control and Data Acquisition System)

A. SCADA System shall be composed of industrial PLC (Programmable Logic Controller) hardware and software, field instrumentation, meteorological stations, and communications devices designed for remote monitoring, control and historical trending of the PROJECT.

B. CONTRACTOR shall supply, install, and commission the SCADA System hardware in the telecommunications enclosure in connection with performance of the Work pursuant to the terms of the AGREEMENT.

C. SCADA System shall display data in real time, recording and logging performance data at a minimum of 60-second intervals. The data shall be directed through the OWNER's Pi-interface and then to the internet for remote-access monitoring and data collection.

D. Communications shall be transmitted via a fiber communications infrastructure.

E. SCADA System

1. CONTRACTOR shall program the control software for the PROJECT on an industry-standard SCADA platform for easy integration into OWNER's operation. Software shall be Wonderware, Also Energy, Skytron Energy, or approved equal.

F. Programmable Logic Controllers (PLCs)

1. PLCs shall be deployed at major data collections points in the PROJECT. Typical locations for the PLCs include the PCSs.
2. The PLCs shall function as the input/output point for the command and control signals.

G. Telecommunications Enclosure

1. CONTRACTOR shall provide a telecommunications enclosure that will act as the central point for the SCADA System and the primary point for laptop connection by local operators and technicians for troubleshooting and controlling the SCADA System.
2. The Telecommunications Enclosure shall function as the communications center for the PROJECT.

a. CONTRACTOR shall provide space for one 21U 19 inch rack for OWNER use.

b. The communications center may be housed in the telecommunications enclosure, or incorporated into a PCS as determined at time of detailed design.

H. Meteorological Station (Met Station): The Met Station shall consist of instruments to measure the meteorological parameters listed below. A minimum of two (2) Met Stations shall be installed. Proposed locations shall be reviewed and accepted by OWNER.

I. Typical SCADA points monitored include but are not limited to the following:

1. Meteorological Parameters shall conform to NREL specifications including, but not limited to, the following (unless otherwise specified in this Exhibit A):

a. Thermopile Pyranometer for measuring GHI (Direct & Indirect Irradiance)

b. Plane of Array irradiance (a minimum of two for each racking type used)

c. Ambient Temperature

d. Precipitation

e. Anemometer and Wind Vane (Wind Speed and Direction)

2. PCS Points (per PCS)

a. Inverter Performance Points

i. Shall include real-time AC and DC electrical characteristics including: power, generated energy, inverter status and diagnostics, and all data available from inverter system.

3. PV Module Points

a. PV Module Temperature (Quantity of 8 – 4 at perimeters, 4 at interior)

4. PV Sub-Array DC Current Points

a. PV DC Current measurements (one per combiner box)

5. OWNER's AC Revenue Meter Points

a. An allowance is included in Exhibit C for thirty points from OWNER's equipment via data communications (i.e. Modbus)

b. To include real time AC electrical characteristics, including power, generated energy, meter status and diagnostics

4.0 ELECTRICAL INSTALLATION

4.1 General

A. All above grade outdoor electrical conduits shall be schedule 80 pvc, or approved equal with NEMA 4 enclosures. All transitions to below grade conduit shall be schedule 80 pvc. Any deviation shall be reviewed and accepted by OWNER prior to proceeding.

B. Cable runs shall only be made parallel and perpendicular to the PV Array mounting system.

C. Minimum cover requirements for direct bury cables and conduits shall conform to NEC Table 300.5 (<1000 V) and Table 300.50 (>1000 V).

D. Backfill shall use only clean fill material, free of stones and debris. Cables shall be laid accordingly within the trench, inhibiting crossing or resting of the cables upon each other. If there is more than one layer of cable within a trench, a minimum separation shall be maintained based on NEC 310.60.

E. Multiple conduits and multiple conductors in a trench shall maintain conduit spacing per NEC 310.60.

F. A metal foil marker tape shall be placed 12" below grade continuously over any buried conductors or conductors in conduits.

G. All backfill materials covering and surrounding cables and or conduits shall have a dry thermal rho of no more than 100°C-cm/W. Backfill materials will need to be imported if the existing soil does not meet the thermal resistivity properties mentioned here, unless engineered ampacity studies are provide to prove cables will not be overloaded. Any imported backfill materials are subject to a Change request by CONTRACTOR.

4.2 DC System Wiring

A. Series string connections, between PV modules, shall be via locking, multi-contact connectors compatible with PV modules so as not to render warranties invalid.

B. Series string circuits shall be combined, parallel, and positioned into a single circuit running back to a combiner box. Parallel connections shall be made using factory-supplied wiring harnesses or multi-wired conduits. Wiring shall not be loose, and shall be supported by the mounting structure and/or module frames. CONTRACTOR shall provide corrosion resistant conduit risers and seal against rodents and weather.

C. CONTRACTOR shall provide cable management which will adequately support cables without damaging them, and be rated for long-term durability for the environmental conditions of the project.

D. DC cabling that is below grade and routed to both the combiner box and inverter, shall be rated for direct burial.

E. DC cabling may be routed above grade. Method will to be reviewed and approved by OWNER.

F. DC cable shall have a minimum 1 kV, 90°C (wet or dry), power cable type XHHW or PV wire with UL 1581, VW-1 rating or PV wire. Exposed cables shall be UV resistant and below grade cables shall be suitable for direct burial. Conductors may be stranded copper or aluminum.

G. DC wiring shall be mechanically protected where subject to damage. Protection shall be required when transitioning from above grade routing to below grade routing, and where cables may come in contact with sharp edges or abrasive surfaces.

H. When terminating to bus terminal pads, one hole compression lugs for sizes #2/0 and below and two hole for sizes #3/0 and greater are to be utilized.

I. When terminating aluminum conductors, coat conductor with oxide prohibitor and install per terminator manufacturer's instructions.

4.3 AC System Wiring (600 V and below)

A. All conductors, lugs and cable accessories shall be UL listed.

B. No splicing shall be allowed.

C. System wiring installed in raceways shall be type THHN/THWN-2, or XHHW-2. Conductors may be stranded copper or aluminum.

D. System wiring installed in direct burial applications shall be type USE-2 with XLP insulation. Conductors may be stranded copper or aluminum.

E. When terminating to bus terminal pads, one hole compression lugs for sizes #2/0 and below and two hole for sizes #3/0 and greater are to be utilized.

F. When terminating aluminum conductors, coat conductor with oxide prohibitor and install per terminator manufacturer's instructions.

G. Power cables shall be insulated on the basis of a normal maximum conductor temperature of 90ºC (dry or wet) in 30ºC ambient air with a maximum emergency overload temperature of 130ºC and a short-circuit temperature of 250ºC. In areas with higher ambient temperatures, large conductor shall be used or higher temperature rated insulation shall be selected and de-rated as required per applicable code and standards.

4.4 Medium Voltage AC System Wiring: Inverter step-up Transformer to PCC

A. Location of PCC shall be agreed upon by CONTRACTOR and OWNER.

B. Conductors shall be 15 kV type MV-105, (dry or wet) single compact conductor, copper, 100% or 133% TRXLP or EPR insulation/copper tape shield or equivalent aluminum conductors.

C. CONTRACTOR shall place MV (15 kV) direct bury conductors with approved backfill.

D. Conductors shall be sized to limit the voltage drop to no more than 1.5% from the transformer to the power meter inside the OWNER utility vault at full generation.

E. The bottom of the conductor trench shall be firm and level, free of rock and debris. Sharp objects shall not protrude from the walls or the bottom of the trench. A metal foil detectable marker tape shall be placed 12 inches below grade continuously over the cables.

F. All trenches shall be backfilled as soon as practical after placing the conduit. The first lift of backfill material shall be uniform thickness. Care shall be exercised in compacting the backfill to prevent disturbing placement of conduit. The remainder of the backfill shall be compacted to match the adjacent soil density so that the trench surface will remain level with the surrounding surfaces.

G. The backfill shall adhere to ANSI/IEEE 442-1996 standard.

H. A copper equipment-grounding conductor sized per NEC 250 requirements, shall be routed with the feeder.

I. Medium voltage terminations shall be cold-shrink, outdoor-rated for live front applications and shall be of IEEE-386 class for non-load break, dead front applications.

J. Conduit sleeves in and out of the transformers shall be provided.

4.5 Grounding

A. All ground conductors shall be copper and may be bare if exposed or protected by a conduit sleeve and green insulated if in a raceway along with the circuit conductors.

B. Ground lugs shall be mechanical and acceptable for copper conductor termination.

C. A grounding electrode system consisting of a ring of bare stranded copper #4/0 buried 36” below grade bonded to NEC acceptable grounding electrodes shall be installed around each of the individual outdoor electrical equipment and precast structures. All electrical equipment shall be bonded to the grounding electrode system. The grounding electrode system shall be designed based on the results of CONTRACTOR provided grounding system study.

D. Equipment grounding conductors shall be routed with the phase conductors.

E. Module mounting structure and combiner boxes shall be grounded per NEC requirements. Where bolts and screws are provided, thread cutting, thread forming screws or equivalent shall not be acceptable.

F. CONTRACTOR shall provide a detailed grounding calculation to verify grounding design.

G. All below grade connections shall be via exothermic weld or irreversible crimp and UL listed for direct burial applications.

H. Transformers and inverters/PCSs shall be bonded to the ground ring.

I. Ground test wells shall be furnished at each PCS. A flush cover over the test well shall expose one ground rod and cable with mechanical cable to rod connectors to allow disconnection for testing purposes.

J. Perimeter Fence grounding shall be required where the Perimeter Fence is within 15 feet of energized equipment or within 100 feet of overhead power lines. Isolation shall be provided between grounded and ungrounded Perimeter Fence sections.

4.6 Labeling and Identification

A. For diagnostic and troubleshooting purposes, all multi-string harness inputs to each combiner box and the combiner boxes themselves shall be uniquely tagged and identified with such tagging on the record construction drawings. These cables shall have a label affixed to the outer jacket with a cable marker tape at each termination. The marker tapes shall be vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process. Marker tapes to be approved by OWNER before installation.

B. Electrical equipment shall be labeled to meet applicable safety codes and requirements.

C. As part of CONTRACTOR deliverables that must be delivered prior to Final Completion, CONTRACTOR shall provide to OWNER a Microsoft Access database or Excel spreadsheet including all module serial numbers which can be sorted by PV Array, combiner box, and harness. CONTRACTOR shall also submit an "As-Built" drawing depicting the physical location of each PV Array, combiner box, and harness indicating the unique tag number for each combiner box and harness. Electrical equipment shall be labeled to meet applicable safety codes and requirements.

4.7 Electrical Equipment Enclosures

A. Control Cabinets, pull boxes and junction boxes shall be in accordance with NEMA Standards and type number and shall be suitable for the location conditions. Base design shall be:

1. Indoor: NEMA 1
2. Outdoor: NEMA 4

B. All enclosures shall be provided with pad locking provisions.

4.8 Electrical Interconnections

A. Voltage: OWNER distribution voltage is 12.5 KV. The 12.5 KV system is "effectively grounded" and is used for fourth-wire distribution (phase to neutral connected loads).

B. Effective Grounding: Effective grounding limits the voltage rise (typically to about 130%) on un-faulted phases during single-line-to-ground fault conditions. OWNER maintains effective grounding on its electric distribution system and requires that all facilities connected to its system maintain an effectively grounded system. To achieve effective grounding, OWNER's system equivalent (even in equivalent impedance) must meet the following criteria (Reference IEEE Standard 142 "IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems"):

1. The positive sequence reactance is greater than the zero sequence resistance (X1 >R 0)

2. The zero sequence reactance is less than or equal to three times the positive sequence reactance (X0 <3X1) PROJECT grounding must be such that OWNER contribution to a single-line-to-ground fault be no less than 90% of what it is without OWNER's ground source on-line. When calculating faults and effective grounding using positive, negative and zero sequence networks, the networks should include the following impedances: the step-up transformer, reactance, neutral grounding on the step-up transformer, cable runs greater than 50 feet in length, and the grounding bank.

3. PROJECT effective grounding requirements shall include a step-up transformer with a delta winding with a grounding bank installed on the distribution side. The grounding bank's impedance must be selected so that it meets OWNER's effective grounding requirements, the system current and/or voltage imbalance.

4. OWNER allows an imbalance of no more than 1% phase to phase and 3% phase to ground for voltage and 100 Amps neutral current, at 12.5 KV. The PROJECT Equipment and Materials must be able to withstand allowable imbalances and be able to operate during an imbalance condition.

C. Harmonics: The Total Harmonic Distortion (THD) from the PROJECT will be measured at the OWNER's metering point. Harmonics on the power system from any source must be kept to a minimum. Under no circumstances will the harmonic current and voltage be greater than the values listed in tables from IEEE Standard 519, as amended from time to time, "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems." In addition, any interference with OWNER communications from harmonics generated by PROJECT's equipment in excess of federal, state, and local codes will be resolved at CONTRACTOR's expense.

D. Voltage: Adequate voltage control shall be provided by CONTRACTOR to minimize voltage deviations on OWNER's system. If the PROJECT is operating with a power factor less than 90% leading, CONTRACTOR shall be responsible for installing some type of reactive power compensation to bring the overall power factor up to the 90% minimum level. The magnitude and frequency of voltage flicker (i.e., sudden momentary voltage change) caused by

the PROJECT shall not exceed the values provided in IEEE Standard 141, "IEEE Recommended Practices for Electric Power Distribution for Industrial Plants." Voltage flicker shall be measured at the interface between OWNER's system and the PROJECT.

E. General Design Requirements:

1. Codes: The PROJECT's installations must meet Kentucky Public Service Commission rules, and all applicable national, state, and local construction and safety codes, including IEEE 1547, "IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems".

2. Effective Grounding: The PROJECT must maintain effective grounding, as defined in previous sections of this Exhibit A.

F. Design Specifications: CONTRACTOR is required to submit detailed design specifications and engineering information as required by the AGREEMENT. The design specifications must include an electrical one-line diagram of the PROJECT's PV system, beginning at the point of interconnection and the AC and DC schematics.

G. Inverter Systems: THD from the PROJECT will be measured at the OWNER's metering point. If the PROJECT is found to be interfering with OWNER or public communications, CONTRACTOR will be required to install filtering or other corrective measures to bring the harmonic output of its inverters to the values specified in IEEE Standard 519 Tables I and II.

4.9 Telecommunications

A. Wireless communication is not anticipated. OWNER must pre-approve any wireless communications prior to installation.

B. The telecommunications line of demarcation between OWNER and CONTRACTOR is the OWNER's RTU enclosure, the PPC.

C. OWNER will provide a network communications channel/port for CONTRACTOR to connect to its designated network provider.

D. CONTRACTOR shall identify the network bandwidth required. The cost for this portal shall be negotiated between OWNER and CONTRACTOR at a later time.

E. CONTRACTOR shall provide 4" conduit and fiber optic cable to OWNER's RTU enclosure for telecommunications/network connections

F. OWNER shall provide termination panel in the OWNER's RTU enclosure for landing of CONTRACTOR's fiber optic cable.

5.0 MECHANICAL

5.1 General Requirements

This section provides requirements for major mechanical equipment, mechanical systems, and mechanical interfaces with other PROJECT systems and off-Site facilities.

5.2 General Arrangements

A. The location of Equipment and Materials shall be based on safety, economics, ease of maintenance, and operation. Sufficient space shall be provided for maintenance of all Equipment and Materials including Equipment removal without excessive rigging or removal of surrounding Equipment.

6.0 SITE WORK

6.1 General Requirements

A. This section covers the minimum scope and quality for the PROJECT civil design and construction.

B. CONTRACTOR is responsible to inspect the Site, obtain all necessary Site data not provided by OWNER, and determine all Site data for the design and construction of the PROJECT. This shall include determination of local code requirements for seismic and wind design loads. It is CONTRACTOR's sole responsibility to ensure that the Site work complies with all federal, state, and local code requirements and all applicable industry codes and standards, including standards of the local authority having jurisdiction.

C. The scope shall include, but not be limited to the following, as required:

1. Clearing and grubbing.
2. All subgrade preparation.
3. Dust control.
4. Drainage during construction.
5. Construction wastewater and storm water disposal.
6. Construction Stormwater Management.
7. Site re-vegetation.
8. Construction of all foundations and structures.
9. Roads (permanent and temporary construction).
10. Permanent and temporary fencing for laydown areas, including gates if desired by OWNER.

D. The PROJECT design shall take into account existing site conditions with respect to soil characteristics, site clearing, grading, and drainage. CONTRACTOR shall be responsible for all site preparation including any soil stabilization, minor grading, drainage, roadways, and temporary parking areas.

6.2 Units

A. All design dimensions and design calculations shall be in British (United States Customary) units.

6.3 Geotechnical

A. CONTRACTOR's final design shall be based on the Geotechnical Report.

6.4 Site Preparation and Maintenance

A. Site Clearing and Grubbing:

1. Immediately prior to commencement of construction, CONTRACTOR shall remove vegetation from areas on the Site surrounding the proposed location of any PV modules, other electrical equipment and Site infrastructure. CONTRACTOR shall be responsible for all applicable permitting with jurisdictional agencies for use of herbicides should the decision be made to use them during construction.

B. Debris:

1. All construction-related debris and unsuitable material from Site clearing and grubbing shall become the immediate property of CONTRACTOR and shall be removed from the premises and lawfully disposed of off-Site by CONTRACTOR at CONTRACTOR's cost.

C. Erosion Control

1. CONTRACTOR shall prepare a Storm Water Pollution Prevention Plan (SWPPP) for their construction activities. CONTRACTOR shall be responsible for maintaining the storm water controls and best management practices. CONTRACTOR shall provide for sediment and erosion control during and after construction in accordance with project permits and local and state laws and regulations. Best management practices in accordance with Exhibit DD shall be used during construction and such costs are covered by an allowance included in Exhibit C.

D. Road Maintenance

1. All temporary access roadways within the Site used by CONTRACTOR, as well as the new Site permanent roads shall be maintained in serviceable condition. CONTRACTOR shall keep the surfaces of those roadways free from spills, mounds, depressions, and obstructions, which might present a safety hazard or annoyance to traffic.

2. CONTRACTOR shall be responsible for securing authorization and permits to transport oversized/overweight loads on local, County and State roads for the supply of Equipment and Materials under CONTRACTOR's scope. CONTRACTOR shall supply and install any temporary or permanent facilities required to facilitate delivery of this Equipment and Materials. CONTRACTOR shall also be responsible for removing all such temporary facilities.

E. Signs and Barricades

1. Signs and barricades shall be provided and maintained by CONTRACTOR and shall be in accordance with jurisdictional regulations for accident prevention and the Construction Safety Plan.

F. Dust Control

1. Dust Control for Construction Activities

a. CONTRACTOR shall be responsible for dust control at the Site. CONTRACTOR shall prevent the spread of dust during its operations. CONTRACTOR shall moisten all surfaces with water to reduce the risk of dust becoming a nuisance. CONTRACTOR shall furnish labor and equipment necessary for dust control including tank trucks and hoses to apply the water. CONTRACTOR shall be responsible for compliance with State and local requirements for fugitive dust emissions and shall obtain local authority approvals and conform to the dust control regulations. CONTRACTOR shall conform to all requirements of the Applicable Permits.

G. Open Burning

1. Onsite open burning is not permitted.

H. Earth Grading

1. CONTRACTOR shall install the racking to follow the existing contours and grades of the Site and will review to confirm that the existing contours fall within the selected racking's tolerances. CONTRACTOR shall leave no stockpiles or pits remaining at the completion of the full build-out of the PROJECT. (Stock piling in accordance with applicable regulations may be permitted in support of phased construction.).

2. Prior to Substantial Completion, CONTRACTOR will smooth surface conditions in the Site that are rutted due to construction operations.

I. Site Grading and Drainage

1. Rough grading is not included and the existing contours and drainage patterns will not be modified. If there are any grade modifications that occur to small localized areas of the Site, then those working areas shall be well drained during and after construction.

2. OWNER shall perform remediation of any wetland areas as required to accommodate the indicative PV Array layout.

J. Excavation, Filling, and Backfilling

1. Excavated native material is assumed to be suitable for backfill and may be used on the Site for embankment and backfill. Disposal of any unsuitable materials such as rock, concrete, wood, metal, and other materials from the excavation is not included.

2. CONTRACTOR shall be solely responsible for maintaining the stability of all excavated faces and shall provide adequate sheeting, shoring, and bracing to support any lateral earth pressure.

3. CONTRACTOR shall be solely responsible to protect personnel and adjacent structures against any damage from cave-ins, heaving or other earth movements. Sheeting, shoring and bracing shall be removed as backfilling proceeds or it may, with the approval of OWNER, be left fully or partially in place.

4. Fill characteristics and compaction requirements shall be determined by CONTRACTOR's geotechnical investigation and report recommendations.

5. All Equipment used to meet compaction requirements shall be specifically designed for such duty.

6.5 Roads

A. Site Access:

1. The Site is immediately adjacent to Interstate 64 but has no direct access from the Interstate. Access is available from Lexington Road (Highway 60) via the existing OWNER headquarters driveway.

B. CONTRACTOR shall construct roads within the array site which shall consist of the following:

1. The perimeter driveways shall follow around the entire perimeter of the Site and the construction phases. Perimeters access driveways shall consist of a 15-foot wide compacted dirt roadway.

2. Driveways within the Site shall be constructed to provide access to the interior PV Array inverters. They shall consist of a 15-foot width gravel pavement over compacted base, in compliance with the recommendations of the geotechnical evaluations.

6.6 Security

A. A security chain link Perimeter Fence and a 3-strand wire Perimeter Fence shall be installed around the perimeter of the Site. The Perimeter Fence for each fenced area shall be contiguous without interruption (except for personnel and vehicle gates).

B. Permanent Perimeter Fence shall consist of 6 feet of chain link fence fabric topped with three strands of barbed wire, with an overall height of 7 feet from

the bottom of the fabric to the top barbed wire. The Perimeter Fence shall have top and bottom tension wire, and three strands of barbed wire mounted on 45 degree extension arms. The upper strand shall be approximately 12 inches out from the Perimeter Fence and 12 inches above the top of the fabric. Corner, end, pull, and gate posts shall be set in concrete. Fence fabric shall be no more than 2 inches above finish grade.

C. Materials for site chain link fencing shall be as follows:

1. All steel or malleable iron parts and accessories shall be hot-dip galvanized in accordance with ASTM A123 after fabrication.

2. Fabric - 12 gauge, 2 inch mesh; galvanized ASTM A392, Class 1; twisted selvage on bottom, knuckled selvage on top.

3. Posts - Steel pipe, ASTM F1083 standard weight (Schedule 40).

4. Line posts – 1-5/8 inch OD pipe.

5. Terminal posts (end, corner, and pull) - 2-3/8 inch OD pipe.

D. Gates:

1. Main Entrance: CONTRACTOR shall install a 24-foot wide gate for access at the PROJECT Site entrance.

E. CONTRACTOR shall repair and/or replace fencing damaged by construction activities.

F. See section 4.5 for additional grounding requirements

6.7 As-Built Drawings

A. CONTRACTOR shall prepare as-built drawings as may be necessary to meet the standards of the jurisdictional government agencies. At minimum, CONTRACTOR shall prepare as-built drawings for OWNER's record which contain as-built elevations, dimensions, etc. and any variation from the design drawings, sealed by an engineer or surveyor licensed in the state of Kentucky.

7.0 STRUCTURAL

7.1 Materials

A. Steel

1. Design of structural and miscellaneous steel shall be in accordance with the American Institute of Steel Construction (AISC) "Manual of Steel Construction". Design of structural and miscellaneous steel shall also be in accordance with National Electrical Manufacturers Association (NEMA) "SG6" and "TT1", American Society of Civil Engineers (ACSE) "Guide for the Design of Steel Transmission Towers, Manual No. 52" and the International Code Council "International Building Code". Design of cold-formed steel shall be in accordance with the American Iron and Steel

Institute (ANSI) “North American Specifications for the Design of Cold-Formed Steel Structural Members”.

2. Materials for structural steel and miscellaneous steel shall conform to the following requirements of the American Society for Testing and Materials:

    a. Wide Flange (WF) Shapes and Tees cut from WF: ASTM A992, Grade 50 or multi-certification A36/A572, Grade 50.

    b. M shapes, S shapes, HP (Bearing Piles), Channels, and Angles: ASTM A36

    c. Structural Plates and Bars: ASTM A36

    d. Square/Rectangular Hollow Structural Sections (HHS): ASTM A500 Grade B

    e. Pipe: A53, Grade B

3. High strength bolts, nuts, and washers shall conform to ASTM A325, ASTM A563, and ASTM F436 respectively and shall be galvanized in accordance with ASTM A2329.

4. Bolts, nuts and washers under one-half inch in diameter shall conform to ASTM A307, Grade B, ASTM 563 and ASTM F844 respectively and shall be galvanized in accordance with ASTM F2329.

5. Anchor bolts, anchor bolt assemblies and concrete embedments shall be galvanized.

6. Anchor bolts shall conform to ASTM A449, ASTM F1554, Grade 36, or A307. Anchor bolt sleeves shall conform to ASTM A501.

7. All structural welding shall conform to the requirements of AWS D1.1.

8. Galvanizing, as specified herein, shall conform to the requirements of ASTM A123, ASTM A153 or ASTM A2329, as applicable.

9. Stainless steel shall conform to ASTM A167.

B. Aluminum

1. Design of structural and miscellaneous aluminum shall be in accordance with the latest version of the Aluminum Association – “Aluminum Design Manual” and “Aluminum Standards and Data”.

2. Materials for structural and miscellaneous aluminum, including structural shapes and plate, shall conform to ASTM B209 and ASTM B308 and shall be aluminum alloy 6061-T6.

3. Bolts and nuts shall conform to ASTM F468 and ASTM 467, respectively and shall be aluminum alloy 6061-T6. Washers shall be aluminum-clad steel Alclad 2024-T4 or approved equal.

C. Concrete

1. Design of structural concrete shall be in accordance with the latest version of the American Concrete Institute (ACI) - "Building Code Requirements for Structural Concrete," ACI 318. All concrete formwork shall conform to ACI 347. Concrete structures required for containment shall be designed to ACI 350.

2. Concrete mix proportions, including documentation of materials, admixture product information, and compressive strength of mix, shall be submitted and approved by OWNER prior to placing concrete.

3. Minimum concrete strength classes for various structures shall be as follows unless otherwise required by geotechnical or corrosion analysis, ACI 318, or ACI 350:

Item	Minimum Ultimate Compressive Strength (psi) (at 28 Days)
Major equipment/structures where required and all other construction	4,000

4. Reinforcing bars shall be deformed bars conforming to ASTM A615, Grade 60. Welded wire fabric shall conform to ASTM A185. Plain wire shall conform to ASTM A82. Placement shall be in accordance with Chapters 7 and 12 of ACI 318 and the Manual of Standard Practice of The Concrete Reinforcing Steel Institute.

5. Cement shall be Portland cement conforming to ASTM C150, Type I or Type II or as suggested by the Geotechnical Report.

6. Aggregates for normal weight concrete shall conform to ASTM C33.

7. All foundations shall extend a minimum of 6 inches above the adjacent finish grade.

8. All concrete trucks may be rinsed out on-Site at OWNER approved locations only.

7.2 Concrete Testing

A. Field testing and sampling shall be performed by an independent testing laboratory at CONTRACTOR's expense. The testing technician shall be an ACI Concrete Field Testing Technician Grade 1.

B. Compressive strength determinations shall be made from 6-inch diameter by twelve inch long concrete cylinders tested in accordance with ASTM C39. Cylinders shall be prepared for compressive strength tests on concrete with a designed compressive strength of 2,500 psi or higher for the following conditions:

1. Each one-hundred (100) cubic yards or fraction thereof of concrete poured;

2. At least once per day

3. For each 5,000 square feet of surface area for slabs or walls.

4. A minimum of four concrete cylinders shall be prepared from each composite sample.

C. Field slump tests shall be performed in accordance with ASTM C143 and shall be performed for the following conditions:

1. The first batch produced each day,

2. For every 50 cubic yards or fraction thereafter, and

3. With every set of test cylinders.

D. Air content, concrete temperature, and air temperature tests shall be performed for the first batch of each day and with each set of test cylinders. All testing shall be done in accordance with the requirements of the American Society of Testing Materials (ASTM). Test results shall be provided to OWNER for records within 30 days of test completion. In the event of failure of any aforementioned test, OWNER shall be notified.

7.3 Structural Loading

A. CONTRACTOR shall determine all Site data which has not been provided by OWNER as of the date of the AGREEMENT for the design and construction of the PROJECT. It is CONTRACTOR's sole responsibility to ensure that the PROJECT structural and architectural facilities comply with all federal, state, and local code requirements and all industry codes and standards.

1. CONTRACTOR shall use the data provided in the Geotechnical Report as needed. Any additional information required shall be obtained at CONTRACTOR's expense.

B. Dead Loads

1. Dead loads shall include all vertical loads due to weight of permanent structural and nonstructural components, including permanent hung loads.

C. Live Loads

1. Live loads shall be in accordance with the 2013 Kentucky Building Code and ASCE-7 2010 (or latest edition).

D. Snow/Ice Loads

1. Snow loads shall be in accordance with the 2013 Kentucky Building Code and ASCE-7 2010 (or latest edition).

2. CONTRACTOR to include snow removal maintenance in O&M manual such that ice damming or ground snow accumulation at bottom edge of PV modules that may prevent falloff does not allow for on-module accumulation to exceed design snow load.

E. Wind Loads

1. Wind loads shall be in accordance with the 2013 Kentucky Building Code and ASCE-7 2010 (or latest edition). The PV module support structures shall be designed in such a way that deflections due to wind will not damage the PV modules. CONTRACTOR shall ensure that the PV modules support foundations can withstand the uplift due to wind loading.

F. Seismic Loads

1. Seismic loads shall be in accordance with the 2013 Kentucky Building Code and ASCE-7 2010 (or latest edition) or OWNER adopted design code. The soil profile type shall be determined by CONTRACTOR based on the results of a subsurface investigation.

G. Thermal Loads

1. Buildings and structures shall be designed for forces and/or movements resulting from changes in temperature. Induced thermal loads (i.e., thermal loads induced by equipment operating temperatures) shall be considered in design of applicable structural elements.

H. Vehicle Loads

1. Design loading, for areas accessible to trucks shall be minimum (AASHTO) HS20.

I. Soil and Hydrostatic Pressure Loads

1. Earth pressure and hydrostatic pressure loads shall be based on the geotechnical conditions and groundwater levels at the Site.

J. Transmission Line Loads

1. In addition to the aforementioned loading criteria, overhead transmission loads shall also conform to ASCE Manuals and Reports on Engineering Practice No. 74 “Guidelines for Electrical Transmission Line Structural Loading” and to NESC requirements.

K. Load Combinations

1. Load combinations shall be in accordance with the 2013 Kentucky Building Code and ASCE-7 2010 (or latest edition).

7.4 Structural Foundations

A. Type of foundations required and allowable bearing values for soil and rock shall be as recommended by a geotechnical engineer based on the subsurface conditions found in the Geotechnical Report. An allowance is included in Exhibit C for the foundation system. All loose materials shall be removed from excavation bottoms. Subgrade materials are assumed to suitable for concrete or pier foundations. Total foundation settlements will be limited to 1 inch or as required by applicable building or industry codes, and equipment supplier’s recommendations.

B. A minimum of 18 inches of the native soil to be removed and compacted to 95% of relative compaction as a subgrade for various concrete housekeeping pads.

1. All Equipment used to meet compaction requirements shall be specifically designed for such duty.

C. Equipment Foundations

1. Equipment foundations utilizing concrete shall be reinforced and shall include all formwork, rebar, waterstop, etc.

D. Transformer Foundation and Containment

1. Transformers shall be provided with secondary oil containment equal to 110% of the volume of oil present in the transformer in addition to the volume of rain water for a 100-year/24 hour storm event over the area of the containment.

7.5 Corrosion Protection

A. In general, all exposed carbon steel surfaces shall get a corrosion protection treatment. CONTRACTOR shall design and specify corrosion protection systems, which shall include surface preparation measures, for the following conditions:

1. Carbon steel exposed to ambient environmental conditions (i.e. PV module support structure, if applicable)

2. Carbon steel exposed to soil conditions below grade (i.e. driven or augured piles, if applicable). This coating shall be designed such that it is not damaged during installation. CONTRACTOR shall consult a corrosion engineer to recommend corrosion protection measures based on the soil conditions, and shall submit the corrosion engineer's recommendations to OWNER for information and acceptance of the recommendations.

B. Stainless steel and galvanized steel shall not be painted.

C. Solar support structural design shall account for section loss due to corrosion based on the design life of the PROJECT.

8.0 COMMISSIONING AND PROJECT ACCEPTANCE TESTING

8.1 See Exhibit N and O for requirements for Commissioning and Performance Testing

9.0 PROJECT AND CONSTRUCTION MANAGEMENT

9.1 Staffing

A. CONTRACTOR shall provide the appropriate personnel to manage all aspects of the Work.

B. CONTRACTOR shall ensure an OSHA "competent" person be present during all work hours.

C. CONTRACTOR may work on Site at any time subject to Applicable Laws.

9.2 Reporting/Meetings

A. CONTRACTOR shall provide progress and schedule reporting on a weekly basis. A two-week look ahead of activities shall be provided at weekly reoccurring meetings with OWNER, CONTRACTOR and CONTRACTOR'S subcontractors.

B. Progress meetings shall be held at the Site or a mutually agreeable location on a monthly basis on dates mutually agreeable to OWNER and CONTRACTOR.

9.3 Safety Plan

A. CONTRACTOR shall maintain a safety plan and observe all safety practices required for performing construction work of this type including OSHA standards as further detailed in the AGREEMENT.

9.4 Work Schedule

A. CONTRACTOR shall submit a detailed schedule in using Primavera or Microsoft Project which also meets the requirements of the AGREEMENT.

B. The Project Schedule shall be updated monthly against the baseline schedule and submitted to OWNER.

10.0 DESIGN ENGINEERING

10.1 Engineering Design Package

A. CONTRACTOR shall develop a comprehensive design package consisting with drawings generated in a format in accordance with the AGREEMENT. Engineering package shall be provided for OWNER review in native or PDF format (Exhibit CC: Submittal Schedule).

EXHIBIT B-1

SITE DESCRIPTION

See attached.

EAST KENTUCKY POWER COOPERATIVE SOLAR

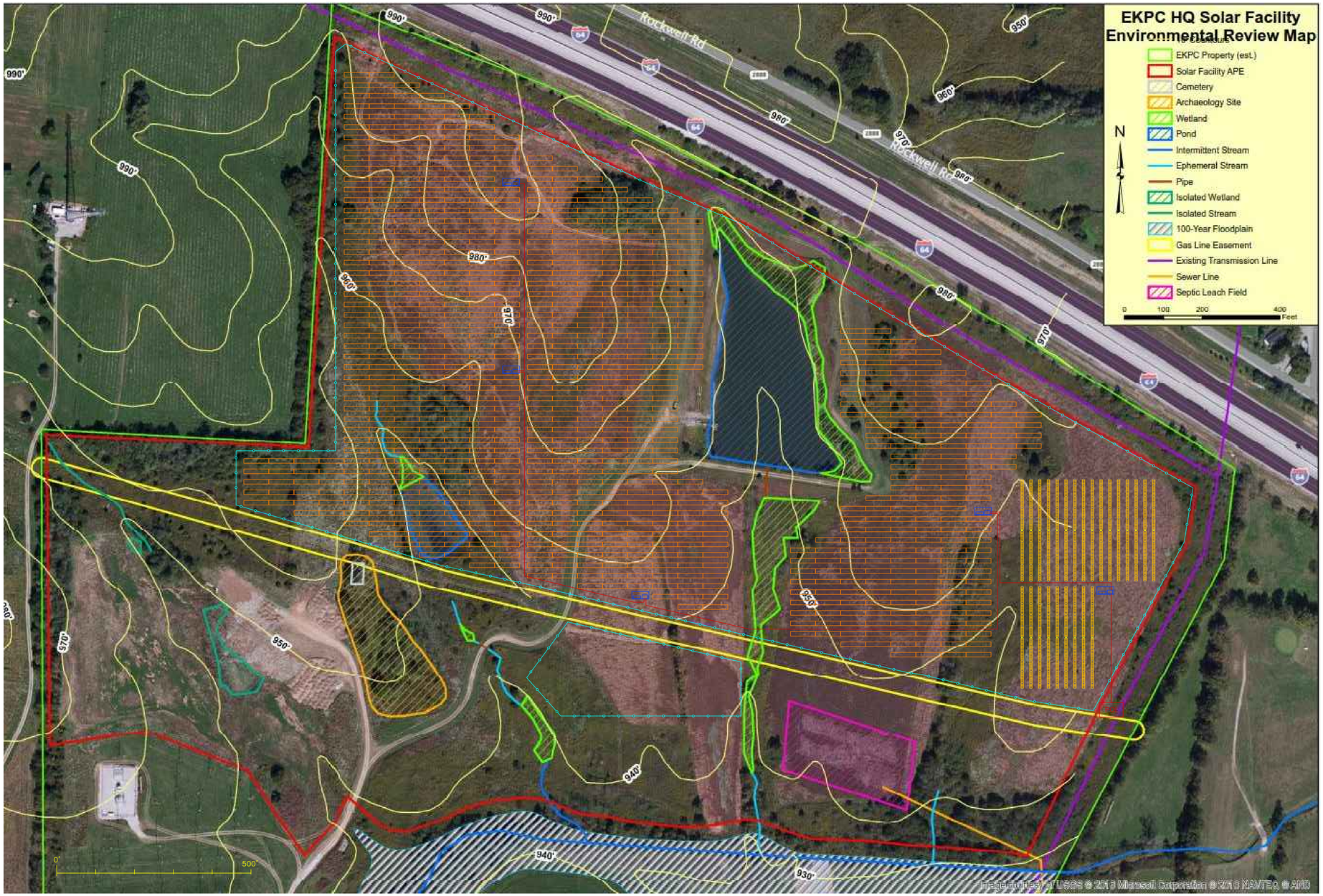
LEXINGTON ROAD

WINCHESTER, KENTUCKY 40391

SOLAR PLANT SUMMARY			
ITEM	FIXED TILT	SINGLE AXIS TRACKER	TOTAL
DC NAMEPLATE	10.184 MWDC	636.5 KWDC	10.82 MWDC
AC NAMEPLATE	8MWAC	500KWAC	8.5MWAC

FIXED TILT BLOCK		
ITEM	QTY	MANUFACTURER AND MODEL
DC NAMEPLATE	10.184 MW DC	
AC NAMEPLATE	8 MWAC	
INVERTERS	4	EATON POWER XPERT 2000+
MODULES	30,400	CANADIAN SOLAR 335
STRING SIZE	19	
TRANSFORMERS	4	
RACKING	FIXED TILT	SOLAR FLEX RACK OR EQ
TABLES	800	
TILT ANGLE	25	
ROW TO ROW SPACING	15'	
PITCH	26.9'	

SINGLE AXIS TRACKER BLOCK		
ITEM	QTY	MANUFACTURER AND MODEL
DC NAMEPLATE	636.5 kW DC	
AC NAMEPLATE	500 kW AC	
INVERTERS	1	SOLECTRIA SGI 500XTM
MODULES	1,900	CANADIAN SOLAR 335
STRING SIZE	19	
TRANSFORMERS	1	2.5KVA
RACKING	SAT	NEXTRACKER
ROWS	25	
MODULES PER ROW	76	
ROW TO ROW SPACING	16'	



EKPC KENTUCKY LAYOUT FIXED TILT R4.dwg

06.03.2014

Client Name and Address

General Notes

Placement Study:

No.	Revision/Issue	Date

Firm Name and Address

lendlease

2300 Yorkmont Rd
Suite 700
Charlotte, NC 28217

Project Name and Address

EKPC SOLAR
LEXINGTON ROAD

Project	Sheet
EKPC SOLAR	1.0
Date: 5/13/2016	
Scale: As Noted	

EXHIBIT B-2

ALTA SURVEY

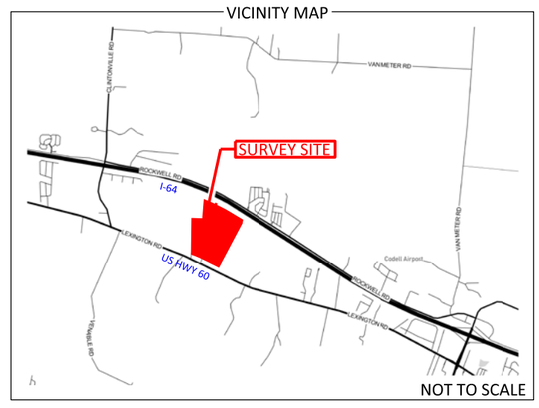
See attached.

N

50 200
0 100 400
Scale: 1" = 200'

ALL BEARINGS ARE REFERRED TO THE BEARING OF REFERENCE. BEING THAT TANGENT SECTION OF CENTERLINE OF US HWY 60 AND TAKEN TO BE N64°07'11"W AS MEASURED BY GLOBAL POSITIONING SATELITES. ALL BEARINGS ARE REFERRED TO GRID NORTH OF THE KENTUCKY STATE PLANE COORDINATE SYSTEM - NORTH ZONE.

SOURCE OF TITLE
EAST KENTUCKY POWER RURAL ELECTRIC COOPERATIVE CORPORATION
D.B. 175 PG. 594
D.B 214 PG. 104

VICINITY MAP


LAND CLASS: "RURAL"
PROPERTY OWNER/CLIENT : EAST KENTUCKY POWER RURAL ELECTRIC COOPERATIVE CORPORATION
ADDRESS: P O BOX 707
WINCHESTER , KY 40392

CURVE	RADIUS	CHORD BEARING	CHORD DISTANCE
C1	11329.16'	S66°42'17"E	710.61'
C2	11329.16'	S59°56'39"E	578.60'
C3	5729.65'	N66°50'42"W	546.23'

IPS @ COR POST
130 RIGHT OF C-LINE I-64

C1

IPS 130 RIGHT OF C-LINE I-64

691.95'
S63°09'27"E

COMMONWEALTH OF KENTUCKY
D.B. 163 PG. 563

INTERSTATE I-64 ROW VARIES

IPS 130 RIGHT OF C-LINE I-64

C2

IPS 130 RIGHT OF C-LINE I-64

659.19'
S58°31'53"E

IPF @ COR POST
130 RIGHT OF C-LINE I-64

234.61'
S10°29'46"W

IPS @ COR POST

1145.34'
N04°34'33"E

JUDY K. JERNIGAN
D.B.500 PG. 38

POND

IPS @ CORNER POST

647.50'
S87°57'40"E

IPS @ CORNER POST

POND

KENTUCKY GAS TRANSMISSION CORPORATION EASEMENT
DEED BOOK 141 PAGE 349 (NO WIDTH SPECIFIED)

GAS

GAS

KENTUCKY GAS TRANSMISSION CORPORATION EASEMENT
DEED BOOK 141 PAGE 349 (NO WIDTH SPECIFIED)

GAS

GAS

1084.55'
N00°39'15"E

IPS @ FENCE

TRACT 1
179.794 ACRES
BY RETRACEMENT SURVEY

ZONED A-1
CITY OF WINCHESTER/CLARK COUNTY ZONING MAP
SHOWS THIS AREA TO BE "PLANNED DEVELOPMENT"

1002.80'
S27°49'41"W

IPS @ FENCE

ZONE A-1 SETBACKS
FRONT YARD =75'
SIDE YARD =50'
REAR YARD =50'

ZONE PLANNED DEVELOPMENT AREA
NO SETBACKS IDENTIFIED IN THE ZONING ORDINANCE

1086.91'
N00°39'15"E

JUDY K. JERNIGAN
D.B.500 PG. 38

ZONED A-1
CITY OF WINCHESTER/CLARK COUNTY ZONING MAP
SHOWS THIS AREA TO BE "PLANNED DEVELOPMENT"

1016.68'
S27°57'52"W

ANDREW & MARGARET MCCORD
D.B. 425 PG. 341

PURPOSE OF PLAT:

1.) TO RETRACE THE EAST KENTUCKY RURAL ELECTRIC COOPERATIVE CORPORATION AS RECORDED IN D.B. 175 PG. 594 & D.B. 214 PG. 104 AT THE CLARK COUNTY CLERKS OFFICE BEING SHOWN HEREON AS TRACT 1.

IPS @ CORNER POST
40' FROM C-LINE OF US HWY 60

144.90'
N69°30'43"W

IPS 40' FROM C-LINE OF US HWY 60

10' WATER LINE EASEMENT
TO CLARK COUNTY WATER DISTRICT #1
D.B. 188 PG. 504

C3

D.B. 175 PG. 594
D.B. 214 PG. 104

D.B. 214 PG. 104
D.B. 175 PG. 594

SEWAGE PLANT EASEMENT
TO CITY OF WINCHESTER, KENTUCKY
D.B. 383 PG. 242

IPS @ FENCE

573.95'
S27°57'52"W

IPS 40' FROM C-LINE OF US HWY 60

10' WATER LINE EASEMENT
TO CLARK COUNTY WATER DISTRICT #1
D.B. 188 PG. 505

ANDREW & MARGARET MCCORD
D.B. 425 PG. 341

- LEGEND -

- ○ ⅝" x 18" STEEL REBAR PIN W/ ALUMINUM SURVEY CAP BEARING (P.L.S. #3118) SET
- □ INTERNAL PROPERTY CORNERS ALONG R/W
- △ FOUND MONUMENT (AS NOTED)
- BOUNDARY LINES OF AGE SURVEY
- ADJOINING PROPERTY BOUNDARY LINES PER DEEDED DESCRIPTIONS
- —X— EXISTING FENCE
- —W— EXISTING WATER LINE EASEMENT
- —GAS— EXISTING UNDERGROUND GAS LINE AS MARKED BY OTHERS

US HWY 60 (80' ROW)
COMMONWEALTH OF KENTUCKY
D.B. 113 PG. 309

1153.24'
N64°07'11"W

10' WATER LINE EASEMENT
TO CLARK COUNTY WATER DISTRICT #1
D.B. 188 PG. 506

REFERENCE BEARING N64°07'11"W

IPF @ FENCE

349.91'
S27°57'52"W

ANDREW & MARGARET MCCORD
D.B. 425 PG. 341
TRACT 1A
PLAT SLIDE 1700

IPF 40' FROM C-LINE OF US HWY 60

CERTIFICATE OF OWNERSHIP & DEDICATION

I/WE CERTIFY THAT I/WE AM/ARE THE OWNER(S) OF THE PROPERTY DESCRIBED HEREON, AND THAT I/WE HEREBY ADOPT THIS PLAN OF SUBDIVISION WITH MY/OUR FREE CONSENT, ESTABLISH THE MINIMUM BUILDING RESTRICTION LINE, DEDICATE ALL EASEMENTS AND RIGHTS-OF-WAY TO PUBLIC OR PRIVATE USES AS NOTED.

DATE EAST KENTUCKY RURAL ELECTRIC COOPERATIVE CORPORATION

SURVEYORS CERTIFICATE

I DO HEREBY CERTIFY THAT THE SURVEY SHOWN HEREON WAS PERFORMED UNDER MY DIRECTION USING A TRIMBLE RTK GPS; THE BASE RECEIVER WAS A TRIMBLE R10 AND THE ROVER WAS A TRIMBLE R8. THE POOREST RELATIVE POSITIONAL ACCURACY OF ANY CORNER WAS 0.03 FEET AND THE BEST WAS 0.02 FEET. THE HORIZONTAL DATUM IS REFERENCED TO THE KENTUCKY STATE PLANE SOUTH ZONE COORDINATE SYSTEM (NAD83) AND VERTICAL DATUM IS REFERENCED TO NAVD88. GEOID MODEL 12A WAS USED ON THIS PROJECT.

STATE of KENTUCKY
D.G. GOOCH
3118
LICENSED PROFESSIONAL LAND SURVEYOR

DOUGLAS G. GOOCH 3118 LRLS# 6/11/16 DATE

SURVEY NOTES

1.) NO TITLE RESEARCH HAS BEEN PERFORMED, IN REGARDS TO ANY EASEMENTS THAT MIGHT HAVE BEEN DEDICATED ON OR ACROSS THIS PROPERTY. THIS SURVEY IS SUBJECT TO ANY RIGHTS-OF-WAY OR EASEMENTS, PUBLIC OR PRIVATE, WHETHER OF RECORD OR NOT, AND IS SUBJECT TO LOCAL CITY AND COUNTY ZONING ORDINANCES.
2.) THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE REPORT.
3.) THIS SURVEYOR IS NOT RESPONSIBLE FOR ANY INACCURATE INDEXING OF RECORDS THAT THE COUNTY CLERK OR THE PROPERTY VALUATION OFFICE MAY HAVE MADE.
4.) THE SURVEY COMPLIES WITH 201 KAR 18:150.

AGE ENGINEERING SERVICES, INC.
P.O. BOX 204
165 FOSTER LANE
STANFORD, KY 40484
PHONE (606) 365-8362
FAX (606) 365-1097

RETRACEMENT PLAT
EAST KENTUCKY RURAL ELECTRIC COOPERATIVE CORPORATION
1 TRACT TOTALING 179.794 ACRES BY SURVEY
US HWY 60 & I-64
WINCHESTER, CLARK COUNTY, KENTUCKY

DATE: 06-07-15
SCALE: 1" = 200'
DRAWN BY: R.D.S.
APPROVED BY: GOOCH
FILENAME: 16157 REC

EXHIBIT C

SCHEDULE OF VALUES

See attached.

CONTINUATION SHEET

AIA DOCUMENT G703

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.

In tabulations below, amounts are stated to the nearest dollar.

Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:

APPLICATION DATE:

PERIOD TO:

ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	ITEM	SCHEDULED VALUE	WORK COMPLETED FROM PREVIOUS APPLICATION (D + E)	WORK COMPLETED THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
1	30% Design	$72,769.74						$72,769.74	
2	80% Design	$50,938.82						$50,938.82	
3	90% IFP Design	$14,553.95						$14,553.95	
4	100% IFC Design	$7,276.97						$7,276.97	
5	Precon/Design Management and General Conditions	$181,613.00						$181,613.00	
6	Construction Mobilization	$245,227.03						$245,227.03	
7	SWPPP Controls	$144,290.52						$144,290.52	
8	Site Civil	$559,121.02						$559,121.02	
9	Fencing	$154,319.37						$154,319.37	
10	Foundations - Installation (type 1 piles)	$238,516.25						$238,516.25	
11	Racking - Material (includes type 1 piles)	$1,232,684.40						$1,232,684.40	
12	Racking - Installation	$346,233.26						$346,233.26	
13	Modules - Material	$6,935,174.72						$6,935,174.72	
14	Modules - Installation	$184,657.79						$184,657.79	
15	Inverters/Transformers - Material	$1,215,970.56						$1,215,970.56	
16	DC Cable - material	$149,570.36						$149,570.36	
17	String Wiring Harnesses - material	$154,137.86						$154,137.86	
18	Combiner Boxes - material	$106,126.05						$106,126.05	
19	Grounding - material	$47,392.32						$47,392.32	
20	MV Cable - material	$194,574.65						$194,574.65	
21	Trenching	$178,452.74						$178,452.74	
22	DC Installation	$1,218,516.05						$1,218,516.05	
23	AC Installation	$34,433.22						$34,433.22	
24	Aux Elec Equipment and Installation	$77,939.11						$77,939.11	
25	Monitoring	$121,597.06						$121,597.06	
26	Commissioning	$9,671.41						$9,671.41	
27	Construction General Conditions and Site Logistics	$558,151.55						$558,151.55	
28	Insurance / Fee	$838,714.59						$838,714.59	
29	Payment and Performance Bond	$86,523.43						$86,523.43	
30	Allowance for Foundations - Type 4 Cast in Place	$1,045,965.86						$1,045,965.86	
31									

CONTINUATION SHEET

AIA DOCUMENT G703

PAGE OF PAGES

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.

In tabulations below, amounts are stated to the nearest dollar.

Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:

APPLICATION DATE:

PERIOD TO:

ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	ITEM	SCHEDULED VALUE	WORK COMPLETED FROM PREVIOUS APPLICATION (D + E)	WORK COMPLETED THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
	GRAND TOTALS	$16,405,113.66	$0.00	$0.00	$0.00	$0.00		$16,405,113.66	

Allowances and Unit Prices

The Contract Price shall include the amounts of any allowances for the Work as set forth below. Whenever costs are more than or less than the amount identified in the applicable allowance, the Contract Price shall be adjusted accordingly pursuant to a Change Order in accordance with ARTICLE 7. The Parties also acknowledge and agree that the Contract Price for certain specific portions of the Work includes quantities and/or unit prices and that in the event that the quantities differ, the Contract Price shall be modified in accordance with the applicable unit price identified pursuant to a Change Order in accordance with ARTICLE 7.

Foundation Allowance

The Contract Price includes 3,497 Type 1 - Driven Pile foundations. An Allowance is included in the amount of $1,045,953 for the incremental increased cost of providing the 3,497 piers as the Cast In Place option. The actual number of foundation types will be finalized during the design phase.
In the event that additional piles or other types of piles are required, then they shall be charged at the additional rate identified in the table below

Foundation Pile Type	**Number of Piles**	**Cost per Pile**	**Incremental Cost per Pile vs. Type 1**	**Total Cost**	**Allowance for Incremental Cost vs. Type 1**
Type 1 - Driven Pile	3,497	$106.89		$373,794	
Type 2 - Vibratory Pile	3,497	$196.78	$89.89	$688,140	$314,345
Type 3 - Ground Screw	6,994	$156.18	$205.48	$1,092,323	$718,529
Type 4 - Cast in Place (auger spoils to be disposed of onsite)	**3,497**	**$405.99**	**$299.10**	**$1,419,747**	**$1,045,953**

Trench Rock and BMP Allowance

An Allowance is included in the Contract Price for the removal of trench rock. Material to be excavated that can not be removed by the excavating equipment being utilized for the performance of work on this project shall be considered rock. The excavation operation will first remove any non-rock material, then CONTRACTOR must notify OWNER and provide sufficient time to survey the top of rock surface. The total cubic yards are estimated quantities and compensation shall be based on actual verifiable quantities measured at the site. CONTRACTOR is responsible for adequately notifying OWNER for verification of rock quantities as provided. Method of rock removal is a large class excavator with a hoe-ram attachment in the 4" diameter range. Excavated rock material is to be disposed of onsite and suitable soil shall be sourced onsite for backfill in the trench. Hauling rock offsite and importing of backfill is not included.

CONTINUATION SHEET

AIA DOCUMENT G703

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.

In tabulations below, amounts are stated to the nearest dollar.

Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:

APPLICATION DATE:

PERIOD TO:

ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	ITEM	SCHEDULED VALUE	WORK COMPLETED		MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
			FROM PREVIOUS APPLICATION (D + E)	THIS PERIOD					

Trench Rock and BMP	**Unit**	**Unit Price**	**Total Cost**
Trench Rock Allowance	$		$11,000
Unit price to excavate rock (based on 157 CYD of rock and unit price includes mobilization of large class excavator)	CYD	$70.06	
BMP Allowance	$		$85,000
Unit price for silt fence	LNFT	$5.02	
Unit price for fiber roll	LNFT	$7.25	
Unit price for 4' deep sediment basin	SQFT	$0.55	

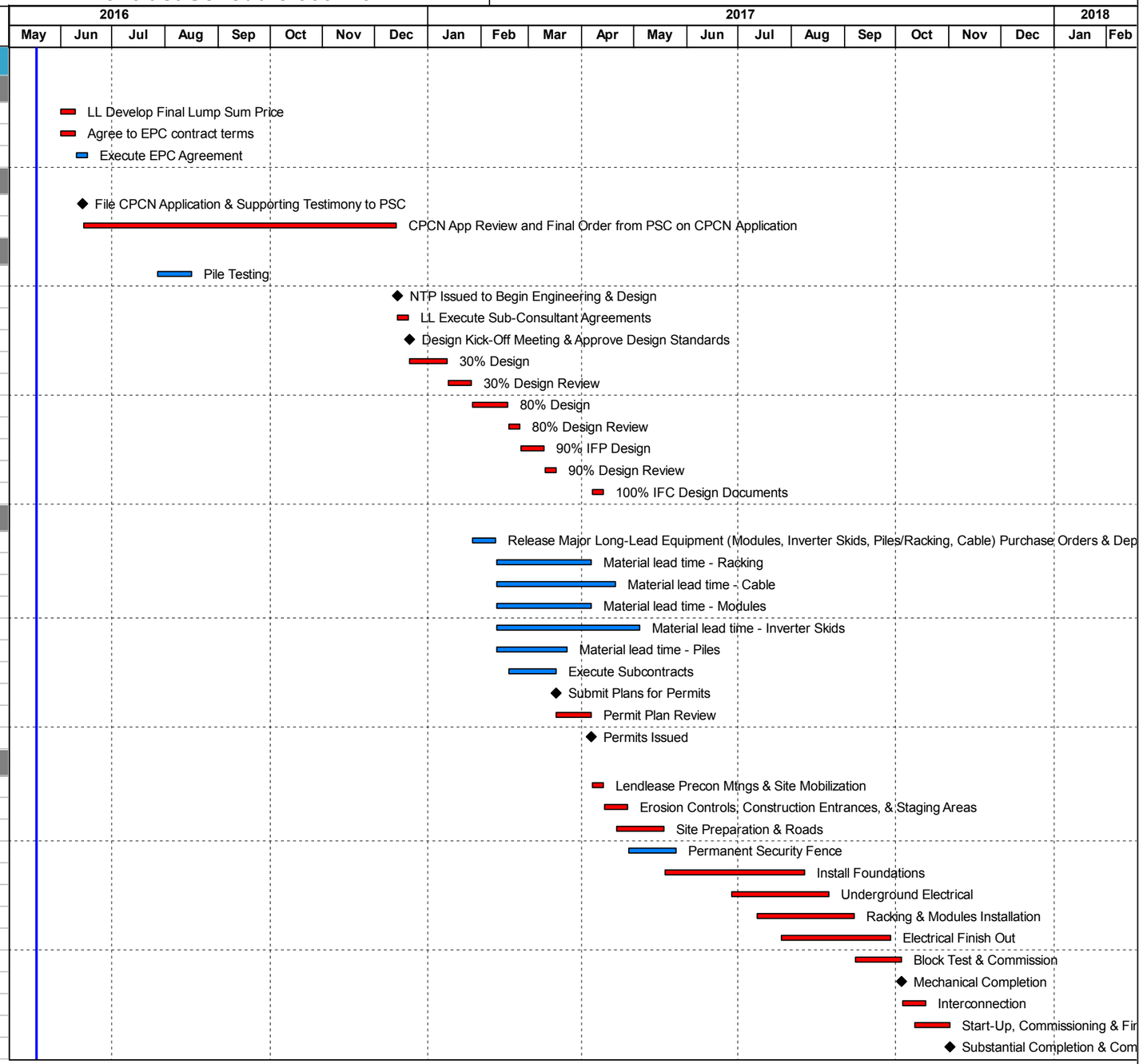
EXHIBIT D

PRELIMINARY PROJECT SCHEDULE

See attached.

EKPC EPC Contract Schedule 060216

Act. ID	Activity Name	Orig. Dur.	Rem. Dur.	Start	Finish
EKPC EPC Contract Schedule 060216					
Contracting					
A1140	LL Develop Final Lump Sum Price	7	7	01-Jun-16*	09-Jun-16
A1820	Agree to EPC contract terms	7	7	01-Jun-16	09-Jun-16
A1580	Execute EPC Agreement	5	5	10-Jun-16	16-Jun-16
CPCN					
A1880	File CPCN Application & Supporting Testimony to PSC	0	0		13-Jun-16
A1930	CPCN App Review and Final Order from PSC on CPCN App	126	126	14-Jun-16	13-Dec-16
Engineering & Design					
A1080	Pile Testing	15	15	27-Jul-16	16-Aug-16
A1050	NTP Issued to Begin Engineering & Design	0	0	14-Dec-16*	
A1060	LL Execute Sub-Consultant Agreements	5	5	14-Dec-16	20-Dec-16
A1070	Design Kick-Off Meeting & Approve Design Standards	0	0	21-Dec-16	
A1110	30% Design	15	15	21-Dec-16	12-Jan-17
A1120	30% Design Review	10	10	13-Jan-17	26-Jan-17
A1240	80% Design	15	15	27-Jan-17	16-Feb-17
A1260	80% Design Review	5	5	17-Feb-17	23-Feb-17
A1180	90% IFP Design	10	10	24-Feb-17	09-Mar-17
A1190	90% Design Review	5	5	10-Mar-17	16-Mar-17
A1130	100% IFC Design Documents	5	5	07-Apr-17	13-Apr-17
Planning, Procurement, & Permitting					
A1210	Release Major Long-Lead Equipment (Modules, Inverter Skic	10	10	27-Jan-17	09-Feb-17
A1830	Material lead time - Racking	40	40	10-Feb-17	06-Apr-17
A1840	Material lead time - Cable	50	50	10-Feb-17	20-Apr-17
A1850	Material lead time - Modules	40	40	10-Feb-17	06-Apr-17
A1870	Material lead time - Inverter Skids	60	60	10-Feb-17	04-May-17
A1900	Material lead time - Piles	30	30	10-Feb-17	23-Mar-17
A1410	Execute Subcontracts	20	20	17-Feb-17	16-Mar-17
A1200	Submit Plans for Permits	0	0		16-Mar-17
A1220	Permit Plan Review	15	15	17-Mar-17	06-Apr-17
A1230	Permits Issued	0	0		06-Apr-17
Construction					
A1250	Lendlease Precon Mtngs & Site Mobilization	5	5	07-Apr-17	13-Apr-17
A1270	Erosion Controls, Construction Entrances, & Staging Areas	10	10	14-Apr-17	27-Apr-17
A1360	Site Preparation & Roads	20	20	21-Apr-17	18-May-17
A1370	Permanent Security Fence	20	20	28-Apr-17	25-May-17
A1290	Install Foundations	56	56	19-May-17	08-Aug-17
A1280	Underground Electrical	40	40	27-Jun-17	22-Aug-17
A1300	Racking & Modules Installation	40	40	12-Jul-17	06-Sep-17
A1310	Electrical Finish Out	45	45	26-Jul-17	27-Sep-17
A1320	Block Test & Commission	20	20	07-Sep-17	04-Oct-17
A1380	Mechanical Completion	0	0		04-Oct-17
A1330	Interconnection	10	10	05-Oct-17	18-Oct-17
A1340	Start-Up, Commissioning & Final Inspections	15	15	12-Oct-17	01-Nov-17
A1390	Substantial Completion & Commercial Operation Date	0	0		01-Nov-17



Remaining Level of Effort ◆ Milestone
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work

EKPC EPC Contract Schedule 060216

EKPC EPC Contract Schedule 060216

Act. ID	Activity Name	Orig. Dur.	Rem. Dur.	Start	Finish
A1350	Final site stabilization & Remove Erosion Controls	10	10	02-Nov-17	16-Nov-17
A1400	System Acceptance Tests & Punchlist	10	10	02-Nov-17	16-Nov-17
A1460	Demobilize	5	5	17-Nov-17	27-Nov-17
A1470	Contract Closeout Activities	10	10	17-Nov-17	04-Dec-17
A1480	Final Completion	0	0		04-Dec-17

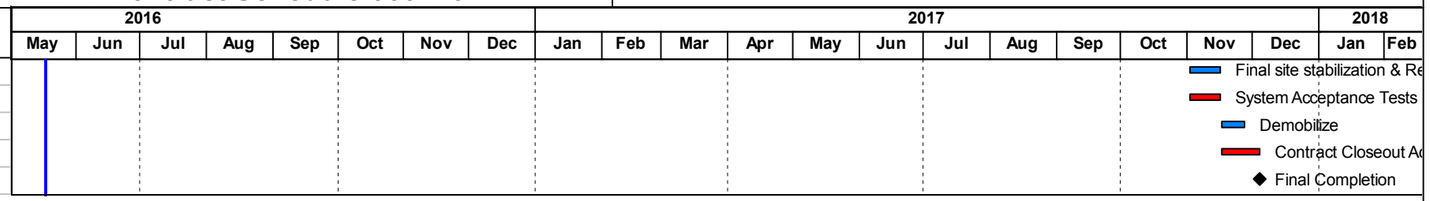


EXHIBIT E

OWNER'S PERMITS

Owner Permits:

Owner will obtain and maintain the following Permits associated with the Project:

- CPCN: Certificate of Public Convenience and Necessity (Kentucky Public Service Committee)
- United States Army Corps of Engineers Section 404 (Nationwide Permit 51)
- Kentucky Division of Water Section 401 – Water Quality Certification
- Kentucky Division of Water – Floodplain Permit
- United States Fish and Wildlife Service – Endangered Species Concurrence
- Kentucky Heritage Council – National Historic Preservation Act Concurrence

EXHIBIT F

FORM OF CHANGE ORDER

The undersigned hereby requests a Change Order pursuant to ARTICLE 7 of that certain Turnkey Engineering, Procurement and Construction Agreement, dated as of June __, 2016, by and between by and between LENDLEASE (US) PUBLIC PARTNERSHIPS LLC, a Delaware corporation ("**Contractor**") with offices at 200 Park Avenue, 9th Floor, New York, New York 10166, and EAST KENTUCKY POWER COOPERATIVE, INC. a Kentucky rural electric cooperative ("**Owner**", and together with Contractor, the "**Parties**"), with offices at P.O. Box 707, Winchester, Kentucky 40392-0707. Terms used and not defined herein shall have the meanings set forth in the Contract. The following changes shall, upon execution of this Change Order, become part of the Project Documents, and shall be subject to the same terms and conditions contained therein:

1) Description of requested change in the Work, including detailed supporting information:

2) Description of requested change to Contract Price:

3) Description of requested change to Project Schedule:

Original Contract Price Prior	
Change Orders	
To Date Current Contract Price	
New Change Order	
New Contract Price	

This Change Order shall constitute a final settlement of, and waiver by, Contractor of the right to assert (i) any further claim based on or arising out of the subject matter of this Change Order or (ii) any further claim in any way addressed by the items set forth in this Change Order, including any compensation for, impact on or delay or acceleration in performing the Work. Except as may be otherwise provided in this Change Order, Contractor agrees to furnish all labor, Equipment and materials and perform all work required to complete the above described change in accordance with the requirements of the Contract for the stated consideration.

[SIGNATURE PAGE FOLLOWS]

Executed this ____ day of _____, 20__.

LENDLEASE (US) PUBLIC PARTNERSHIPS LLC

By: _____

Name: _____

Title: _____

EAST KENTUCKY POWER COOPERATIVE, INC.

By: _____

Name: _____

Title: _____

EXHIBIT G - CONTRACTOR'S INVOICE

TO OWNER:_____ PROJECT: _____
APPLICATION NO.: _____ PERIOD TO: _____
DISTRIBUTION TO:

- ❑ OWNER
- ❑ CONTRACTOR

PROJECT NOs. FROM CONTRACTOR:
CONTRACT DATE:_____

CONTRACT FOR:_____

CONTRACTOR'S INVOICE
Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet is attached.

The undersigned Contractor has been employed by _____ (the "Owner") to furnish labor, material, services, and other improvements.

1. **ORIGINAL CONTRACT SUM**

   $_____

2. **Net change by Change Orders**

   $_____

3. **CONTRACT SUM TO DATE** (Line 1 ± 2)

   $_____

4. **TOTAL COMPLETED & STORED TO DATE**
   $_____
   (Column G)

5. **RETAINAGE:**
   a. 10% of Completed Work
   $_____
   (Columns D + E)
   b. _____% of Stored Material

$_____
(Column F)
Total Retainage (Line 5a + 5b or
Total in Column I)

$_____

6. **TOTAL EARNED LESS RETAINAGE**
   $_____
   (Line 4 less Line 5 total)
7. **LESS PREVIOUS CERTIFICATES FOR PAYMENT**
   (Line 6 from prior Certificate)

   $_____
8. **CURRENT PAYMENT DUE**

   $_____
9. **BALANCE TO FINISH, INCLUDING RETAINAGE**
   (Line 3 less Line 6)

   $_____

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous Months by Owner		
Total approved this Month		
TOTALS		

CONTRACTOR:

By:_____
Date:_____

State of:
County of:
Subscribed and sworn to before me this
_____ day of _____, 20__.

CONTRACTOR'S APPLICATION AND CERTIFICATE FOR PAYMENT; RELEASE OF CLAIMS

APPLICATION NO.: _____
containing Contractor's signed Certification, is attached. APPLICATION DATE: _____

In tabulations below, amounts are stated to the nearest dollar. PERIOD TO: _____

Use Column I on Contracts where variable retainage for the line items may apply.

A	B	C	D	E	F	G		H	I
			WORK COMPLETED						
ITEM NO.	DESCRIPTION OF WORK	SCHEDULE OF VALUES AMOUNT	FROM PREVIOUS APPLICATION (D + E)	THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)

EXHIBIT H

CONTRACTOR INTERIM LIEN WAIVER

STATE OF KENTUCKY
COUNTY OF _____

THE UNDERSIGNED MECHANIC AND/OR MATERIALMAN, _____ HAS BEEN EMPLOYED BY _____ TO FURNISH _____ FOR THE CONSTRUCTION OF IMPROVEMENTS KNOWN AS _____ WHICH IS LOCATED IN THE CITY OF _____, COUNTY OF _____, AND IS OWNED BY_____ AND MORE PARTICULARLY DESCRIBED AS FOLLOWS:

_____

_____

_____

(*DESCRIBE THE PROPERTY UPON WHICH THE IMPROVEMENTS WERE MADE BY USING EITHER A METES AND BOUNDS DESCRIPTION, THE LAND LOT DISTRICT, BLOCK AND LOT NUMBER, OR STREET ADDRESS OF THE PROJECT.)*

UPON RECEIPT OF THE SUM OF $_____, THE MECHANIC OR MATERIALMAN WAIVES AND RELEASES ANY AND ALL LIENS OR CLAIMS OF LIENS IT HAS UPON THE FOREGOING DESCRIBED PROPERTY OR ANY RIGHTS AGAINST ANY LABOR AND/OR MATERIAL BOND THROUGH THE DATE OF _____, 20__ AND EXCEPTING THOSE RIGHTS AND LIENS THAT THE MECHANIC AND/OR MATERIALMAN MIGHT HAVE IN ANY RETAINED AMOUNTS, ON ACCOUNT OF LABOR OR MATERIALS, OR BOTH, FURNISHED BY THE UNDERSIGNED TO OR ON ACCOUNT OF SAID CONTRACTOR FOR SAID BUILDING OR PREMISES.

GIVEN UNDER HAND AND SEAL THIS DAY OF _____, 20__.

_____
(SIGNATURE)

ON THIS _____ DAY OF _____, 20_____, BEFORE ME APPEARED THE ABOVE-SIGNED, KNOWN OR IDENTIFIED TO ME PERSONALLY, WHO, BEING FIRST DULY SWORN, DID SAY THAT S/HE IS THE AUTHORIZED REPRESENTATIVE OF CONTRACTOR AND THAT THIS DOCUMENT WAS SIGNED UNDER OATH PERSONALLY AND ON BEHALF OF CONTRACTOR.

NOTARY PUBLIC _____ MY COMMISSION EXPIRES: _____

NOTICE: WHEN YOU EXECUTE AND SUBMIT THIS DOCUMENT, YOU SHALL BE CONCLUSIVELY DEEMED TO HAVE BEEN PAID IN FULL THE AMOUNT STATED ABOVE, EVEN IF YOU HAVE NOT ACTUALLY RECEIVED SUCH PAYMENT, 60 DAYS AFTER THE DATE STATED ABOVE UNLESS YOU FILE EITHER AN AFFIDAVIT OF NONPAYMENT OR A CLAIM OF LIEN PRIOR TO THE EXPIRATION OF SUCH 60 DAY PERIOD. THE FAILURE TO INCLUDE THIS NOTICE LANGUAGE ON THE FACE OF THE FORM SHALL RENDER THE FORM UNENFORCEABLE AND INVALID AS A WAIVER AND RELEASE UNDER *[INSERT APPROPRIATE STATUTE REFERENCE]*.

EXHIBIT I

CONTRACTOR INTERIM WAIVER AND RELEASE

STATE OF KENTUCKY
COUNTY OF _____

The undersigned, _____("Contractor"), has been engaged under contract with _____ ("Owner") to furnish certain materials, equipment, services, and/or labor for the construction of improvements known as _____, together with all improvements and appurtenances attendant thereto ("Project"), which is located at _____ and is owned by Owner and is more particularly described as follows:

_____

_____

_____

(DESCRIBE THE PROPERTY UPON WHICH THE IMPROVEMENTS WERE MADE BY USING EITHER A METES AND BOUNDS DESCRIPTION, THE LAND LOT DISTRICT, BLOCK AND LOT NUMBER, OR STREET ADDRESS OF THE PROJECT.)

Upon receipt of the sum of $_____, Contractor waives, releases and discharges any and all claims, damages, demands, actions, and causes of action, including but not limited to any and all manner of claims for delay, disruption, acceleration or extra work against Owner and Owner's successors or assigns from the Effective Date of the parties' Contract through the date of _____, _____ ("Current Date") and reserving those rights that Contractor might have in any contractual retainage. Exceptions as follows:

(If no exception or "none" is entered above, undersigned shall be deemed not to have reserved any claim other than retainage and claims for which the time period for asserting provided under the parties' Contract has not expired.)

Contractor affirms, warrants, and represents that the list attached hereto as "Attachment 1" and made a part hereof contains the names of all of the laborers, materialmen, mechanics, manufacturers, suppliers, and subcontractors who have furnished services, labor, equipment, or materials, or any one of these items directly to Contractor, and Contractor further affirms, warrants, and represents (a) that all persons or entities listed on "Attachment 1" have been paid in accordance with the applicable Subcontract terms for all work performed and all materials, equipment, labor or services supplied to Contractor for use at the Project through and including _____, ____ (date of Contractor's last prior Invoice).

This Waiver and Release is freely and voluntarily given and the undersigned acknowledges and represents that it has fully reviewed the terms and conditions of this Waiver and Release, that it is fully informed with respect to the legal effect of this Waiver and Release,

and that it has voluntary chosen to accept the terms and conditions of this Waiver and Release in return for the payment recited above.

The undersigned further agrees that making and receipt of payment and execution of this Waiver and Release shall in no way release the undersigned from its continuing obligations with respect to the completion of any work remaining undone, including any obligations of the undersigned to Owner.

FOR CONTRACTOR:

Applicable to Invoice No(s). _____

Signed: _____

By: _____

Title: _____

Date: _____

AFFIDAVIT

On this _____ day of _____, 20_____, before me appeared the above-signed, known or identified to me personally, who, being first duly sworn, did say that s/he is the authorized representative of Contractor and that this document was signed under oath personally and on behalf of Contractor.

_____
Notary Public
My Commission Expires:

“Attachment 1”

List Of All Subcontractors, Sub-subcontractors, Suppliers,
Materialmen, Laborers, Mechanics, And
Manufacturers Providing Goods Or
Services To Contractor For The Project

EXHIBIT J

RESERVED

EXHIBIT K

CONTRACTOR FINAL LIEN WAIVER

STATE OF KENTUCKY
COUNTY OF _____

THE UNDERSIGNED MECHANIC AND/OR MATERIALMAN, _____ HAS BEEN EMPLOYED BY _____ TO FURNISH _____ FOR THE CONSTRUCTION OF IMPROVEMENTS KNOWN AS _____ WHICH IS LOCATED IN THE CITY OF _____, COUNTY OF _____, AND IS OWNED BY_____ AND MORE PARTICULARLY DESCRIBED AS FOLLOWS:

_____

_____

_____

(*DESCRIBE THE PROPERTY UPON WHICH THE IMPROVEMENTS WERE MADE BY USING EITHER A METES AND BOUNDS DESCRIPTION, THE LAND LOT DISTRICT, BLOCK AND LOT NUMBER, OR STREET ADDRESS OF THE PROJECT.)*

UPON THE RECEIPT OF THE SUM OF $_____, THE MECHANIC AND/OR MATERIALMAN WAIVES AND RELEASES ANY AND ALL LIENS OR CLAIMS OF LIENS IT HAS UPON THE FOREGOING DESCRIBED PROPERTY OR ANY RIGHTS AGAINST ANY LABOR AND/OR MATERIAL BOND ON ACCOUNT OF LABOR OR MATERIALS, OR BOTH, FURNISHED BY THE UNDERSIGNED TO OR ON ACCOUNT OF SAID CONTRACTOR FOR SAID PROPERTY.

GIVEN UNDER HAND AND SEAL THIS DAY OF _____, 2___.

_____
(SIGNATURE)

ON THIS _____ DAY OF _____, 20_____, BEFORE ME APPEARED THE ABOVE-SIGNED, KNOWN OR IDENTIFIED TO ME PERSONALLY, WHO, BEING FIRST DULY SWORN, DID SAY THAT S/HE IS THE AUTHORIZED REPRESENTATIVE OF CONTRACTOR AND THAT THIS DOCUMENT WAS SIGNED UNDER OATH PERSONALLY AND ON BEHALF OF CONTRACTOR.
NOTARY PUBLIC_____ MY COMMISSION EXPIRES: _____

NOTICE: WHEN YOU EXECUTE AND SUBMIT THIS DOCUMENT, YOU SHALL BE CONCLUSIVELY DEEMED TO HAVE BEEN PAID IN FULL THE AMOUNT STATED ABOVE, EVEN IF YOU HAVE NOT ACTUALLY RECEIVED SUCH PAYMENT, 60 DAYS AFTER THE DATE STATED ABOVE UNLESS YOU FILE EITHER AN AFFIDAVIT OF NONPAYMENT OR A CLAIM OF LIEN PRIOR TO THE EXPIRATION OF SUCH 60 DAY PERIOD. THE FAILURE TO INCLUDE THIS NOTICE LANGUAGE ON THE FACE OF THE FORM SHALL RENDER THE FORM UNENFORCEABLE AND INVALID AS A WAIVER AND RELEASE UNDER *[INSERT APPROPRIATE STATUTE REFERENCE]*.

EXHIBIT L

CONTRACTOR'S FINAL WAIVER AND RELEASE

STATE OF KENTUCKY
COUNTY OF _____

The undersigned, _____ ("Contractor"), has been engaged under contract with _____ ("Owner") to furnish certain materials, equipment, services, and/or labor for the construction of improvements known as _____, together with all improvements and appurtenances attendant thereto ("Project"), which is located at _____ and is owned by Owner and is more particularly described as follows:

_____

_____

_____

(DESCRIBE THE PROPERTY UPON WHICH THE IMPROVEMENTS WERE MADE BY USING EITHER A METES AND BOUNDS DESCRIPTION, THE LAND LOT DISTRICT, BLOCK AND LOT NUMBER, OR STREET ADDRESS OF THE PROJECT.)

Upon receipt of the sum of $_____, Contractor represents that it has been paid in full for all labor, services, equipment and material furnished to the Project, and Contractor hereby waives and releases any and all claims, damages, demands, actions, and causes of action, including but not limited to any and all manner of claims for delay, disruption, acceleration or extra work, against Owner and its successors and assigns, at law, in contract, tort, equity or otherwise, which Contractor has, may have had or may have in the future arising out of Contractor's performance of work on the Project.

This Waiver and Release applies to all facts, acts, events, circumstances, changes, constructive or actual delays, accelerations, extra work, disruptions, interferences and the like which have occurred, or may be claimed to have occurred prior to the date of this Waiver and Release, whether or not known to Contractor at the time of execution of this Waiver and Release.

Contractor further represents that all of its obligations, legal, equitable, or otherwise, relating to or arising out of its work on the Project have been fully satisfied or will be satisfied after receiving the above identified payment due, including, but not limited to obligations relating to:

Employees, laborers, materialmen and subcontractors employed by Contractor;
Labor, materials, equipment and supplies furnished by others to Contractor; and
Social security taxes, income tax withholding, unemployment insurance, privilege taxes, license fees, and any other taxes and obligations imposed by governmental authorities.

This Waiver and Release is freely and voluntarily given, and Contractor acknowledges and represents that it has fully reviewed the terms and conditions of this Waiver and Release and that it is fully informed with respect to the legal effect of this Waiver and Release. Contractor understands, agrees and acknowledges that, upon payment, this document waives rights unconditionally and is fully enforceable to extinguish all claims of Contractor.

FOR CONTRACTOR:

Applicable to Invoice(s) No. ___All___ *
*If all, print "all."

Signed: _____

By: _____

Title: _____

Date: _____

AFFIDAVIT

On this _____ day of _____, 20_____, before me appeared the above-signed, known or identified to me personally, who, being first duly sworn, did say that s/he is the authorized representative of Contractor and that this document was signed under oath personally and on behalf of Contractor.

_____
Notary Public

My Commission Expires: _____

EXHIBIT M

SUBCONTRACTOR'S FINAL WAIVER AND RELEASE

STATE OF _____
COUNTY OF _____

The undersigned, _____("Subcontractor"), has been engaged under contract with _____ ("Contractor") to furnish certain materials, equipment, services, and/or labor for the construction of improvements known as _____, together with all improvements and appurtenances attendant thereto ("Project"), which is located at _____ and is owned by _____ ("Owner") and is more particularly described as follows:

_____
_____
_____

(DESCRIBE THE PROPERTY UPON WHICH THE IMPROVEMENTS WERE MADE BY USING EITHER A METES AND BOUNDS DESCRIPTION, THE LAND LOT DISTRICT, BLOCK AND LOT NUMBER, OR STREET ADDRESS OF THE PROJECT.)

Upon receipt of the sum of $_____, Subcontractor represents that it has been paid in full for all labor, services, equipment and material furnished to the Project, and Subcontractor hereby waives and releases any and all claims, damages, demands, actions, and causes of action, including but not limited to any and all manner of claims for delay, disruption, acceleration or extra work, against Contractor, Owner, and their successors and assigns, at law, in contract, tort, equity or otherwise, which Subcontractor has, may have had or may have in the future arising out of Subcontractor's performance of work on the Project.

This Waiver and Release applies to all facts, acts, events, circumstances, changes, constructive or actual delays, accelerations, extra work, disruptions, interferences and the like which have occurred, or may be claimed to have occurred prior to the date of this Waiver and Release, whether or not known to Subcontractor at the time of execution of this Waiver and Release.

Subcontractor further represents that all of its obligations, legal, equitable, or otherwise, relating to or arising out of its work on the Project have been fully satisfied, including, but not limited to obligations relating to:

Employees, laborers, materialmen and subcontractors employed by Subcontractor;
Labor, materials, equipment and supplies furnished by others to Subcontractor; and
Social security taxes, income tax withholding, unemployment insurance, privilege taxes, license fees, and any other taxes and obligations imposed by governmental authorities.

This Waiver and Release is freely and voluntarily given, and Subcontractor acknowledges and represents that it has fully reviewed the terms and conditions of this Waiver and Release and that it is fully informed with respect to the legal effect of this Waiver and Release. Subcontractor understands, agrees and acknowledges that, upon payment, this document waives rights unconditionally and is fully enforceable to extinguish all claims of Subcontractor.

FOR CONTRACTOR:

Applicable to Invoice(s) No. ___All___ *
*If all, print "all."

Signed: _____

By: _____

Title: _____

Date: _____

AFFIDAVIT

On this _____ day of _____, 20_____, before me appeared the above-signed, known or identified to me personally, who, being first duly sworn, did say that s/he is the authorized representative of Subcontractor and that this document was signed under oath personally and on behalf of Subcontractor.

_____
Notary Public

My Commission Expires: _____

EXHIBIT N

COMMISSIONING REQUIREMENTS

1.0 OVERVIEW

The Commissioning process provides a quality-orientated methodology for verifying and documenting the design, construction, functionality, and performance of the PROJECT. The Commissioning process shall ensure that all system components perform interactively to meet the defined system objectives and criteria of the OWNER, as established in the Agreement and its supporting documents. Capitalized terms not otherwise defined above or elsewhere in this Exhibit N shall have the meaning given such terms in the Agreement. The "Agreement" refers to that certain Turnkey Engineering, Procurement and Construction Agreement between OWNER and CONTRACTOR.

2.0 SCOPE

All Commissioning activities shall be executed under a phased approach, as identified below. Activities of each phase shall be documented and submitted to the OWNER for review, acceptance, and documentation:

3.0 DESIGN PHASE

3.1 Design Review:

3.1.1 Design review is part of the Commissioning process. CONTRACTOR shall provide regular design reviews with OWNER to ensure OWNER'S PROJECT requirements are being met. Design reviews will be held at intervals agreed upon between OWNER and CONTRACTOR. The Commissioning team will participate in any and all reviews beyond, but not including 50% PROJECT design.

3.2 Commissioning Plan:

3.2.1 A PROJECT-specific Commissioning plan (the "Plan") shall be developed and issued by CONTRACTOR. The Plan shall outline the tasks, processes, procedures, and deliverables required to prove the function and performance of the PROJECT and all of its components. It will include a section on Deficiencies and Resolution Procedures for each phase and the Commissioning schedule. The Plan shall also reference safety requirements for start-up and Commissioning, including electrical safety and lock-out/tag-out procedures. The Plan shall be submitted to OWNER for review and approval.

3.3 Commissioning Specifications

3.3.1 Commissioning specifications shall be provided by CONTRACTOR to outline the requirements for the installing Subcontractors.

3.4 Commissioning Review

3.4.1 A commissioning review shall be performed by CONTRACTOR of the design drawings and shall address design fundamentals for safety, reliability, maintainability, and commissionability.

3.5 Commissioning Log

3.5.1 A detailed commissioning log will be developed and issued by the CONTRACTOR for the tracking of all Commissioning issues, observations, and deficiencies. The commissioning log will enable current status and resolution tracking of any open items. The log will be circulated to the Commissioning Team on a regular basis for review.

4.0 CONSTRUCTION PHASE

4.1 Meetings

4.1.1 Commissioning meetings will be held on-Site on a periodic basis. A commissioning kick-off meeting will be held with the Commissioning Team at the commencement of project construction. The "Commissioning Team" consists of, at a minimum, the CCM, CONTRACTOR's design team representative, CONTRACTOR's construction team representative, OWNER, OWNER's commissioning agent, Owner's Project Manager, Owner's Construction Site Manager, and Owner's Engineer.

4.2 Submittal Reviews

4.2.1 Approved Equipment submittals shall be reviewed by CONTRACTOR for compliance with the PROJECT design, intent and specifications.

4.3 Pre-functional Checklists

4.3.1 Project and Equipment-specific pre-functional checklists will be developed and issued by CONTRACTOR to the installing Subcontractors. The pre-functional checklists shall address proper installation methods, vendors' requirements (including requirements of any Manufacturer's Warranties), Applicable Laws, applicable codes and standards, and Prudent Industry Practices.

4.4 Inspections

4.4.1 Select Site and Equipment delivery inspections will be carried out by CONTRACTOR during the course of construction. Reports will be issued on all inspections. This will include signed reports verifying proper installation of all Equipment, devices, and wiring per manufacturer's recommendations. This will also include observations and punch-lists from those responsible for the design verifying installation has occurred per their design drawings and specifications.

4.5 Functional Testing

4.5.1 Project and Equipment-specific functional testing protocols will be developed by CONTRACTOR to address functionality and safe operation of components and systems. The functional testing protocols shall be detailed so as to address all facets of operation, failure modes, and recovery modes. It shall include all points to be measured and the pass/fail criteria.

4.6 Each Power Block (as defined by CONTRACTOR) will consist of the PV Arrays (as defined in Exhibit A), cable harnesses, combiner boxes, DC fuse boxes, inverters, transformers and combining switchgear (in total or a portion of it), as well as all associated structural elements and interconnecting cables that will allow the Power

Block to generate and output the AC power as defined per Power Block to the OWNER-supplied interconnection point.

4.7 Each Power Block shall be tested when energized and connected to the grid.

4.8 Block Functional Testing will ensure that a fully functioning Power Block is Commissioned and placed into automatic operation, including confirmation of the following:

4.8.1 Proper mechanical and electrical installation of the PV modules.
4.8.2 Completion of the pre-functional tests of the PV Modules and Combiner Boxes, including but not limited to open circuit voltage testing, polarity testing, continuity testing, Megger tests, grounding tests, etc.
4.8.3 Proper installation and operation of the Power Conversion Station equipment, including the inverters and transformers.
4.8.4 Proper installation of the DC and AC cables, and completion of pre-functional tests of the cables, including but not limited to continuity testing, insulation resistance testing, etc.
4.8.5 Completion of inverter pre-functional checks and functional tests per CONTRACTOR's Commissioning protocols (including phase rotation and synch checks, emergency and safety features, etc.)
4.8.6 Completion of the functional tests of the transformers, including, but not limited to, Megger tests, VLF or HI-POT tests (as applicable), polarization index tests, oil sampling tests, grounding tests, etc.
4.8.7 Completion of the functional test of the combining switchgear per CONTRACTOR's commissioning protocols, including, but not limited to, HI-POT testing, circuit breakers and disconnect devices integrity and operability, etc.
4.8.8 All auxiliary systems and devices, including HVAC system, are installed and functionally tested.
4.8.9 Proper operation of the DAS or SCADA monitoring and control system at the Power Block level. This includes all associated instrumentation, communications between SCADA and other system devices (i.e. inverters), alarms, data acquisition and historian.

4.9 CONTRACTOR shall develop a detailed plan to test the functionality of each Power Block and submit to OWNER for OWNER's review and acceptance ("Block Functional Testing"). The Plan shall be submitted to OWNER at least thirty (30) days prior to the start of Power Block testing. Block Functional Testing shall be conducted by CONTRACTOR in accordance with the agreed Block Functional Testing Plan.

4.10 The Block Functional Test Plan shall define and record the pre-test start condition of the Power Block, automatic start-up and shut-down of the inverters, auxiliary systems or devices, or any other automatic operation of the Power Block. Basic parameters that define such automatic operation shall be recorded as part of the Block Functional Testing (i.e. inverter wake-up voltage, shutdown, etc.)

4.11 During the Block Functional Testing, as a minimum, the following operating parameters shall be captured:

a) Irradiance
b) Ambient temperature
c) Power Conversion Station power, voltage, amperage (both DC and AC)
d) Power Conversion Station temperature (or inverter temperature if no shelter is used)
e) Combining switchgear power, voltage, amperage
f) PV module temperatures

5.0 ACCEPTANCE PHASE

5.1 Performance Testing

5.1.1 The performance of the PROJECT and its components and systems shall be measured and documented pursuant to the procedures set forth in Exhibit O: PERFORMANCE TEST REQUIREMENTS.

5.2 Commissioning Specific Training

5.2.1 CONTRACTOR shall provide a training program to OWNER as agreed to in the AGREEMENT, including classroom and field training.

5.3 O&M Manuals

5.3.1 CONTRACTOR shall provide detailed and specific Operations and Maintenance (O&M) Manuals in mutually-agreed format as described in Exhibit CC: CONTRACTOR SUBMITTALS. The O&M Manuals shall include, but not be limited to: system description, method of plant operation, sequences of operation, troubleshooting procedures, maintenance procedures, as-built drawings, and all Equipment vendor and Subcontractor supplied manuals, warranties, and specification sheets.

5.4 Warranty Review

5.4.1 CONTRACTOR shall review all Equipment warranties for compliance with the AGREEMENT. Extended warranty requirements and warranty activation dates shall be documented.

5.5 Commissioning Manual

5.5.1 CONTRACTOR shall create a Commissioning manual (*see* Exhibit CC: CONTRACTOR SUBMITTALS), addressing the disposition of all system installation, functionality and operation tests identified in the Plan (the "Commissioning Manual"). The Commissioning Manual shall include all relevant start-up and Commissioning documentation, test data, site reports, Equipment start-up data, and checklists in a logical and sequential format. Upon Final Completion, the Commissioning Manual shall be submitted to OWNER.

6.0 OPERATIONAL PHASE

6.1 Performance Verification

6.1.1 The performance of the PROJECT will be monitored by OWNER throughout its life to ensure the PROJECT is maintaining performance levels as stated in

the Warranties. Performance degradations observed during the Defect Correction Period shall be addressed promptly according to the agreed upon Warranties.

6.2 Operation

6.2.1 A maintenance/event log shall be kept by CONTRACTOR to document any operational issues and remedies that they are under contract to respond to, throughout the life of the Warranties.

7.0 INSTRUMENTATION

CONTRACTOR shall be responsible for all standard testing instrumentation. Testing instrumentation should include, but is not limited to;

- Power meters
- PV string testers
- Voltmeters
- Clamp-on meters (Amp meters)
- Irradiance meters
- Power quality test equipment
- Temperature sensors

All instrumentation is to be NIST calibrated; calibration certificates shall be current for all instrumentation used by CONTRACTOR during testing.

8.0 SAFETY

During Commissioning, CONTRACTOR shall be responsible for any requirements for specific safety procedures and Equipment that are in addition to the standard site safety requirements of the Construction Safety Plan. This shall include such items as:

- Fall protection
- Electrical safety
- Lockout/Tagout

EXHIBIT O

PERFORMANCE TEST REQUIREMENTS

1. GENERAL

Capitalized terms not otherwise defined in this Exhibit O shall have the meaning given such terms in the AGREEMENT. The following is an overview of the procedures to be utilized in connection with the execution of performance tests of the PLANT. The objective of the tests is to verify contract requirements and guarantees have been met. There are three main tests to be performed:

1) CAPACITY TEST

2) AC LOSS TEST

3) INVERTER TESTS

The tests are to be executed once the CONTRACTOR has successfully completed all startup and commissioning activities, including all Functional Tests and the Operational Test set forth in Exhibit N, Commissioning. The CONTRACTOR shall remediate the shortcomings and re-test until the guarantees are achieved.

On or before Substantial Completion of the PLANT, CONTRACTOR shall commence the Performance Test which shall be witnessed by OWNER or OWNER's Representative. In such case that the CONTRACTOR fails to satisfy all requirements of the Performance Test on or before the Substantial Completion of the PLANT, CONTRACTOR to remediate the shortcomings during the Cure Period before commencing re-tests.

2. DEFINITIONS

AGREEMENT
The Turnkey Engineering, Procurement and Construction Agreement between OWNER and CONTRACTOR.

CAPACITY GUARANTEE
This is the guarantee by the CONTRACTOR for the total POWER RATING of the PLANT. It shall be verified by the CAPACITY TEST (see section 5) in which the guaranteed MINIMUM POWER RATING, as calculated with the PV SIMULATION MODEL at the REPORTING CONDITIONS, is compared to the POWER RATING, as measured by the AC power meter at the Point of Common Coupling.

Irradiance band
The range of irradiance values which are eligible to be included in the data analyses. Should be no less than Irr_0 +/- 15%, and no less than Irr_0 +/- 40%

GUARANTEED FACILITY PERCENTAGE
Shall be calculated as 100% – SE.

MINIMUM FACILITY PERCENTAGE
Shall be calculated as 90% – SE.

MINIMUM POWER RATING (P_{MIN})
This shall mean the expected power output of the PLANT at the REPORTING CONDITIONS, as computed by the procedure outlined in section 5 below.

PERFORMANCE CRITERIA
Shall mean the POWER RATING divided by the MINIMUM POWER RATING for the PLANT at the time the CAPACITY TEST is performed, expressed as a percentage.

PLANT
The PLANT will consist of 8.5 MW_{AC} of PV generation equipment, including the PV arrays, cable harnesses, combiner boxes, DC fuse boxes, inverters, transformers and switchgear (if required), as well as all associated structural elements and interconnecting cables that will allow the PLANT to generate and output AC power to the OWNER-supplied interconnection point.

Point Of Common Coupling (PCC)
This shall be the point of electrical interconnection between the PLANT and the grid, where CONTRACTOR's responsibility ends. The delivered energy to this point will be measured by the OWNER's revenue meter or other agreed upon power meter. Power measurements will be conducted within the range of power factor as defined in Exhibit A Section 1.6.G.1. The range of power factor conditions will be accounted for in the PVSyst model.

POWER RATING (P_{RC})
This shall mean the actual power output of the PLANT at the REPORTING CONDITIONS, per section 3.3.17 of ASTM E2848-13. It shall be computed by the procedure outlined in section 5 below. Power measurements will be conducted within the range of power factor as defined in Exhibit A Section 1.6.G.1. The range of power factor conditions will be accounted for in the PVSyst model.

PV SIMULATION MODEL
The PV SIMULATION MODEL shall be based on PVSYT version 6.4.3. All of the program inputs shall be proposed by the CONTRACTOR, and agreed upon by OWNER and CONTRACTOR at the time of contract execution with a corresponding CAPACITY GUARANTEE. In the event the PLANT is modified by mutual agreement between the CONTRACTOR and OWNER, the program inputs may be modified to match the constructed PLANT if agreed upon by OWNER and CONTRACTOR.

PRIMARY MEASUREMENT DEVICE
An instrument which provides a measurement or reading that is used in calculating output power.

REPORTING CONDITIONS

This shall be as defined as the reference irradiance (Irr_0), the reference temperature (T_0), and the reference wind speed (WS_0) as determined by the procedures outlined below, and referred to in section 3.2.4 of ASTM E2848-13.

SECONDARY MEASUREMENT DEVICE

An instrument which provides a measurement or reading that is not used in calculating the output power, but is used as check on primary measurements.

STANDARD ERROR (SE)

Shall be calculated per section 9.4 Of ASTM E2848-13

SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

The hardware and software installed at the Site which is used to monitor and collect the weather and performance data from the PLANT. This typically consists of programmable logic controllers, data loggers, software, and other network devices.

TEST PERIOD

Shall mean the "data collection period" referred to in section 3.2.2 of ASTM Standard E2848-13 and Test Period contained in this document below.

3. TEST MEASUREMENTS

All test measurement devices shall be fully defined for their make/model, accuracy, calibration and location. The following tables summarize these measurements that will be required for all of the tests:

Test Measurements (Minimum)

Measurement	Quantity	Type	Instrument Type	Range	Minimum Accuracy
Irradiance	4	Primary	Pyranometer: Plane of Array (POA), 2 ea. mounted on fixed tilt racking, 2 ea. mounted on tracker system	Same as modules in solar field	+/- 3.0%
Net Power Output (kW)	1	Primary	OWNER's power meter(s) installed at the PCC with calibrated CTs and PTs.		+/- 0.2%

Net Power Output (kW)	1 per inverter	Primary	Inverter internal power meter		+/- 2.0%
Ambient Temperature	2	Primary	Part of weather station	-50 – 60°C	+/- 0.3°C
Module cell temperature	4	Secondary	Platinum RTD (resistance temperature detector) transmitter (.00385 TCR DIN B), on back surface or cell of module	-10 – 140°C	+/- 0.3°C
AC/DC power, volts and amperage	1 per Inverter	Primary	From inverter CTs and PTs connected to plant SCADA		+/- 1%
Meteorological conditions: air temp, wind speed and direction, GHI (secondary)	2	Primary	On-Site weather station		

Instrument Calibration

All instruments used for primary measurements shall have current NIST or equivalent calibration certificates. All calibrations certificates shall be submitted to the OWNER for review prior to commencement of the applicable test.

Data Collection

Data shall be recorded by the SCADA system. The use of alternative means for data acquisition shall be used only with the prior written consent of OWNER, which consent shall not be unreasonably withheld or delayed.

4. GENERAL TEST REQUIREMENTS

Scheduling

CONTRACTOR, in coordination with OWNER's Engineer, shall notify OWNER in writing of proposed Performance Test date not less than 10 Business Days prior to the proposed date for the Performance Test.

Pre-test Conditions

The Performance Tests may be performed only when the following conditions are met:

1. All FUNCTIONAL TESTS (as defined in Exhibit N) have been successfully completed.
2. Weather conditions as required to complete the Performance Tests, as addressed in this exhibit and in the approved Performance Test Procedures.
3. There is grid connectivity at each inverter such that the Performance Tests can be accomplished under load.
4. CONTRACTOR has achieved Mechanical Completion with respect to the PLANT.

Pre-Test Meeting

Prior to each Test, a pre-test meeting shall be conducted and recorded. The meeting shall review the applicable approved TEST PROCEDURE, instrumentation locations, calibration sheets and other relevant topics including safety requirements. Minutes of this meeting shall be recorded by the CONTRACTOR and approved by all parties.

Test Duration and Data Frequency for CAPACITY TESTs and LOSS TESTs

Testing duration and frequency shall be as follows:

CAPACITY and LOSS TEST Data Collection	
TEST PERIOD	The TEST PERIOD will consist of at least 5 valid days. A day is considered valid if a wide distribution of data is collected over the range of insolation values from 200 W/m^2 to 1000 W/m^2 (unless otherwise approved by OWNER or invalidated by the procedures in ASTM E2848-13). Each day will have an adequate quantity of data points
Data Sampling Interval	1 minute

Data Collection

Data shall be recorded by the SCADA system. The use of alternative means for data acquisition shall not be used unless approved by OWNER.

Adjustments

Any adjustments made during the Tests to any portion of the PLANT or test measurement devices shall be documented by CONTRACTOR, and reviewed and approved by OWNER prior to execution. The OWNER, and the OWNER's ENGINEER, shall be available during test in order to grant such approval, which will not be unreasonably withheld.

Test Reporting

CONTRACTOR shall submit a detailed test report, within 15 Business Days of completion of successful Test, to the OWNER consisting of the following:

1. Test procedures (as executed)
2. Instrument calibration sheets/certificates
3. Test data (manual and data acquisition)
4. Test Results uncertainty
5. Field notes
6. Calculations and Results

5. ACCEPTANCE TESTS AND VALIDATION

The CONTRACTOR shall validate the performance of the overall PLANT through the following Performance Tests, which will be conducted by the CONTRACTOR, in order to determine if the guarantees have been met:

1. CAPACITY TEST
2. AC LOSSES
3. INVERTER TEST

1. CAPACITY TEST

a. General

The CAPACITY TEST is used to determine the PERFORMANCE CRITERIA, by evaluating the POWER RATING of the PLANT compared to the expected MINIMUM POWER RATING at the REPORTING CONDITIONS. The results of the CAPACITY TEST are used to determine if the CONTRACTOR has met the CAPACITY GUARANTEE.

b. Data Collection

i. The pyranometers used to collect irradiance measurements shall be cleaned immediately prior to testing and weekly during non-operating hours (morning or night) during the TEST PERIOD. In general soiling of the modules will be accounted for in the PVSyst model.

ii. OWNER shall be responsible for:

1. Routinely reviewing collected weather and operating data for the PLANT following SUBSTANTIAL COMPLETION.
2. Selecting a TEST PERIOD for which there are sufficient valid data to meet or exceed the data requirements necessary to perform the procedures as described below.

iii. CONTRACTOR shall follow Section 8 “Procedure” of ASTM E2848-13 to collect data for calculating the P_{RC}.

c. Selection of REPORTING CONDITIONS (RC)

i. Data collected per the above shall be used to determine the REPORTING CONDITIONS, per the following procedure. A unique set of REPORTING CONDITIONS shall be determined for the fixed-tilt and tracking portions of the PLANT, according to this procedure.

ii. For the Plane-of-Array (POA) Irradiance measurements, the data recorded from multiple pyranometers will be averaged for each time interval for both the tracking and fixed tilt portions of the system.

1. The calculation for the tracking RC shall use the data from the POA sensors mounted to the trackers, and the fixed RC shall use the data from the POA sensors mounted to the fixed racking.

2. In the event that data from one of the pyranometers is excluded due to malfunction or sensor discrepancy, the data from the un-excluded pyranometers shall be averaged (in the case of malfunctions), or the data from all the pyranometers may be excluded (in the case of sensor discrepancy out of range of sensor accuracy).

iii. The collected data set shall be filtered according to the following operations:

1. The procedure described per section 9.1 of ASTM E2848-13 will be followed, with the exception of section 9.1.6, “Irradiance Outside of Range”. All data identified by the applied filters shall be excluded.

2. Any test data points in which the power output of an inverter is recorded to be greater than 100% of the inverter maximum output shall also be excluded.

3. Data points affected due to snow or frost coverage of the Modules shall be excluded if one or both of the following apply:

a. A snow depth sensor, other measurement equipment, or a visual inspection supported by photographic data by the OWNER or CONTRACTOR at the PLANT indicates the presence of snow or frost on the modules.

b. There is a significant difference between actual and expected output, based on statistical means or engineering judgment.

iv. After filtering, the resultant data set shall be used to determine the reference

irradiance (Irr_0) for the REPORTING CONDITIONS.

1. In order to determine the Irr_0, the test data shall be sorted according to POA irradiance from highest to lowest, and examined to determine the highest POA irradiance value for which there is a nearly equal distribution of data points in the range of the selected POA irradiance +/- 20%. This irradiance shall be considered Irr_0.

2. There shall be no more than a 40%/60% spread in the irradiance distribution, i.e., no more than 40% of irradiance data above Irr_0 and 60% of irradiance data below Irr_0, or vice versa.

3. All test data where the irradiance is outside of the range of Irr_0 plus or minus the irradiance band (Irr_0 ± 20%) shall be excluded.

4. The minimum value for consideration as the Irr_0 will be calculated by dividing the following equation:

$$Irr_{min} = \frac{400\ \mathrm{W}/m^2}{1 - Irr_{band}} = \frac{400\ \mathrm{W}/m^2}{1 - 0.2} = 500\ \mathrm{W}/m^2$$

   Where:

   Irr_{min} is the minimum value for Irr_0.

   Irr_{band} is the size of half the irradiance band expressed as a number, so a band of +/- 20% would mean Irr_{band} = 0.2.

   All irradiance values less than Irr_{min} shall be excluded from consideration as the Irr_0. A value of 300 W/m^2 may be used in place of 400 W/m^2 if more data points are required, per section (v) below.

5. The maximum irradiance value for consideration of the Irr_0 shall be determined by the following equation:

$$Irr_{max} = \frac{Irr_{high}}{1 + Irr_{band}}$$

   Where:

   Irr_{max} is the maximum value for Irr_0.

   Irr_{high} is the highest irradiance value of collected and filtered data set (as determined in section iii above)

   All irradiance values greater than Irr_{high} shall be excluded from consideration as the Irr_0.

v. The FILTERED MEASUREMENT DATA shall be defined as the resulting data set of section iv above, and it shall have a minimum of five hundred (500) data points.

1. The five hundred (500) or more data points are under the assumption of a one (1) minute data interval.

2. If the filtered data set does not contain enough data, then the TEST PERIOD will be shifted per ASTM 2848-13 section 8.3.

3. At the agreement of the CONTRACTOR and OWNER, the irradiance band in section (iv) above may be increased (not to exceed Irr_0 ± 40%) or reduced (not less than Irr_0 ± 15%), in order to obtain a necessary and reasonable number of data points.

4. All data points with irradiance less than 400 W/m2 (or 300 W/m^2 if more data points are needed) shall be excluded.

vi. The average ambient temperature of the FILTERED MEASUREMENT DATA shall be calculated. This average ambient temperature shall be the reference temperature T_0. This T_0 may be different for the fixed and tracking systems.

vii. The average wind speed of the FILTERED MEASUREMENT DATA shall be calculated. This average wind speed shall be the reference wind speed WS_0. This WS_0 may be different for the fixed and tracking systems.

d. MINIMUM POWER RATING (P_{MIN})

i. The PV SIMULATION MODEL, as derived from PVsyst simulations, shall be used to establish the Facility's expected annual energy output as measured by the inverters and confirmed by the revenue meter.

1. OWNER and CONTRACTOR shall agree on all inputs to PVsyst for the creation of the PV SIMULATION MODEL, including (but not limited to): losses, weather data file, and component model files.

ii. The PV SIMULATION MODEL shall include separate outputs for the fixed and tracking portions of the PLANT.

iii. Each of the PV SIMULATION MODEL outputs shall include, as a minimum, the following columns in the respective output .csv files (or 8760 files):

1. Date & Time (formatted with Month; Day; Hour in separate columns)

2. POA Irradiance (GlobInc, W/m2)

3. Horizontal Irradiance (GlobHor, W/m2)

4. Ambient Temperature (T Amb, °C)
5. Wind Speed (WindVel, m/s)
6. Near Shadings Beam Loss (ShdBLss, W/m2)
7. Inverter Loss Due to Low Voltage Maximum Power Point (MPP) Window (IL Vmin, kW)
8. Inverter Loss Due to Power Limitation (i.e. "clipping" loss) (IL Pmax, kW)
9. Available Energy at Inverter Output (EOutInv, kW)
10. Energy Injected into Grid (E_Grid, kW)

iv. For the purposes of this procedure, the TARGET PERIOD shall mean the 90-day period extending an equal number of days prior to, and after, the TEST PERIOD. For example, if the TEST PERIOD is May 1 – 6, then the Target Period will be March 17 – June 17. The TEST PERIOD may be concurrent for the fixed and tracking portions of the site.

v. The MINIMUM POWER RATING (P_{MIN}) at the REPORTING CONDITIONS shall be determined from the PV SIMULATION MODEL for each of the portions of the site in accordance with the following:

1. Filter the 8760 file for the PLANT to only include data within the 90-day Target Period.
2. Apply the following filters to the resulting 90-day data file:
    a. Exclude any data points with beam shading values ShdBLss > 0.
    b. Exclude any data points where the inverter is not in 'Peak Power Point Tracking' mode, as such term is defined in section 9.1.8 of ASTM E2848-13.
    c. Exclude any data with irradiance values outside of the range established section (c)(iv)(3) above.
    d. Data points with POA irradiance < 400 W/m^2 (or 300 W/m2, whatever is consistent with what was used in (c)(v)(4) and (c)(v)(5)) shall be excluded.
3. After filtering, the resulting dataset shall have 50 or more data points.
    a. If less than 50 data points remain in the set, then the TEST PERIOD shall be shifted and a new TARGET PERIOD shall be

identified per to section (c)(v)(2) above.

b. At OWNER's discretion, the irradiance threshold may be expanded to a larger range as described in (c)(v)(3) and (c)(v)(4) above.

4. For the filtered Target Period dataset, a regression analysis shall be performed on the POA irradiance, ambient temperature, wind speed, and energy at the inverter output. The regression analysis shall be used to determine the regression coefficients A, B, C and D in the following Equation 1 (Eq. 1):

$$EOutInv = GlobInc * (A + B * GlobInc + C * T_{Amb} + D * WindVel) \quad \textbf{(Eq. 1)}$$

vi. The MINIMUM POWER RATING (P_{MIN}) shall be calculated for each of the portions of the site by substituting in coefficients A, B, C and D and the appropriate REPORTING CONDITIONS (Irr_0, T_0 and WS_0) as shown in the following Equation 2 (Eq. 2):

$$P_{MIN} = Irr_0 * (A + B * Irr_0 + C * T_0 + D * WS_0) \quad \textbf{(Eq. 2)}$$

e. POWER RATING (P_{RC})

i. The FILTERED MEASUREMENT DATA for each portion of the site identified in section (c)(v) above shall be used to calculate P_{RC} for each portion of the site.

ii. Filtering of the test data and calculation of the P_{RC} shall be conducted according to section 9 'Calculation of Results' of ASTM E2848-13. The equation used for the final calculation (equation 2 in ASTM E2848-13, modified for the terminology used in this test report) is:

$$P_{RC} = Irr_0 * (a_1 + a_2 * Irr_0 + a_3 * T_0 + a_4 * WS_0)$$

Where the coefficients a_1, a_2, a_3, and a_4 are calculated from the measured, filtered data, as described in ASTM E2848-13.

iii. The results of this section (P_{RC}) shall be reported in accordance with section 10 'Report' of ASTM E2848-13.

f. PERFORMANCE CRITERIA

i. The PERFORMANCE CRITERIA shall be calculated as defined in section 1 above and expressed as a percentage:

$$PC = (P_{RC} / P_{min}) * 100$$

ii. If the PERFORMANCE CRITERIA is greater than or equal to the GUARANTEED

FACILITY PERCENTAGE, then the CONTRACTOR has met the CAPACITY GUARANTEE.

iii. If the PLANT has so achieved the CAPACITY GUARANTEE, then no further analysis is required.

iv. If, however, the PLANT did not so satisfy the CAPACITY GUARANTEE, then CONTRACTOR shall follow the process outlined in Section 10.2 of the AGREEMENT.

3. AC Losses

The AC side of the PLANT that is to be tested is from the inverter output to the PCC power meter.

The AC Losses shall not exceed 2% of the power measured at the PCC power meter. These losses include mainly transformer losses, and wiring ohmic losses.

The losses shall be measured by simply subtracting the power measured at the inverter output from the power measured at the PCC meter. Power at these points shall be measured by means of the SCADA.

These losses shall be measured for a duration of 2 days. A test day will be considered valid only if there are no inverter or system failures, shutdowns, or interruptions.

Ancillary Load Considerations: The test shall account for ancillary loads up to the PCC which deduct energy from the net AC output. These are loads which are used for the running of the PLANT, but which reduce the net delivered power to the AC Point of Interconnection. An example of this would be HVAC/lighting loads for the enclosures (if used) which house the inverters, back feed power to inverters and transformers, etc. If such loads exist, they must be connected upstream of the power meters, fed from the power produced from the solar arrays and not a separate electrical circuit. These loads must be modeled during the test by making sure these loads are running during the test, or deducting an agreed upon amount from the resultant tested AC output.

Pre-test Conditions for AC Loss Tests

1. Mechanical Completion
2. Commissioning and Reliability Test successfully completed
3. Test schedule and plan reviewed and approved by OWNER

4. Inverter Test Description

CONTRACTOR shall submit test procedures and schedule for the factory acceptance tests of the inverter. OWNER shall witness factory acceptance tests. These tests shall include, at a minimum, the following:

1. Burn in at design DC voltage at stepped loads, 25% increments.

2. Verify clipping at differing simulated insolation values and DC input voltages
3. Validate efficiency at differing loads at design DC input voltages
4. Simulate operation and performance at design environmental conditions of site
5. Verify operation of inverter at voltage limits
6. Demonstrate unit will not be damaged during normal failure modes such as loss of power, loss of single AC phase, loss of DC input, loss of communication link
7. Verify VAR and PF control of inverter at various conditions and phase voltages
8. Verify inverter operation up to 110% of rated power output
9. Demonstrate that inverters do not circulate current among phases or operating units
10. Verify other design parameters of EPC CONTRACTOR

CONTRACTOR shall submit test procedures and schedule for on-site commissioning and testing of inverters. Settings and adjustments of inverter shall be reviewed and approved by OWNER.

EXHIBIT P

LIQUIDATED DAMAGES

Delay Liquidated Damages shall be an amount equal to $2,800 per day.

Performance Liquidated Damages shall be an amount determined in accordance with the following formula: (i) (A) Guaranteed Facility Percentage (expressed as a decimal) *minus* (B) the Performance Criteria (expressed as a decimal) multiplied by (ii) the Contract Price.

EXHIBIT Q

INSURANCE

Contractor's Insurance

Contractor shall provide and maintain, and shall regarding items (i), (ii) and (iii) require any and all Major Subcontractors to provide and maintain, with an insurance company authorized to do business in the United States or otherwise reasonably acceptable to Owner the following insurance:

i. Workers Compensation and Employer's Liability Policy: Prior to the start of the Work, Contractor shall submit evidence of Contractors Workers' Compensation and Employer's Liability Insurance Policy, and the respective policy shall include:

   a. Workers' Compensation (statutory benefits coverage) Insurance:
      i. in accordance with the laws of the Commonwealth of Kentucky
      ii. Federal Employer's Liability Act Endorsement "FELA" (WC 00 01 04); if exposures warrant.

   b. Employer's Liability with a limit of one Million Dollars ($1,000,000) with respect to Bodily Injury Each Accident/($1,000,000) Bodily Injury by Disease Each Employee/($1,000,000) Bodily Injury by Disease and Policy Limit.

ii. Commercial General Liability Policy: Prior to the start of Work, Contractor shall provide evidence of Contractor's Policy by providing a certificate evidencing the Commercial General Liability Insurance, with a combined single limit for bodily injury and property damage of One Million Dollars ($1,000,000) each Occurrence and Two Million Dollars ($2,000,000) General Aggregate. The Commercial General Liability shall include the following coverages:
   a. Coverage for premises and operations.
   b. No exclusion of coverage for Blanket Contractual Liability to the extent covered by the policy against liability assumed by Contractor under this Contract.
   c. No exclusion for Broad Form Property Damage hazard.
   d. No exclusion for liability arising out of blasting, collapse, and underground property damage hazards.
   e. Products and Completed Operations Liability Coverage with a Two Million Dollars ($2,000,000) Aggregate Limit. Said coverage must continue in force for a minimum of two (2) years from the Acceptance of Work.
   f. Said policy shall name Owner as an Additional Insured to the extent necessary to fulfill Contactor's indemnity obligations under this Contract, with Contractor's policy deemed to be primary.
   g. Said policy shall be endorsed to provide that the underwriter(s) have fully waived their Rights of Recovery Against Others (subrogation) against Owner and Owner's insurance carrier(s).

iii. Commercial Automobile Liability Insurance Policy: Prior to the start of Work, Contractor shall provide evidence of Contractor's Commercial Automobile Liability Insurance Covering the use of all owned, non-owned and hired automobiles, with a combined single limit for bodily injury and property damage of $1,000,000 each Accident with respect to Contractor's vehicles assigned to or used in performance of Work under this Contract. Said policy shall name Owner as an Additional Insured to the extent necessary to fulfill Contractor's indemnity obligations under this Contract, with said policy designated to be primary. Said policy shall include an endorsement providing that the underwriter(s) have waived their Rights of Recovery Against Others (subrogation) against Owner and Owner's insurance carrier(s).

iv. Environmental Impairment ("Pollution") Liability Insurance: If applicable, Contractor shall provide prior to the start of work, evidence of Contractor's Environmental Impairment Liability Insurance covering Contracting operations. Said policy shall extend to Contractor's use of vehicles as well as Contractor's operations and work, and shall provide for monitoring, testing, cleanup and remediation expenses. Limits of liability shall not be less than $3,000,000 Each Occurrence. Said policy shall be endorsed to provide Additional Insured status of Owner and shall be endorsed to provide Waiver of Subrogation in favor of Owner.

v. Umbrella/Excess Liability Insurance: Contractor shall provide prior to start of work evidence of Contractor's Umbrella or Excess Liability Insurance providing excess limits of liability over and above the primary policies outlined in Items 15.01 (A) Employers Liability, (B) Commercial General Liability, and (C) Commercial Automobile Liability above. Said policy shall provide in the minimum Ten Million Dollars ($10,000,000) Each Occurrence and, Ten Million Dollars ($10,000,000) in the Aggregate. Said policy shall be "follow-form" to the extent of coverage provisions in the primary forms (B) (C) (D) and (E) with regards to coverage terms and policy provisions. Said coverage must continue in force for two (2) years from the Acceptance of Work by Owner.

vi. Professional/Errors and Omissions Liability Insurance: If applicable, Contractor shall provide prior to the start of work, evidence of Contractor's Professional Liability Insurance insuring Contractor and any other firms or persons under Contractor's direction, professional acts, errors, omissions in planning, operation, design, and completion of the contracted work. Said insurance will have as minimum limits of liability $1,000,000 Each Occurrence and $3,000,000 Aggregate. Should policy contain a deductible clause, said deductible shall be shown on the Certificate of Insurance, and Contractor's carrier shall agree to pay any such claims "first dollar" and then recover the deductible amount from Contractor.

vii. It is understood and agreed that East Kentucky Power Cooperative, Inc. is included as additional insured to the extent specified herein and on a primary non-contributory basis with respect to All-Risk Builder's Risk, General Liability, and Auto policies; Umbrella policy follows form. Waiver of Subrogation is afforded for General Liability, and Auto policies; Umbrella policy follows form.

Quality of Insurance Coverage: The above policies to be provided by Contractor shall be written by companies satisfactory to Owner or having a Best Rating of not less than A- ("Excellent"). These policies shall not be cancelled except with thirty (30) days written notice to Owner from the Contractor and the Insurance Carrier. Evidence of coverage, or notification of cancellation or other changes shall be mailed to:

ATTN: Risk Management
East Kentucky Power Cooperative, Inc.
P. O. Box 707
Winchester, KY 40392-0707

Implication of Insurance: Owner shall not be obligated to review any of Contractor's Certificates of Insurance, insurance policies, or endorsements, or to advise Contractor of any deficiencies in such documents. The limits and coverages required under this Article should not be construed to necessarily be adequate for Contractor's own insurance and risk management needs. Any receipts of such documents or their review by Owner shall not relieve Contractor from or be deemed a waiver of Owner's rights to insist on strict fulfillment of Contractor's obligations under the Contract.

Certificates of Insurance: Owner reserves the right to request and receive a certificate of coverage of any of the above policies or endorsements.

Owner Insurance

Builder's All-Risk: Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Amount, plus value of subsequent Change Orders, comprising total value for the entire Project at the Site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in this Contract or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until Substantial Completion of the Project or termination of the Contract. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

EXHIBIT R

FINAL COMPLETION REQUIRED DOCUMENTATION AND RECORDS

1. All diagnostics, licenses, intellectual property rights, warranty rights, operation and maintenance (O&M) manuals, documents and materials, and turnover packages with QA/QC reports, whether developed or issued by the Contractor or any Subcontractor, that support or which may be reasonably necessary or convenient for the Owner to assume the efficient operation, maintenance and repair of the Facility.

2. All manuals, test reports, vendor information, and other documentation, whether developed or issued by the Contractor or any Subcontractor, required to be delivered pursuant to this Contract.

3. All Drawings (including, without limitation, final stamped as-built Drawings), documents, and on-Site engineering and other data furnished or to be furnished by Contractor or Subcontractor in connection with the Work, including, without limitation the Engineering and Design Materials Documents and the Construction Documents.

4. All notices, whether written or in electronic format, to Contractor or any Subcontractor from any Governmental Authority or to any Governmental Authority from Contractor or any Subcontractor pertaining to the Work.

EXHIBIT S

FORM OF NOTICE TO PROCEED

This Notice to Proceed (this "Notice to Proceed") is agreed and entered into by LENDLEASE (US) PUBLIC PARTNERSHIPS LLC, a Delaware corporation ("**Contractor**") with offices at 200 Park Avenue, 9th Floor, New York, New York 10166, and EAST KENTUCKY POWER COOPERATIVE, INC. a Kentucky rural electric cooperative ("**Owner**", and together with Contractor, the "**Parties**"), with offices at P.O. Box 707, Winchester, Kentucky 40392-0707, on _____ __, 201__ pursuant to the Turnkey Engineering, Procurement and Construction Agreement (the "**Contract**") between Owner and Contractor dated June __, 2016. All capitalized terms used herein but not otherwise defined herein shall have the meanings ascribed to such terms in the Contract. All rules of construction set forth in the Contract are applicable to this Notice to Proceed.

Pursuant to the Contract, Owner hereby authorizes Contractor to commence and complete the Work in accordance with the Contract.

This Notice to Proceed has been entered into by the Parties on the date first written above.

LENDLEASE (US) PUBLIC PARTNERSHIPS LLC

By: _____

Name: _____

Title: _____

EAST KENTUCKY POWER COOPERATIVE, INC.

By: _____

Name: _____

Title: _____

EXHIBIT T

FORM OF LIMITED NOTICE TO PROCEED

This Limited Notice to Proceed (this "Limited Notice to Proceed") is agreed and entered into by LENDLEASE (US) PUBLIC PARTNERSHIPS LLC, a Delaware corporation ("**Contractor**") with offices at 200 Park Avenue, 9th Floor, New York, New York 10166, and EAST KENTUCKY POWER COOPERATIVE, INC. a Kentucky rural electric cooperative ("**Owner**", and together with Contractor, the "**Parties**"), with offices at P.O. Box 707, Winchester, Kentucky 40392-0707, on _____ __, 201_ pursuant to the Turnkey Engineering, Procurement and Construction Agreement (the "**Contract**") between Owner and Contractor dated June __, 2016. All capitalized terms used herein but not otherwise defined herein shall have the meanings ascribed to such terms in the Contract. All rules of construction set forth in the Contract are applicable to this Limited Notice to Proceed.

WHEREAS, pursuant to the Contract, Owner and Contractor may agree to engage Contractor to perform certain Work prior to Owner's issuance of the Notice to Proceed;

NOW THEREFORE, pursuant to the Contract, Owner and Contractor hereby agree that Contractor will perform the Work set forth in this Limited Notice to Proceed subject to and in accordance with the Contract and the following terms and conditions set forth herein.

A. Scope of Services:[1] Contractor shall perform the following Work and all work and services reasonably inferable therefrom and submit the following deliverables: ***[to be inserted]***

1. _____

2. _____

3. _____

B. Schedule, Commencement Date and Completion Date: The schedules for completion of the Work contemplated by this Limited Notice to Proceed shall be as follows:

1. Contractor shall commence the Work contemplated by this Limited Notice to Proceed *[on/by _____ ___, 201_]* (the "LTP Commencement Date").
2. *[Insert all other dates relevant to the schedule for the Work]*

[1] Note for Form of Limited Notice to Proceed only: The Scope of Work of this Limited Notice to Proceed and all significant deliverables shall be completed in full for each project by listing all specific task items and specific deliverables (reports, tests, drawings, specifications, photos, etc.)

3. Contractor shall complete the Work contemplated by this Limited Notice to Proceed by *[_____ ___, 201_]*.

C. Limited Notice to Proceed and/or Schedule of Values:

[Insert relevant information related to payment in accordance with the Schedule of Values.]

D. Special Provisions or Requirements: *[insert any special provisions or requirements applicable to this Limited Notice to Proceed.]*

[Signature page to follow]

This Limited Notice to Proceed has been entered into by the Parties on the date first written above.

LENDLEASE (US) PUBLIC PARTNERSHIPS LLC

By: _____

Name: _____

Title: _____

EAST KENTUCKY POWER COOPERATIVE, INC.

By: _____

Name: _____

Title: _____

EXHIBIT U

OWNER QUALITY MANAGEMENT GENERAL REQUIREMENTS

CONTRACTOR shall provide a copy of its final QA/QC Plan. Upon review by the OWNER, all Work shall be managed in accordance with such QA/QC Plan. The QA/QC Plan shall include such procedures and systems as follows:

1. Pile design, pile installation monitoring and verification testing.
2. Road construction interior and perimeter access roads.
3. Compaction Testing.
4. Torque values and checking of all critical bolted connections.
5. Fill material requirements.
6. Rebar and conduit placement.
7. Backfill and compaction of trenches.
8. Concrete placement and testing.
9. All wire insulation testing, Megger Testing.
10. MV wire insulation testing, VLF (Very Low Frequency) Testing.
11. Fiber optic cable testing.
12. Mechanical system - trackers, mounting structures, tracker controls.
13. Factory testing of inverters and transformers, as well as on-site pre-commissioning testing of inverters (see Exhibit N: Commissioning Requirements).
14. PV source open circuit measurements – V_{oc} at combiner boxes.
15. Termination pull testing.
16. All visual inspections.
17. Grounding continuity testing.
18. Earth ground resistivity testing.
19. PV module inspection and manufacturer documentation of factory test (STC) of every module.
20. Metering and instrumentation calibration testing.
21. Step-up transformer testing and manufacture certification.
22. Medium voltage transformer testing and manufacture certification.
23. Inverter phase rotation and matching with utility.
24. Inverter PF control matching LGIA requirements
25. Plant controller
26. Relay settings at the point of interconnection to Company.
27. Other Supplier prescribed procedures.
28. Weld inspection.
29. Welder specifications.
30. SCADA data checkout.

31. Any Kentucky Building Code required inspections not listed above, including Special Structural Inspections

All QA/QC testing procedures shall be witnessed and documented by a representative of the CONTRACTOR qualified to perform the Work. OWNER may observe and witness QA/QC as necessary in accordance with provisions of the Agreement. Qualified representative of the CONTRACTOR shall date and sign documentation indicating completion and acceptance of each QC/QA test procedure. All test documents should be completely filled out by a qualified representative responsible for the testing/inspection. All tests should contain pass/fail criteria and should explicitly state whether each test passes or fails.

CONTRACTOR shall submit a complete binder containing documented and signed QA/QC test results (Exhibit CC: Contractor Submittals). In the event the OWNER determines that QA/QC test results are not satisfactory, CONTRACTOR shall promptly take such actions necessary to achieve satisfactory results. Such procedure shall be repeated as necessary until QA/QC test results are satisfactory, which in no event shall be later than the Provisional Acceptance date.

EXHIBIT V

KEY PERSONNEL

See attached.

Exhibit V - Key Personnel

*Note - final resource assignments will be made once project start is determined.

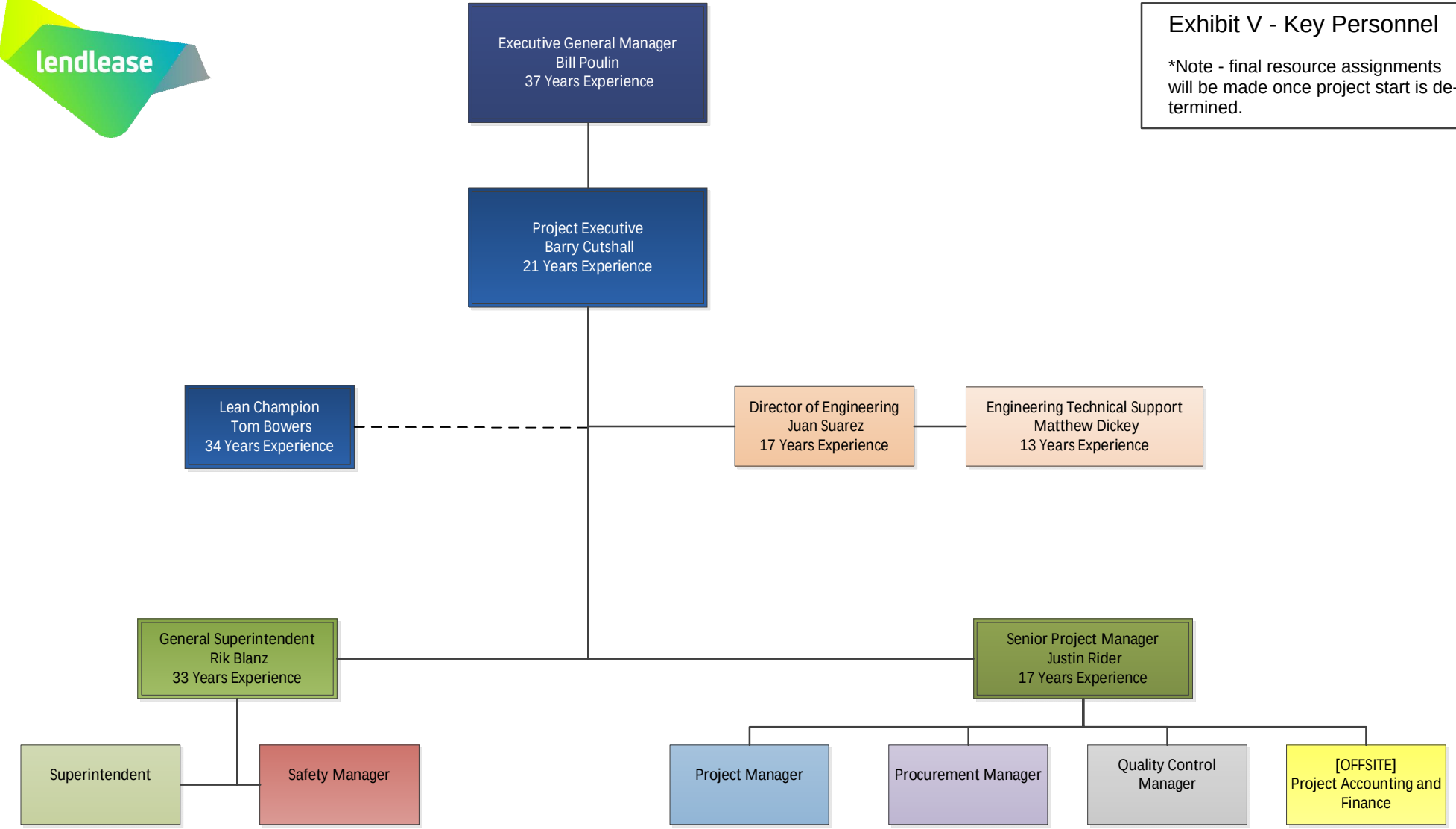


EXHIBIT W

PROJECT SPARE PARTS

CONTRACTOR shall submit a list of recommended spare parts for the Facility. CONTRACTOR shall include any requirements for spare parts as defined by any local law or regulation and according to Good Industry Practices. The recommended spare parts list shall detail the cost per individual spare part, number of spare parts, the total cost of each type of spare part required and a total cost estimate for all recommended spare parts. CONTRACTOR's spare parts list shall include the following information:

1. CONTRACTOR to provide minimum (20) modules or a minimum of (1) full pallets as spare.
2. Identification of replacement parts for racking, trackers and tracker motors (as applicable).
3. Identification of replacement parts for inverters, transformers, and other power conditioning system equipment.
4. CONTRACTOR to provide (1) combiner box as a Capital Spare.
5. CONTRACTOR shall list the manufacturer and part number for each spare part.
6. CONTRACTOR shall list the complete spare part description.
7. CONTRACTOR shall provide a final approved spare parts list in excel format to include the CONTRACTOR's branding / logo on document.

CONTRACTOR shall specify how the recommended quantities of spare parts were developed and what the anticipated availability for the Project will be with the recommended spares inventory. Expected annual usage shall be indicated for scheduled and unscheduled replacements.

Upon approval by OWNER of such spare parts list (the "Spare Parts Inventory"), the Spare Parts Inventory shall be attached as Exhibit CC and made a part hereof. Prior to Final Acceptance, CONTRACTOR shall procure, the approved Spare Parts Inventory. Contract Price does not include the cost of Spare Parts. CONTRACTOR's actual cost for Spare Parts will be passed through to OWNER without mark-up.

As items are used or otherwise depleted from the Spare Parts Inventory during such time as the contractor is in charge of operating the site, CONTRACTOR shall be obligated to replenish such items at its actual cost as described in the preceding paragraph. For the avoidance of doubt, CONTRACTOR shall not be permitted to submit a Change Order in connection with replenishing Spare Parts Inventory.

EXHIBIT X

FORM OF CONTRACTOR PERFORMANCE BOND

Performance Bond

Bond No. _____ Premium Amount $ _____

KNOW ALL MEN BY THESE PRESENTS,

That
we, _____
(Full Name and Address of Subcontractor)

_____

(hereinafter called the Principal), as
Principal, and _____
(Full Name and Address of Surety)

_____

a corporation duly organized under the laws of
the state of _____
(hereinafter called the Surety), as Surety, are held and firmly bound unto:

Lend Lease's Name:

Lend Lease's Address:
(Lend Lease address from page 1 of Subcontract)

(hereinafter called the Obligee)

in the sum _____ U.S. Dollars
of
($), for the payment of which we, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal entered into a certain Contract ,
dated _____
(Month, Day) *(Year)*

with for:

(Project Name)
(Project Address)
(Project Number)

which is hereby referred to and made a part hereof as if fully set forth herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the Principal shall promptly and faithfully perform said Contract, within the time provided therein and any extension thereof that may be granted by the Obligee, and during the life of any guaranty required under said Contract, and shall also promptly and faithfully perform any and all authorized modifications of said Contract that may hereafter be made, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

The Surety agrees that no change, extension of time, alteration, addition, omission or other modification of the Contract or the Project Documents, as specified in the Contract, shall in any way affect its obligations under this Bond, and the Surety hereby waives notice of any such changes, extensions of time, alterations, additions, omissions or other modifications.

Whenever Principal shall be, and declared by Obligee, to be in default, in breach, and/or to have failed to perform in any manner under the Contract, the Obligee having performed its obligations thereunder, the Surety shall promptly remedy the default by one of the following:

1. Complete the Contract in accordance with its terms and conditions.

2. Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, or if the Obligee elects, upon determination by the Obligee and the Surety jointly of the lowest responsible bidder, arrange for a contract between such bidder and Obligee, and make available as Work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the Contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, and pursuant to the Contract, the amount set forth in the first paragraph hereof. The term "balance of the Contract price," as used in this paragraph, shall mean the total amount payable by Obligee to the Principal under the Contract and any amendments thereto, less the amount properly paid by Obligee to the Principal.

3. Pay to Obligee the full amount of the penal sum above stated.

For projects located in the State of Connecticut, Surety is liable for and is obliged to pay any interest, costs, penalties or attorneys' fees imposed upon the Principal under any provisions of Connecticut Public Act 99-153, entitled "An Act Concerning Fairness in Financing in the Construction Industry."

No right of action shall accrue on this bond to or for the use of any person or corporation other than the Obligee named herein or the heirs, executors, administrators, successors or assigns of the Obligee.

Principal and Surety shall not be liable to the Obligee unless the Obligee has performed its obligations to the Principal in accordance with the terms of said Contract.

Sealed with our seals and dated this _____ (Day) day of _____ (Month), _____ (Year)

Principal: _____

Attested By: _____ By: _____

Print Name: _____ Print Name: _____

Signatory's Title: _____ Signatory's Title: _____

SEAL

Surety: _____

Attested By: _____ By: _____

Print Name: _____ Print Name: _____

Signatory's Title: _____ Signatory's Title: Attorney-in-Fact

SEAL

***Attach Power-Of-Attorney**

EXHIBIT Y

CONTRACTOR'S "GLOBAL MINIMUM REQUIREMENTS FOR ENVIRONMENT, HEALTH AND SAFETY MANAGEMENT"

Subcontractor shall conform, and shall cause all Subcontractor's lower-tier subcontractors to conform, to the following:

1. RETURN TO WORK PROGRAM:

   Subcontractor must submit a Return to Work policy to Design-Builder prior to commencing work onsite. Subcontractor's Return to Work policy must require Subcontractor's workers who are injured as a result of work-related activity to return to modified duty which meets the restrictions of the attending physician. Subcontractor's failure to attempt to provide modified duty and reasonable accommodations for such injured workers may result in a penalty assessment to Subcontractor of $500.00 per workday, in Design-Builder's sole discretion, until such time that the injured worker is returned to work.

2. GLOVE POLICY:

   Lend Lease is implementing a 100% hand protection policy across all projects and assets. This policy requires all Lend Lease employees, workers and visitors to wear general purpose gloves while on any Lend Lease project as part of the basic required PPE. Other protective gloves (cut resistant, chemical, etc.) will be used when needed for specific tasks. The updated GMRs (GMR 6- Health, Protective Equipment and Welfare) also support this initiative.

3. LEND LEASE (US) PUBLIC PARTNERSHIPS LLC FALL PROTECTION POLICY:

   Lendlease does not prescribe specific fall protection measures to be used. Instead, it is each Subcontractor's responsibility to outline the means and methods that will be used to complete its work. The Lendlease on-site safety resource will review these means and methods to confirm that the Subcontractor's means and methods meet the minimum requirements of the Lendlease (US) Public Partnerships LLC Falls Mandate. Any such review, confirmation or other action or inaction by Lendlease shall not relieve the Subcontractor of its obligations hereunder or its responsibilities to safely perform its work. All self-retracting lifelines used by the Subcontractor on this Project will either (i) be purchased new by the Subcontractor specifically for this Project or (ii) otherwise have received reconditioning certification from the manufacturer (if so provided by the manufacturer) prior to use on this Project. Documentation of purchase and such certifications, together with serial numbers for each self-retracting lifeline will be provided to the Lendlease on-site safety resource. A legible manufacturer's serial number must be present on all self-retracting lifelines. Each self-retracting lifeline must be recertified by the manufacturer at least on an annual basis. Documentation of the manufacturer's recertification shall be promptly provided to the Lendlease on-site safety resource.

NOTE: Subcontractor operations with inherent fall hazards shall provide a Passive Fall Protection System such as scaffolding, wall walkers, Whalen jacks, guardrail systems, hole-covers, elevated work platforms, horizontal nets or similar methods or systems. As part of Subcontractor's submittals, Subcontractor shall provide the Fall Protection System they propose to utilize for review and approval by the Lendlease on-site safety resource and the Senior Construction Manager. Fall restraint or fall arrest methods shall be used minimally and only when no other means is feasible. Rope grabs are not permitted on a Lendlease Project without prior approval which must be requested by a written variance request. If Subcontractor desires to use fall restraint or fall arrest methods in lieu of the required passive fall protection system, Subcontractor shall submit a written variance request to the Lendlease on-site safety resource for review and approval. A variance request will only be considered when it will ensure a higher level of protection in a particular application.

4. SITE SPECIFIC SAFETY ORIENTATIONS:

   All Subcontractor's employees must receive a site-specific orientation prior to starting any work activities on a Lend Lease project. Our jobsites are in varied locations and will have hazards specific to that location, therefore each project location will have a site-specific orientation which every individual working at that site must attend. All Subcontractors' employees will be provided with a site-specific orientation sticker upon receiving their orientation. This sticker must be prominently displayed on their hardhat.

5. JOB HAZARD ANALYSIS:

   Prior to any employer beginning work on a Lend Lease project, it is imperative they review the hazards associated with their scope of work and have the necessary controls in place to eliminate or mitigate those hazards. To ensure this, Lend Lease requires all employers to submit a Job Hazard Analysis (JHA) outlining all tasks they will be performing, the hazards associated with those tasks, and the controls they will be implementing to eliminate or mitigate these hazards. The JHAs will be submitted to Lend Lease management and safety staff for review prior to the start of any work on a jobsite. Every contractor must participate in a pre-construction meeting where the Lend Lease Safety Department, Quality Control Department and Construction Operations are present. This required meeting is intended to ensure all contractors have a clear understanding of the Lend Lease expectations in terms of their performance. No contractor will be permitted to begin work until this meeting has taken place, and the necessary requirements of Lend Lease have been met.

6. INTERIOR STAIRWELLS:

   No second floor or higher level framing may proceed until such time interior stairs are installed and ready to be utilized for safe access to the upper level where work is to proceed. This requirement includes the installation of handrails and guardrails as appropriate to provide the necessary protection against falls to a lower level. This requirement is intended to ensure safe access and egress to work assignments and minimize the use of ladders as a primary means of reaching work locations.

7. INCIDENT & INJURY FREE ("IIF"):

   Incident & Injury Free training shall be provided on the following basis: Consultant's and Subcontractor's managers/supervisors who regularly work for Lend Lease or other Lend Lease businesses will be required to attend and complete periodic, relevant Incident & Injury Free training (e.g., Supervisor Skills Workshops, Commitment Workshops, and Incident & Injury Free refresher training) while assigned to the site.

8. CRANE OPERATOR CERTIFICATION

   All crane operators must be certified by an independent testing agency approved by the National Commission for the Certification of Crane Operator (NCCCO). Crane operator's credentials must be specific to the crane type and must be available for review by Design-Builder prior to mobilization. Operators will be required to carry certification wallet cards identifying the specialty certification for the type of crane they are operating, i.e., mobile cranes such as telescopic boom truck used for hoisting.

9. ADDITIONAL CLAUSES:

   9.1. Subcontractor(s) shall comply with the reasonable recommendations of insurance companies having an interest in the Project and shall stop any part of the Work that the Owner, governmental or quasi-governmental authorities having jurisdiction and Design-Builder deems unsafe until corrective measures satisfactory to party(s) directing the stop of any part of the work has been taken. Failure of any party(s) to stop unsafe practices shall not relieve Design-Builder nor Subcontractor(s) of its responsibility therefore.

   9.2. Subcontractor(s) shall continuously protect the Work, other work, and the property of Design-Builder, Owner and others from damage, injury or loss arising in connection with their respective performance of Work.

9.3. The Owner shall not be responsible for any loss or damage to Design-Builder's Work or the property of Subcontractor, however caused, until after Final Acceptance thereof by Owner and Final Payment therefore. Likewise, neither Owner nor Design-Builder shall be responsible for loss of or damage (however caused) to materials, tools, equipment, appliances, and other personal property of Subcontractor(s) stored and/or used in the performance of Subcontractor's Work.

9.4. Subcontractor(s) shall remove all snow, ice, dirt and mud as may be required or requested for the proper protection and prosecution of their respective work. Design-Builder and Subcontractor(s) shall provide and maintain adequate protection against weather so as to protect their respective stored materials and Work from injury or damage.

9.5. Design-Builder shall enforce Owner's instructions and Subcontractor(s) shall enforce Design-Builder's instructions regarding signs, advertisements, fire, smoking, alcoholic beverages, and the possession of firearms by any person at the Site.

9.6. Subcontractor(s), as necessary for performance and completion of their respective Work, shall provide flagman, erect proper barricades and other safeguards, and post danger signs and other warnings as warranted by hazardous and existing conditions.

9.7. Design-Builder shall promptly report in writing to the Owner and Subcontractor(s) shall promptly report in writing to Design-Builder and their respective insurance carriers of all incidents or accidents arising out of, or in connection with, the performance of their work, whether on or off the Site, which caused death, bodily injury or property damage, giving full details and statements of witnesses. In addition, if death or serious injury or serious damages occur, the incident shall be reported immediately to the Owner and Design-Builder by telephone or in person.

9.8. In addition to the Design-Builder's Safety Program, Subcontractor(s) shall develop a written Site Specific Safety and Health Plan that will include Means & Methods that will be used to comply with the Global Minimum Requirements. Such Plan shall be submitted to Design-Builder for approval prior to the commencement of any portion of Subcontractor's respective Work on the project.

9.8.1. Subcontractor's safety and health program shall address tasks to be performed on the Project with attendant risks analysis and have appropriate controls and safeguards to prevent injury and illness that complies with or exceeds, Design-Builder's Safety Program. Design-Builder will review the safety and health program prior to the start of Subcontractor's work. Any questions, comments or inquiries by Design-Builder as to the adequacy of this program must be completely addressed to the Design-Builder by Subcontractor before its respective work is started.

9.9. In addition, Subcontractor shall provide Design-Builder with a list of Subcontractor's employees at the Project site who are trained in first-aid and CPR. Submit the list and a copy of all current certificates to the Design-Builder's Project Office.

9.10. Weekly safety meetings with the workers of Design-Builder and Subcontractor(s) and its subcontractors of any tier are required, with written evidence of the meeting results being supplied to Design-Builder.

9.11. Subcontractor(s) must have a Safety Disciplinary Program and Design-Builder will use a safety disciplinary system with Subcontractor(s).

9.12. If Subcontractor(s) fails to immediately commence compliance with such safety duties within twenty-four (24) hours after receipt from Design-Builder of written notice of noncompliance, Design-Builder shall implement such safety measures without further notice and deduct the cost thereof from any amounts due or to become due Subcontractor(s).

10. SUBCONTRACTOR DRUG AND ALCOHOL TESTING POLICY:

10.1. **Policy:** Lend Lease (US) Public Partnerships LLC is dedicated to maintaining a drug and alcohol-free work place. Workers are not permitted to possess, sell, use or purchase illegal drugs or unauthorized

controlled substances. Such possession, use, sale or purchase will be considered a dischargeable offense. Any person working on a Lend Lease project gives consent to the drug and alcohol screening and all associated costs are the responsibility of the subcontractor as set forth in this policy.

10.1.1. Urine is the specimen of choice; however, Design-Builder reserves the right to test, using alternative methods.

10.1.2. The illegal use, sale or possession of narcotics, drugs, or controlled substances while on the job or on Design-Builder property is a dischargeable offense. Any illegal substances will be turned over to the appropriate law enforcement agency and may result in criminal prosecution.

10.1.3. There will be no alcohol consumption on or off Design-Builder property during working hours.

10.1.4. Drugs, which are illegal under Federal, State or local laws include but are not limited to marijuana, heroin, hashish, cocaine, hallucinogens, depressants and stimulants. Controlled substances must be prescribed for current personal treatment by an accredited, U. S. licensed physician. The abuse of prescription drugs, whether prescribed for the Subcontractor employee or anyone else, shall be handled as a violation of this policy. Design-Builder's drug and alcohol policy specifically prohibits the use of adulterants to a specimen submitted for drug and alcohol testing. On a urine specimen, which is outside the temperature range, a second collection may be done, observed.

10.1.5. Subcontractor's employees who are under the influence of alcohol, or who possess or consume alcohol on the job have the potential for interfering with work and endangering other persons. Such conditions will be proper cause for administrative action up to and including removal from Design-Builder property.

10.1.6. Off-the-job illegal drug use which could adversely affect a Subcontractor employee's job performance or which could jeopardize the safety of others, the public, or Design-Builder equipment is proper cause for administrative or disciplinary action up to and including removal from Design-Builder property.

10.1.7. Subcontractor's employees who are arrested for off-the-job drug activity may be considered to be in violation of this policy. In deciding what action to take, Design-Builder's Safety Manager will take into consideration the nature of the charges and the Subcontractor employee's present job assignment and other factors relative to the impact of the Subcontractor employee's arrest upon the conduct of Design-Builder's business.

10.1.8. All person working on Federal projects are subject to all rules governing the Drug-Free Workplace Act of January 1989. Specific requirements will be communicated on each appropriate jobsite.

10.2. TESTING PROCEDURES:

10.2.1. Probable Cause Testing. Subcontractor's employees suspected of being under the influence of alcohol, narcotics or dangerous drugs as evidenced in job impairment, high absenteeism or other outward signs, shall submit to a chemical analysis of urine sample, alcohol breathalyzer test or alternative matrixes by a recognized hospital, clinic or laboratory. An alternate test may be used if the Subcontractor employee is not able to produce a urine specimen. Reasonable suspicion shall include, but not be limited to, Subcontractor employee's involvement in an accident, physical altercation in the work place, injuries on duty, excessive absenteeism, unexplained significant deterioration in job performance or involvement in activities Design-Builder believes to be of suspicious nature. The authority to order a test is limited to Design-Builder's Safety Manager.

10.2.2. Random Testing. A percentage of current job sites and office locations will be selected randomly for drug/alcohol testing each quarter. ALL personnel on-site, including Subcontractor's employees, will be tested except in those states where state law prohibits testing. In those states where law prohibits testing, Subcontractor's employees who operate equipment above the level of hand tools, and Subcontractor's employees assigned to a job site, who drive a Design-Builder vehicle, will be subject to testing. Testing will be done by an outside agency either using their

personnel and Design-Builder's facility as the collection site or a mobile unit. On occasion, trained personnel from Design-Builder's Safety department will collect the specimens. Design-Builder's Safety Department will coordinate the testing.

10.2.3. Random Testing for Crane/Heavy Truck Operators. Each Subcontractor employee who operates any crane (including boom trucks, overhead cranes, and mechanic truck cranes) or trucks exceeding 26,001 pounds will be required to take and pass a random drug/alcohol test according to DOT regulations.

10.2.4. Post Accident. Any individual who experiences a personal injury on the job which requires professional medical treatment shall undergo a test for drug/alcohol abuse. Testing will be done at medical clinics as assigned by Design-Builder's Safety Manager. Based on State regulations, any person found with a positive level of illegal drugs/alcohol in their system could be ineligible for workers' compensation benefits or payment of medical expenses incurred, based upon results of further investigation. Any person involved in an accident that involves damage to Design-Builder property or private property regardless of value shall undergo said drug/alcohol screening. A positive result will automatically refer the Subcontractor employee to Design-Builder's Safety Manager for follow-up. **ALL Subcontractor's employees must IMMEDIATELY report ANY accident or injury to his/her supervisor.**

10.2.5. Refusal to Take a Drug/Alcohol Test. If a Subcontractor employee refuses to take a random, post-accident or probable cause test, he/she may request a hearing by Design-Builder's Safety Manager. At that time, the Subcontractor employee may explain why he or she should not be required to undergo the test. Design-Builder's Safety Manager is the sole arbitrator in this matter and shall decide whether or not to excuse the Subcontractor employee from the test. If Design-Builder's Safety Manager decides to order the drug/alcohol test and there is continued refusal by the Subcontractor employee to take the test, it will be treated as a positive test result, and the Subcontractor employee will not be allowed to work on a Design-Builder jobsite for 60 days. If a Subcontractor employee has had a previous confirmed positive test result during their employment on a Design-Builder jobsite, he/she will not be allowed to work on a Design-Builder jobsite for 12 months, and only after a successful drug test result. **A Subcontractor employee's refusal to submit to drug/alcohol testing may be grounds for termination of the Subcontract, at Design-Builder's sole discretion.**

10.2.6. Prescription Drugs. If a Subcontractor employee tests positive for a prescription drug which was prescribed for the Subcontractor employee and he/she can provide a prescription or documentation from a U. S. licensed physician to support that positive result, no further action will be taken. If no documentation is available to support the positive drug test result for a prescription, that result will be treated as a positive test result for an illegal drug since the drug was not prescribed for that Subcontractor employee. The abuse of prescription drugs, whether prescribed for the Subcontractor employee or anyone else, shall be a violation of this policy.

10.2.7. Positive Test Results Procedure. Persons who are found by such tests to have illegal drugs, alcohol or adulterants in their system while at work are considered to be positive for such drugs/alcohol and in violation of this policy, even if impairment of functions may not be apparent. Because unauthorized drug use is illegal and due to the potentially serious safety consequences, Design-Builder is unwilling to accept even the slightest risk that Subcontractor's employees with illegal drugs/alcohol in their systems might cause, or contribute to an accident. For the protection of Design-Builder, its employees, subcontractors, Subcontractor's employees, and the public, persons failing the drug/alcohol tests, will be immediately removed from Design-Builder's jobsite and will not be allowed to work on a Design-Builder jobsite for 60 days and only after a successful drug test result. If a Subcontractor employee has had two (2) confirmed positive test results while working on a Design-Builder jobsite, he/she will not be allowed to work on a Design-Builder jobsite for 12 months, and only after a successful drug test result.

10.3. **Assistance:** Subcontractor's employees who voluntarily request assistance in dealing with a personal drug/alcohol problem (however NOT after a positive drug/alcohol test) will not be discriminated against with respect to working on Design-Builder's jobsite because of the request for assistance, but will continue to be subject to this Policy. Subject to applicable law, the strictest rules of confidentiality will be adhered to with regard to assistance, investigations, Subcontractor employee violations and discussions.

10.4. **Conclusion:** Subcontractor employee compliance is a condition of working on Design-Builder's jobsite. All Subcontractor's employees are expected to comply fully and promptly with instructions issued under the authority of this program. Failure to do so can result in discipline, including removal from Design-Builder's jobsite or termination of the Subcontract. **ALL CONDITIONS of this policy apply to all subcontractors, subcontractor's employees, vendors or third parties on any Design-Builder property or jobsite.**

10.5. This policy will be made available to all interested parties at all Design-Builder jobsites and office locations.

4.1 FALL OF PERSONS

RISK EVENT PREVENTATIVE CONTROLS AND PERFORMANCE STANDARDS

4.1.1 FALL PREVENTION BARRIERS

CONTROL

Provide robust physical barriers to protect people falling from height.

PERFORMANCE STANDARD

i) All areas under construction or demolition (including deep excavations) from which a person could fall must be effectively protected by physical barriers of sufficient height and strength to prevent people from falling or being blown off the edge of the structure or into an excavation or opening (e.g. screens, handrails, scaffolds, guard rails or cable and netting systems for temporary structures).

ii) All open edges from which a person could fall in asset operations and maintenance scenarios must also be effectively protected by barriers of sufficient height and strength to prevent people from falling (e.g. permanent climb resistant balustrades, guard rails or void screens) taking into account all relevant parameters such as the nature of the operation, likely usage, location, structural stability and weather conditions.

iii) All mobile work platforms, temporary works platforms, equipment or machinery used for work at height must have edge protection in place to prevent the fall of a person from both the elevated work and from any potential for the platform to be destabilized from adjustment, movement or positioning maneuvers. Restraining harnesses must be worn and secured by people working in MEWPs with booms unless when working over water where the risk of the work platform submerging beneath the water exists creating the risk of a person being unable to exit from the platform in an emergency. Note: GMR 4.18 drowning addresses related events.

4.1.2 HEIGHT ACCESS EQUIPMENT

CONTROL

Height access equipment must be operated and maintained in accordance with the manufacturer's instructions.

PERFORMANCE STANDARD

i) Control and prevent unauthorized access to climbable building equipment (e.g. cooling or heating plants and free standing structures such as antennae, power station cooling towers, storage tanks and power transmission lines or towers).

ii) Modify equipment or structures where worker access is required and the risk of the fall of a person exists, to eliminate or minimize the risk of a fall. Equipment requiring regular maintenance must be installed at or moved to ground level to eliminate the need to work at height.

iii) Access to general construction work areas or floors must be provided by a full permanent solution. Where this is not practicable, temporary staircases of adequate width with suitable handrails must be provided.

iv) Suspended access equipment such as bosun's chairs, cradles, gondolas and swing stages must only be used where safer means of height access cannot be achieved.

v) Permanent BMUs such as mechanized cradle systems must provide safe access for cleaning and maintenance. They must be fixed to the operation's structure, have the safe working load clearly marked and have sufficient, clearly designated safety harness anchor points designed to withstand the forces caused by a fall of any person(s) located anywhere on the platform.

vi) All mast climbers, swing stage scaffolds and BMUs must be installed, maintained and inspected by an engineer or competent person(s), following the manufacturer's specifications as a minimum. Details of the design, maintenance, inspections and manufacturer's specifications must be provided.

vii) All people using mast climbers, swing stage scaffolds, suspended access equipment and BMUs must use a suitable safety harness and lanyard at all times. Emergency retrieval rescue procedures must be established for work involving a safety harness and lanyards and static lines must be installed and attached to one of or a combination of the following elements:

• A vertical line independent of the portable vertical access equipment and specifically engineered for the purpose of withstanding the forces likely to be experienced in a fall situation.

• An engineered anchor point or horizontal static line fabricated and certified by the manufacturer or independent engineer for that purpose and capable of withstanding the forces likely to be experienced in a fall situation.
• A transportable temporary independent anchor point engineered for that purpose such as a sling choked or looped around a suitable load bearing structure, an anchor strap looped around a suitable load bearing structure or an eyebolt fixed with a trigger catch mechanism for fixing through holes. In all cases these elements must be capable of withstanding the forces likely to be experienced in a fall arrest situation.

4.1.3 TEMPORARY ACCESS PLATFORMS

CONTROL

Temporary access platforms must be structurally sound, free of defects and require three points of contact to be maintained when entering and leaving the access equipment.

PERFORMANCE STANDARD

i) Ensure effective measures are in place for the safe erection and use of all scaffolds, temporary works and working platforms.
ii) Ensure all scaffolds are fit for use, all structural members are free from visible defects and the erected scaffold is stable and secure to prevent movement or collapse. Scaffolds must be plumb, have adequate cross-bracing, sound footings and be tied into the structure when the height/base ratio is greater than 2:1. Climbing up the outside of a scaffold is prohibited.
iii) Working platforms must be closely boarded or planked and free from defects. Remove any damaged boards or planks, debris, materials and waste from scaffolds as soon as it is practicable.
iv) Install guard rails, mid-rails and toe boards on all open sides of platforms representing a fall risk.
v) The use of ladders for work at height must be minimized by effective work planning and using safer means of access consistent with the hierarchy of risk control (e.g. MEWPs, scissor lifts, scaffold towers, podium steps and working platforms).
vi) Maintain three points of contact at all times including when entering and leaving access equipment and when using a ladder to prevent exposure to a fall.

4.1.4 MANAGEMENT OF PENETRATIONS, RISERS AND SHAFTS

CONTROL

Effective measures must be in place to prevent the fall of people or materials down penetrations, risers and shafts.

PERFORMANCE STANDARD

i) Construct all lift and elevator shafts to physically protect both those carrying out the construction and those below carrying out the lift installation. Provide safe working platforms for all those working in lift shafts.
ii) Fully protect openings to lift shafts with a secure full height system that prevents unauthorized entry and the risk of falls of people or materials. Ensure shaft opening protection remains in place until a safe working platform is provided or the lift doors are in place.
iii) Check penetrations and risers have either a structural mesh cast in during construction or are fitted with other protection such as metal guard rails or covers.
iv) Ensure all floor openings and pit covers are mechanically fixed (i.e. screwed or bolted, not nailed) and have clearly labelled covers. Covers must be constructed to minimize the risk of a trip hazard.
v) Ensure all covers to floor openings and pits are adequately load bearing where the cover is to be subjected to mobile plant or other significant loads other than people.
vi) Remove protective measures only when work is taking place in the opening and employ effective safety measures to prevent the potential fall of a person or fall of material. Replace the control measures immediately after the work and regularly inspect these measures.
vii) Permanent balustrades or fencing around voids in public areas must be climb resistant (e.g. with top rails angled away from the void or similar). Climbable material or equipment must not be placed within one meter (3.3 feet) of the balustrade or fencing, unless the balustrade or fencing is extended in height to account for the material or equipment in close proximity.

4.1.5 USE OF A SAFETY HARNESS

CONTROL

Any safety harness in use must be an approved type with fit for purpose anchor points.

PERFORMANCE STANDARD

i) If work at height is required and it is not practicable to install physical barriers (e.g. roof access or where work needs to occur outside the physical barrier) a full body safety harness must be used to provide either fall restraint (preferred) or fall

arrest (least preferred) protection. If a full body safety harness is being used as the primary means of fall protection verification of competency in use is required.
ii) Any safety harness in use must be attached to an appropriate anchor/tie-off point(s) by means of a compatible connector that provides either sufficient fall restraint protection or incorporates a decelerator to provide appropriate fall restraint/arrest. All of these components must be fit for purpose, properly inspected, tagged and maintained in line with the manufacturer's guidelines or related standards and be used only by a competent person.
iii) Where access to concrete or metal frame erection works cannot be avoided, a safety harness with a compatible twin tailed or y-shaped lanyard and energy absorber to provide appropriate fall arrest must be used. Workers must be attached to the structure through an appropriate anchor or tie-off point(s), beam gliders or man locks at bolt points and must never remove both tails of the lanyard at any one time from the structure.
iv) Where a safety harness is configured to either fall arrest or fall restraint the related free fall distance and potential pendulum effect must be allowed for.

RISK EVENT MITIGATING CONTROLS AND PERFORMANCE STANDARDS

4.1.6 SECONDARY FALL PROTECTION

CONTROL

Secondary fall protection measures must be in place where the fall of person risk exists.

PERFORMANCE STANDARD

i) Any work at height where all work faces cannot be enclosed must have in place a horizontal catch net, catch fan, horizontally projecting net or any other structurally designed element) as a secondary measure to prevent a fall of person risk. Where work is conducted outside of the building envelope (e.g. where a person is positioned in an articulated MEWP basket beyond the building envelope and the MEWP is positioned to within 10feet of the edge and is perpendicular to the edge) measures must be implemented to prevent both the MEWP and the person from falling. (e.g. tethering the MEWP back to the structure using an engineered tie or using engineered wheel stops) . All people working in the basket are to be harnessed to the MEWP.
ii) Fall protection netting must always be a minimum of one bay ahead of the area of work with the exception of the last bay when edge protection has already been fitted.
iii) In all cases workers must deploy the use of a safety harness to provide secondary fall restraint if necessary.
iv) All contractors working at heights must submit documentation of fall protection training for all employees.
v) All employees working at heights must attend a Fall Protection Orientation in addition to the required Site Specific Orientation.
vi) When working from a platform/scaffold (6ft or greater), PFAS will be utilized when guardrails are not present and there is a fall exposure greater than 6 inches between the platform/scaffold and the structure.
vii) Ladder extensions/walkthroughs will be installed on all ladders used for access/egress.
viii) Ladder stabilizers will be used on all extension ladders.
ix) Ladder jacks will only be acceptable for operations conducted at 6' or less.
x) Step/A-frame ladders can be used for working in confined areas and for short-term use only.
xi) All ladders over 4ft. must be non-metallic.
xii) Only Type 1A (300 lbs.) and ANSI 14.4 compliant ladders are allowed on Lend Lease project sites.

4.1.7 RESCUE PROCEDURES

CONTROL

Rescue procedures must be in place for the recovery of any fall of person and arrest/suspension in a harness or in netting.

PERFORMANCE STANDARD

i) Rescue and recovery protocols must be in place to recover any person who has fallen into a secondary fall protection element (e.g. horizontal netting or catch fan).
ii) For all circumstances where a safety harness is in use and configured to either fall arrest or fall restraint a recovery plan must be established that addresses the requirement to reach any person suspended within 15 minutes to minimize the risk of death from suspension trauma.

4.2 FALL OF MATERIALS/OBJECTS

RISK EVENT PREVENTATIVE CONTROLS AND PERFORMANCE STANDARDS

4.2.1 ENCLOSURE OF WORK AREAS

CONTROL
Elevated work areas must be enclosed with robust containment material to prevent a fall of material impacting people below.
PERFORMANCE STANDARD
i) Perimeter protection addressing the fall of person risk must also address the fall of material risk posed by stored or handled tools, materials, objects or equipment to prevent these from being kicked, knocked or bumped through openings or gaps.
ii) Any means of containment enclosure must address risks posed by the lateral movement of the largest (weight) and smallest (dimension) items used within any permanent and temporary enclosures. Any enclosure solutions must be installed prior to further work being conducted.
iii) The fall of material risk associated with temporary voids, penetrations, openings or gaps must be managed. Fasten and display warning signage to any cover able to sustain the largest weight and prevent penetration by the smallest object.
iv) For all vertical progressive construction, full height (floor to soffit) edge containment protection must be deployed and in place on multi-story structures under construction prior to the installation of the facade or permanently designed edge protection solutions. For all auxiliary elements (e.g. scaffolds, hoists, MEWPs, perimeter screens or climbing formwork) a strict no gaps policy must be adopted for both horizontal and vertical gaps. Solutions relative to these scenarios must be deployed and maintained to prevent the fall of tools, equipment and materials at all times (e.g. fully boarded out platforms, rubber seals, proprietary engineered hinged flaps and appropriately designed mesh).

4.2.2 TOOL AND EQUIPMENT TETHERS/LANYARDS
CONTROL
Tethers or lanyards must be used where the work area at height is not fully enclosed, or where tools or objects are required for use outside of the perimeter protection.
PERFORMANCE STANDARD
i) Identify scenarios where tools or objects are required to be used outside of an enclosed work area and prescribe associated controls.
ii) A tether or lanyard must be used to separately secure each individual tool or object in use beyond any form of edge protection or enclosure where there is a risk of people below being impacted. The object must be secured prior to crossing through the edge protection or enclosure.
iii) Each tether or lanyard and its sub-components securing an object beyond the encapsulation must be fit for purpose and manufactured to resist the falling object's forces.

4.2.3 WIND EXPOSURE
CONTROL
All objects that are not fixed and could be blown or uplifted from an elevated location must be relocated to an unexposed area or secured appropriately.

PERFORMANCE STANDARD
i) All operations must have information available relating to maximum wind gusts and the placement of objects, either temporary or permanent and must consider the risk of objects being blown or uplifted by wind from any elevated position. Ensure early weather warning systems are in place for operations where there is the risk of windblown falls of materials.
ii) All objects that could be blown from elevated positions must be firmly fixed, secured or relocated to a less exposed area.
iii) Ensure protocols exist to cease work activity at height when wind thresholds are exceeded, with protocols inclusive of the need to monitor components located at height such as any pulleys, guide rollers, swing gates or maintenance units.

4.2.4 STRUCTURAL ALTERATIONS
CONTROL
Adjustments to structures must assess the fall of material risk.
PERFORMANCE STANDARD
i) All structural rectification work or change must have a building and services survey completed by a qualified and registered structural engineer.
ii) Document a review of any proposed changes to the planned activity or sequence during structural alterations and how associated elements could be affected.

4.2.5 EXCLUSION ZONES

CONTROL

An adequate exclusion zone must be in place whenever overhead work has the potential for tools, materials, objects or equipment to fall.

PERFORMANCE STANDARD

i) Exclusion zones must be established below or around all areas where there is a risk of people being struck by falling materials (e.g. below works on the cladding of a building, around mobile crane works, loading/unloading activities, atriums and MEWPs in use).

ii) Exclusion zones must be of adequate size, take into account the risks such as potential arc of fall, deflections and bounce distances, be delineated by physical barriers and have clear signage prohibiting unauthorized entry. The integrity of any exclusion zones must be regularly checked.

iii) Under no circumstance may a person enter an exclusion zone while work is being carried out overhead.

4.2.6 SECONDARY PROTECTION OR CATCH MEASURES

CONTROL

Overhead protection must be installed where the risk of falling objects exists and wherever a public interface on site exists.

PERFORMANCE STANDARD

i) Identify in construction and asset works any scenarios where overhead protection must be installed, particularly where an engineering control preventing the fall of material cannot be implemented, people below cannot be completely excluded, enclosure or tether/lanyard requirements cannot be met or where an object's position, height from next floor level and mass could cause a fatal injury if it fell onto a person. ii) For all structural work on any vertical progressive multi-story construction, a secondary catch system, catch fan, horizontally projecting net or any other structurally designed element) must be positioned immediately below any areas where this work is being undertaken above (e.g. at the level below the screens) and the application must consider the arc of any potential fall of material.

iii) Where there is the potential for members of the public and/or workers to be impacted by a fall of material, a designed and engineered overhead protection (e.g. crash deck) must be appropriately positioned and of adequate strength and coverage taking into account potential material types and the arc of any potential fall of material.

iv) Ensure overhead protection or catch systems avoid failure due to impact with the object it is designed to intercept as a result of over spilling, puncture holes, melting by hot objects, corrosion or overload by weather events (e.g. seasonal maximum wind, rain, hail or snow).

v) Provide details of how the safe retrieval of a fallen object from overhead protection or catch systems will be achieved.

4.3 VEHICLE AND PLANT INCIDENTS (WORK SITE)

RISK EVENT PREVENTATIVE CONTROLS AND PERFORMANCE STANDARDS

4.3.1 TRAFFIC MANAGEMENT

CONTROL

Vehicle routes on construction and haul roads must be managed to ensure risks to vehicles and people are effectively managed.

PERFORMANCE STANDARD

i) Ensure any traffic management plans are current and define the engineering controls to prevent vehicles striking another vehicle, structure or pedestrian.

ii) Separate traffic plans are needed for each stage and area of the operation when the discrete phases of work result in changes to the operating and traffic environment.

iii) Vehicle routes must facilitate the safe movement of the types of vehicles and levels of traffic likely to use them. This must be achieved by avoiding hazards such as steep inclines, tight bends, requirements to reverse in confined areas, inadequate lane widths and any issues related to roundabouts, one way routes and signage.

iv) Traffic management plans must address the interface with public roads and provide effective controls addressing prohibited vehicles, access points, routes for different vehicles or plant, reversing requirements, signs and traffic control aids, technology application and site traffic maintenance.

4.3.2 PEDESTRIAN AND VEHICLE SEGREGATION

CONTROL

All locations must assess the risks presented by the movement of pedestrians, materials and vehicles around or next to the site or workplace and implement appropriate safety measures to eliminate or minimize these risks.

PERFORMANCE STANDARD

i) Pedestrians are to be separated from vehicles and plant at all times by appropriate barriers.

ii) Light and heavy equipment and plant must be separated using appropriate measures such as physical barriers or earth berms and demarcated using visible signage indicating routes and directions to prevent interaction.

iii) Activities such as plant maintenance or refueling must be undertaken in areas specifically designed to ensure that there are barriers between workers and other heavy equipment.

iv) Route sightlines must be unobstructed and adequately lit to ensure good visibility. Blind spots and corners must be avoided, or where they do exist, have mirrors installed.

v) Signage and road markings must provide clear instructions to pedestrian and vehicle route users and be located in positions which allow users to see them and have time to respond. Signs and road markings must be constructed and located so as not to present hazards to drivers or pedestrians.

vi) Loading and unloading areas must be clearly defined. These areas must be separate from parking or access routes for private vehicles and away from pedestrian routes. If reversing cannot be eliminated then it must be controlled by establishing pedestrian exclusion zones.
vii) Speed limits must be set to reduce the risks associated with pedestrian movements. Speed calming measures such as raised crossings, humps on approach to crossings and rumble strips must be implemented in areas where pedestrians and vehicles could interface.
viii) Construction sites must provide separate site entrance and exit points for pedestrians and vehicles. When vehicles and pedestrians are in close proximity due to nearby locations such as security entrance points or where doors open directly onto vehicle routes, engineering controls must be provided to keep pedestrians and vehicles apart (e.g. by fitting physical barriers or providing separate routes).
ix) The use of traffic signalers must be eliminated wherever practicable, particularly around heavy equipment operations. Where traffic signalers are required such as for pedestrian access areas or to manage public road interface, only trained and competent traffic signalers are to be used. In these instances a risk assessment must be undertaken to identify where technology can be implemented to replace or remove the spotter, safe locations, hard barrier controls and adequate line of sight and radio contact.
x) Implement safety measures where work is undertaken next to active roads, train lines or similar, to protect workers from impacts with moving vehicles, trains or associated debris. For large sites like road construction or maintenance projects, physical barriers such as truck mounted attenuators must be used to protect workers from road traffic. Where this cannot be achieved, low speed limits must be in place (less than or equal to 25 miles per hour) in combination with traffic calming measures, hazard signage, demarcation lines and barriers to minimize risk for workers and the public.

4.3.3 PARKING AND TRAFFIC ROUTES

CONTROL

Traffic routes and parking arrangements must be in place to avoid vehicle-to-vehicle and vehicle-to-pedestrian conflict.

PERFORMANCE STANDARD

i) Provide clear signage in carparks, along traffic routes and foot traffic areas to indicate location information, speed limits, hazards and precautions.
ii) Provide clearly defined pedestrian routes in safe zones using hard barriers, flagging and other visual delineation to facilitate safe access and egress.
iii) Locate height bars and signage to entrances to warn drivers of any applicable height limits. Provide safe exit routes for oversized vehicles.
iv) Where amenities are provided, delineated fundamentally stable car parking must be provided.

4.3.4 USE OF LIGHT VEHICLES ON SITE

CONTROL

Lendlease tool of trade vehicles operating in defined construction or engineering zones must be in good working order and operated in a safe manner.

PERFORMANCE STANDARD

i) Vehicles used as a tool of trade by Lendlease personnel must be operated in a safe manner at all times.
ii) Light vehicles on operations must be of a high visibility color (e.g. white) and have reflective taping, flashing lights, a first aid kit, a fire extinguisher, a spill kit and survival or emergency equipment suitable for the operating environment.
iii) Vehicles provided by Lendlease as a tool of trade shall be fitted with in vehicle management systems, reversing cameras and hand brake warning systems.
iv) Seatbelts must be used at all times by all occupants and drivers of vehicles.
v) Vehicle journeys of two hours or more continual driving must be planned to ensure adequate rest breaks are in place and that there is provision to manage fatigue.
vi) Mobile phones, whether hands free or not, must only be used by the driver of a tool of trade vehicle whilst the vehicle is stationary and in a parked safe location. The exception to this is for emergency and incident response vehicles, using hands free communications in a response situation where alternate communications are not available.
vii) All drivers must be appropriately licensed for the vehicle being operated and be fit for work (i.e. not impaired by medication, drugs or alcohol).
viii) When parked all vehicles must be fundamentally stable with the engine turned off, handbrake effectively applied, placed in gear and on level ground. Wheels must be situated in spoon drains, gutters or against wheel stops. If fundamentally stable parking cannot be achieved appropriately sized wheel chocks must be available and implemented.

ix) All Lendlease vehicles must have inspection and maintenance protocols in place for all safety related items such as wheels and tires, steering, suspension and braking systems, seats and seat belts, lamps, indicators, mirrors and reflectors, windscreen and windows including windscreen wipers and washers, the vehicle structure itself and any other safety related item on the vehicle body, chassis or engine including instrumentation.
x) Pre-start inspections must be completed to ensure the lighting and braking systems are in proper working order.
xi) Vehicles must not be used above the manufacturer defined maximum load limit.
xii) Wheel nut indicators must be fitted to all vehicle wheels.

4.3.5 USE OF PLANT, EQUIPMENT AND VEHICLES

CONTROL

Effective controls must be in place for managing the use of all mobile plant, equipment and vehicles used for ground and civil works, including bobcats, excavators, backhoes, graders, scrapers, bulldozers, dump trucks, rollers and compactors.

PERFORMANCE STANDARD

i) Operating mobile plant and equipment must have seat belts for all occupants, adequate lighting (e.g. headlights, tail, turn, brake, strobe and flashing lights) identified isolation or lockout points, adequate walkways, railing, steps or grab handle combinations and boarding facilities including an alternative path of disembarkation from the cabin in case of emergency, reversing alarms, wheel chocks, a horn, a handbrake alarm and effective windscreen wipers.
ii) Technological advances must be considered for collision avoidance, fatigue management, pedestrian proximity notification and visibility improvement, particularly where personnel are required to enter the potential impact zone of operating plant, vehicles and equipment.
iii) Ensure all mobile plant and equipment has protection where there is a risk of rollover, tip over or impact by falling objects (e.g. loading or unloading, work on stockpiles or steep inclines, work below other material or activities or where manufacturer's specifications require it).
iv) Replace or re-certify protection gear after a rollover, tip over or falling object damage and before further use.
v) Prohibit the use of mobile phones when the plant or equipment is in use.
vi) Protocols must be provided for the use of plant and equipment on slopes and batters to avoid vehicle rollovers. Technology solutions must be in place to provide warning for the potential of safe working angles to be exceeded or the loss of traction.
vii) Clearly identify minimum clearance distances for overhead cables and establish controls to prevent plant or equipment coming into contact with these cables.
viii) If personnel are required to enter the potential impact zone of operating plant, vehicles and equipment without a physical barrier, positive eye contact, signals or radio contact must be made with the operator to cease operation and lower implements such as dipper arms, buckets and blades to the ground before entry.
ix) Establish and maintain pedestrian exclusion zones around operating plant and equipment where there is a risk of workers being struck. Clearly identify specific exclusion zones for stationary but operating plant or equipment (e.g. an excavator with its bucket in use) for each type of plant or equipment and implement an appropriate exclusion zone, preferably a physical barrier.
x) When parked all plant and equipment must be fundamentally stable with the engine turned off, handbrake effectively applied, placed in gear and on level ground. Wheels must be situated in spoon drains, gutters or against wheel stops. Implements and attachments such as dipper arms, buckets and blades must be lowered to the ground. If fundamentally stable parking cannot be achieved appropriately sized wheel chocks must be available and implemented for wheeled plant.

4.3.6 INSTALLATION, INSPECTION, MAINTENANCE AND DISMANTLING

CONTROL

Fixed and mobile plant must be installed, erected, adjusted, maintained and dismantled in safe locations, in accordance with the manufacturer's requirements and by competent and qualified personnel.

PERFORMANCE STANDARD

i) Fixed and mobile plant must be installed and dismantled off-site. Where this is not possible, it must be conducted in a safe location on-site. Where there is a risk of workers being struck, establish and maintain physical exclusion zones around plant that is being installed, modified or dismantled.
ii) Where fixed and mobile plant is provided to Lendlease, suppliers must provide a complete set of the manufacturer's operating and maintenance instructions. Inspection and maintenance records must be kept with the plant and conform to the requirements of the standards applicable to the region of operation and as per the manufacturer's requirements. All plant must be installed, inspected, maintained and dismantled by competent and qualified personnel in accordance with the manufacturer's instructions.

4.3.7 VEHICLE AND PLANT RECOVERY AND RESCUE

CONTROL

Effective measures must be in place for the recovery of vehicles and plant immobilized or bogged in mud, sand or other type of similar traction resistant ground conditions.

PERFORMANCE STANDARD

i) In the first instance attempt to drive out the bogged vehicle or plant either through freeing up or digging out the obstructions and/or via the aid of recovery boards and planks to facilitate grip and traction.
ii) Towing of bogged vehicles and plant can only be undertaken when engineering attachment points and/or other methods are identified and verified.
iii) The suitability of recovery equipment such as cables, winches and hooks used to tow vehicles and plant must be fit for purpose and verified by an independent engineer.
iv) Snatch straps and chains such as webbing slings, load resistant slings and rope must not be used for the recovery of vehicles and plant.

RISK EVENT MITIGATING CONTROLS AND PERFORMANCE STANDARDS

4.3.8 HIGH VISIBILITY CLOTHING

CONTROL

All people working on or adjacent to traffic routes and vehicles operating on Lendlease operations must have sufficient high visibility clothing and reflective visible markings.

PERFORMANCE STANDARD

i) Ensure all people working adjacent to traffic routes or engaged in traffic management activities wear high visibility clothing that meets applicable regulatory or industry standards.
ii) Ensure all reflective markings on vehicles or plant on Lendlease operations are in good condition and comply with regulatory or industry standards.
iii) When working at night ensure high visibility clothing is suitable (e.g. effective retroreflective stripes).

4.4 UNCONTROLLED RELEASE OF ELECTRICAL ENERGY

RISK EVENT PREVENTATIVE CONTROLS AND PERFORMANCE STANDARDS

4.4.1 IDENTIFICATION AND SCHEMATICS

CONTROL

All electrical circuits including overhead and underground services are fully identified and recorded in schematics. Procedures exist for safe work.

PERFORMANCE STANDARD

i) Identify all electrical circuits and include schematics in a register(s) irrespective of whether the power supply arrangements are permanent or temporary.
ii) Following installation or removal of any service, ensure comprehensive records and photographs are received from a delegated person such as a utility provider with schematics updated following changes.

4.4.2 APPROPRIATE ELECTRICAL EQUIPMENT

CONTROL

All electrical equipment including insulated MEWPs, tools and PPE must be fit for purpose and compliant with local standards.

PERFORMANCE STANDARD

i) Ensure nationally recognized standards of manufacture and installation of electrical equipment are identified with the assistance of qualified electrical professionals.
ii) Check all electrical equipment supplied to Lendlease operations includes documentation confirming it meets the manufacturing standard identified in the procurement list.
iii) Ensure insulating mats are in place for risers and plant rooms that address any regulatory or applicable national or international codes or standards.
iv) Ensure confirmation is completed post installation of any electrical systems verifying that all circuits are installed as designed.

v) All electrical tools and equipment in the operation, including offices, must be regularly inspected, tested, tagged and marked safe for use.

4.4.3 ELECTRICAL SUPPLY

CONTROL

All temporary electrical supply panels and boards must be sufficient in number and located in close proximity to work areas to minimize trailing cables. Permanent and temporary power sources must be secured to prevent unauthorized access.

PERFORMANCE STANDARD

i) Electrical risks associated with the temporary or permanent supply of electricity to electrical equipment through an outlet, including mobile generator sources, or where appliances, lights or other electrical equipment are supplied from a final sub-circuit of a permanent electrical installation, must be protected by an earth leakage circuit breaker (ELCB), residual current device (RCD) or a ground fault circuit interrupter (GFCI).
ii) Ensure all electrical supply boards, cables, cords plugs and sockets are safe by design for use, appropriate for where it is to be used and located to avoid physical damage by vehicles or water (e.g. by elevation or mechanical protection).
iii) Implement a comprehensive inspection, testing and preventative maintenance regime covering all temporary electrical supplies, including supply panels, circuits, cables, cords, plugs and sockets. Include a process to record and remedy any identified deficiencies and align with any manufacturers' guidelines.
iv)Temporary power outlet circuiting shall be staggered so that more than one circuit will feed an area of construction.
v) Permanent site electrical distribution systems will be installed/energized to a permanent transformer prior to vertical construction when practical.
vi) All extension cords will be a minimum of 12 gauge, 3-wire and have a grounding pin in place.
vii) All cords or hoses that will be subject to vehicle traffic will be protected by manufactured cord protectors.
viii) Each tool and cord, after having been inspected by a qualified person, will have a piece of colored tape applied to the prong end of the electrical cord indicating the tool is in proper working condition.

- July, August, September = Orange
- October, November, December = White
- January, February, March = Blue
- April, May, June = Red

4.4.4 ISOLATION

CONTROL

De-energize, isolate and test for dead prior to any work on electrically powered items.

PERFORMANCE STANDARD

i) Use a qualified electrical technician or electrical engineer to undertake any electrical work.
ii) De-energize circuits and isolate using personal locks prior to any work.
iii) Power sources such as uninterruptable power supplies (UPS), batteries, capacitors, solar power and generators must be identified. Once identified they must be de-energized and securely isolated at the energy source before works commence.
iv) Develop a group isolation procedure with support equipment when multiple isolations involve multiple people.
v) Prior to any work commencing electrical power must be tested with a known working and calibrated meter and proven as dead.

4.4.5 LIVE WORK

CONTROL

Live work is authorized, planned and communicated and prohibits lone working.

PERFORMANCE STANDARD

i) Ensure all operations establish if work on live conductors is required before any investment or contract approvals.
ii) Make sure work on live electrical systems is not undertaken, except where deemed absolutely necessary by a competent person for testing, fault finding and/or commissioning work, or where the electrical supply cannot be interrupted (e.g. hospital life support systems and critical utilities).
iii) Only undertake live work on critical utilities such as distribution and/or transmission networks as directed by the utility provider. Ensure any directive to undertake such activities is supported by documented safe systems of work and in line with legislated practices.
iv) Ensure grounding and short circuiting systems meet applicable national and/or international codes or regulations.
v) Ensure task specific PPE is issued, in place and meets applicable national and/or international codes or regulations.

vi) Assess the risk of electrical fires and implement appropriate precautions (e.g. fire watch, appropriate extinguishers and fire blankets).
vii) Ensure a dedicated and appropriately qualified frontline leader is present and managing any live works related to testing, fault finding and/or commissioning..

4.4.6 FAULT FINDING

CONTROL

When investigating any electrical equipment to identify and rectify faults, all items must be treated as live until the fault is located.

PERFORMANCE STANDARD

i) Prior to any fault finding work commencing, all elements of the circuit must be de-energized, isolated and tested for dead.
ii) While isolated, locate and rectify the fault if found.
iii) Re-energize to determine if the fault has been fixed.
iv) If the fault continues, fault finding live work procedures must be followed including the use of insulating tools and gloves, insulating mats and a qualified electrical spotter trained in cardio pulmonary resuscitation (CPR).

4.4.7 OVERHEAD CONDUCTORS

CONTROL

Prevent inadvertent overhead services contact by equipment or operational activity.

PERFORMANCE STANDARD

i) Use one of the following control options to prevent a fatality:

- Redirect power distribution (e.g. underground)
- Power off all the time with power proven as dead
- Power off part time
- Power on in conjunction with controlled movement or operations

ii) Minimum clearance distances for overhead cables must be clearly identified with controls in place to prevent plant coming into contact with these cables.

iii) For vehicles passing under energized conductors, ensure the power on option requires a crossing point that includes advance warning signs with signed height clearance, nonconductive goal posts and a clearly visible height line set to a safe clearance distance.

4.4.8 UNDERGROUND SERVICES

CONTROL

Prior to ground disturbance, underground electrical services must be positively located with work planned accordingly.

PERFORMANCE STANDARD

i) Ensure a register is in place for buried electrical services on Lendlease controlled operations. The register must include a plot drawing of the route of the electrical service with grid references, description of the depth and type of service, the voltage and any auxiliary protection.

ii) Prior to the disturbance of ground where underground network assets such as electrical or gas may be present, Lendlease operations must ensure that diagrams and plans are obtained from the relevant authority and are available and valid. Existing drawings and/or a Cable Avoidance Tool (CAT) scanner and any other suitable tool must be used to locate and mark underground services before work commences. Where any uncertainty exists regarding the location of underground services, hand digging and/or vacuum excavation must be used to identify the services.

4.5 FIRE AND EXPLOSION

RISK EVENT PREVENTATIVE CONTROLS AND PERFORMANCE STANDARDS

4.5.1 PRIORITISATION OF NON-COMBUSTIBLE MATERIALS

CONTROL

Substitute or minimize use of combustible materials with noncombustible or lowest combustible materials wherever possible.

PERFORMANCE STANDARD

i) Where a business unit requires a particular product for construction such as cross laminated timber (CLT), the product treatment and management practices must demonstrate that combustibility properties meet all local building regulations and material selection standards.

ii) Ensure operations comply with local building regulations and material selection standards for design and procurement applied by the business unit.

iii) Ensure the potential for fire at each stage of construction and asset operations, including fire from an adjoining property, is assessed given any changes to material requirements and storage.

iv) Ensure storage locations and requirements for all combustible material, dangerous goods and hazardous substances are identified and marked on site plans and at the storage location.

4.5.2 IGNITION SOURCES

CONTROL

Identify, minimize and manage ignition sources.

PERFORMANCE STANDARD

i) Ensure design and operational reviews assess the potential for plant and equipment to be a fire ignition source (e.g. from high heat in normal mode, overheating in fault condition, arcing or sparking).

ii) Provide lightning protection where the risk of a strike is deemed high due to prevalence of electrical storms or data made available via meteorological agencies.

4.5.3 INSPECTION AND MAINTENANCE

CONTROL

Inspect and maintain fire monitoring and mitigation systems and equipment.

PERFORMANCE STANDARD

i) Identify all fixed and portable systems and equipment that monitors fire initiation and mitigates fire propagation (e.g. fire suppression).

ii) Implement a testing and maintenance regime that meets statutory guidelines, manufacturer's guidelines and any applicable codes or legislative requirements.

4.5.4 HOT WORK

CONTROL

Permits to work must be in place for all hot works activities.

PERFORMANCE STANDARD

i) A Hot Work Permit is required for all work where there is an elevated heat source or where sparks produced have the ignition energy to ignite any combustible material.

ii) A Hot Work Permit is to be applicable for no more than one day, with the authorizing person(s) to check site conditions and specified risk controls.

iii) During hot works, the worker to whom the permit is issued must remain at the location of hot works at all times and until all ignition or heat sources are eliminated.

iv) Ensure the permit is issued only to individuals who are fluent in the language the permit is written in or who have been inducted in the permit requirements by a suitable interpreter.

4.5.5 REFUELLING EQUIPMENT

CONTROL

Controlled refueling areas and procedures for refueling large equipment, plant, machinery and vehicles.

PERFORMANCE STANDARD

i) Off-site re-fueling is preferred. However, where on-site re-fueling facilities provide the only practicable alternative, the following applies:

• Minimize the quantity of fuel stored and the number of re-fueling facilities.

• A spill kit(s) must be provided and maintained in all workplaces with contents consistent with the type, nature and scale of the potential spills that could occur and key personnel must be trained in spill response. Storage of fuel or other vessels containing hydrocarbons must be in a bunded area with an impervious floor that contains a minimum 110% loss of the largest container in the event of a spill.

• An accountable frontline leader for the area must be in place at all times and accompanied by those trained in response requirements (e.g. spill and fire response), protected by physical barriers.

• Ensure emergency fuel flow shut off capability for bulk fuel supplies.

ii) Operations must implement suitable controls for the re-fueling of small equipment and tools such as brush cutters, generators and demolition saws so as to prevent the occurrence of fire from hot manifolds or other engine components during re-fueling.

iii) No re-fueling of items that are energized is permitted.

4.5.6 EXCAVATIONS AND TUNNELLING

CONTROL

Geotechnical investigations must identify gas or trapped hydrocarbons.

PERFORMANCE STANDARD

i) Identify geo-technical or subsurface hazards caused by flammable substances before designing, procuring or commencing any excavation or tunnel. This includes physically checking the operational site.

ii) For tunneling and excavations where flammable gases or hydrocarbons exist ensure the International Electro technical Commission (IEC) 60079 series of explosive atmosphere standards are applied.

iii) Where other gas or hydrocarbon hazards are identified that cannot be fully mitigated using IEC60079, additional controls must be clearly identified.

4.5.7 BEHAVIOURAL CONTROLS

CONTROL

Adequate policies, procedures and rules must be in place to limit unwanted behaviors.

PERFORMANCE STANDARD

i) Document and communicate a site protocol addressing required behaviors of any person entering the operation or construction site as it relates to fire prevention and emergency response addressing:
• Prohibition of smoking unless designated areas are prescribed that do not pose a fire or explosion risk.
• Fire prevention protocols (e.g. hot works, combustible materials and storage).
• Preservation of fire sensors and alarms, firefighting equipment and emergency routes.
• Accountabilities and emergency response protocols during a fire response.
ii) A separate procedure is required for handling of explosives use for rock blasting.

RISK EVENT MITIGATING CONTROLS AND PERFORMANCE STANDARDS

4.5.8 FIRE ALARM SYSTEMS

CONTROL

Fire detection and alarm systems must be in place to provide notification of fire.

PERFORMANCE STANDARD

i) Effective means for early detection and warning of the presence of fire must be in place that are appropriate for the level of risk. This may range from fully automated wireless or wired systems to the use of manual bells, horns or sirens with people assigned to fire watch duties. All offices and welfare areas must have fire alarm systems installed. Alarms must deliver effective warning (audible and visual) in all areas where people may be present.
ii) All fire alarm systems must be checked and tested, including when they are moved, in line with manufacturer guidelines and applicable codes or regulations to ensure they are functional and the results recorded.

4.5.9 MEANS OF ESCAPE

CONTROL

Provide clear means of escape.

PERFORMANCE STANDARD

i) Effective means of escape must be provided and maintained. A means of escape must be provided that does not require the use of passenger lifts and escalators and which is suitable for the number and specific needs of all people likely to use it.
ii) At least two alternative means of escape must be provided for operations that are open to the public and must be provided for all operations. For low density residential dwellings where there is only one means of escape from upper levels, the provision of temporary emergency means of escape from elevated rooms or levels must be considered (e.g. provision of emergency ladders).
iii) Emergency escape routes must be easily identifiable, of adequate width, kept free from obstruction and not used for storage and have emergency lighting including directional signs and exit points marked using pictograms and lights.
iv) Emergency routes on operations under construction or temporary structures must offer a minimum of one hour fire resistance and have fire doors fitted to them, .

4.5.10 FIRE FIGHTING EQUIPMENT

CONTROL

Provision of adequate and suitable firefighting equipment.

PERFORMANCE STANDARD

i) Sufficient firefighting equipment (e.g. fire extinguishers, hose reels, fire blankets and risers) must be provided that is appropriate for the site and works and which complies with any applicable codes or regulations.
ii) All firefighting equipment must be correctly located, readily accessible, unobstructed, clearly signed and have clear instructions on its correct use.
iii) Risers must progress with the construction or demolition of multi-story buildings, be no more than two floors below the construction floor, be under constant pressure and be regularly tested to ensure adequate water flow rate/pressure for the length and diameter of the riser and hose attached. An alarm advising of when there is a drop in the water flow/pressure of the system must also be fitted.
iv) Connections for the Fire Authority must satisfy the local requirements. In exceptional circumstances where it is impracticable to provide coverage from risers and hose reels, effective means for extinguishing fires must be provided that address the risk and satisfy regulatory requirements (e.g. drench drums, fire pails and additional fire extinguishers).
v) All firefighting equipment must be checked and serviced regularly, including testing of pump sets of wet risers and firefighting lift controls by a competent person in accordance with manufacturer guidelines or any applicable codes or

regulations and the results recorded. A weekly visual check must be carried out on all firefighting equipment to ensure they have not been damaged, discharged or gone missing.
vi) Adequate access must be maintained at all times for emergency services vehicles

4.6 CRANE AND HOISTING EQUIPMENT

RISK EVENT PREVENTATIVE CONTROLS AND PERFORMANCE STANDARDS

4.6.1 CRANES AND HOISTING EQUIPMENT IN USE

CONTROL

Only use lifting and hoisting equipment that addresses all applicable usage and operating requirements.

PERFORMANCE STANDARD

i) Cranes and any of the crane's components (e.g. ties, tower sections and yokes) on all operations must not exceed20 years of age since manufacture at any point during the project to limit the risk of structural failure from base metal fatigue.
ii) All crane and hoisting equipment must be manufactured, inspected and tested to the requirements of the standards applicable to the region of operation. Tower cranes must be assessed against any international standards that are applicable (e.g. EN 14439) or local standards where requirements are higher.
iii) All crane and hoisting equipment in operational service must be fitted with limit switches and alarms that initiate at 95% of the original manufacturer's rated lift capacity and cease operation at 100% of the manufacturer's rated lift capacity. Note: This
is not a further reduction on any regulated de-limiting applicable on cranes in some jurisdictions and only refers to the original manufacturer's lift capacity rating.
iv) Tower cranes must be fitted with limit switches and alarms when operating in close proximity to other tower cranes and a secondary independent brake must be fitted on all winches.
v) The crane boom/jib safe operating envelope must be identified for each item of crane hoisting equipment on a range diagram.
vi) All crane rotating hoisting equipment must be adequately guarded by physical barriers to prevent the potential for entanglement.
vii) Monitoring data must be made available in real time for any tower crane or hoisting equipment fitted with computer monitoring.
viii) Crane towers must be fitted with lighting for safe access to the full height of the tower during early morning or evening hours.
ix) The maximum height required to be climbed by a tower crane operator must not be more than sixteen frames high, past which an intermediate ramp access must be provided.
x) Where a workbox is proposed for use to elevate people using a crane, a risk assessment must be undertaken to review safer alternatives and where determined as the only suitable means of access, its use shall be controlled by a permit to work.
xi) Any crane that uses a workbox to elevate people must be fitted with a secondary independent brake to all winches.

4.6.2 LIFT PLANS

CONTROL

All crane and hoisting equipment must be in accordance with any lift plans.

PERFORMANCE STANDARD

i) A lift plan, approved by a qualified engineer, must be developed for all crane lifts greater than 20 tons and also for any lift that requires a crane to operate at greater than 90% of the original manufacturer's rated capacity. Note: This is not a further reduction on any regulated de-limiting applicable on cranes in some jurisdictions and only refers to the original manufacturer's lift capacity rating.
ii) It must be noted that special lifts that require a third party independent engineer to review the lift plan and where required supervise the execution of a lift to confirm the adequacy of the lifting methodology requires detailed schematics, communication plans and assessment of ground or other applicable conditions. This includes the following lift types:
• Any lifts that require the crane to operate between 95% and 100% of the original manufacturer's rated capacity.
• Any abnormal loads that due to their center of gravity, unusual shape or density may be adversely affected by wind during a lift.
• Any lifting operation that requires the load to slew or travel over public or private properties or infrastructure that requires closure or evacuation of these areas.
• Any load that requires more than one crane (e.g. dual or tandem lifts).
iii) No operational lifting is to be permitted that is above 100% of the original manufacturer's crane and hoisting equipment lifting capacity.

4.6.3 INSTALLATION, INSPECTION, MAINTENANCE

AND DISMANTLING

CONTROL

Cranes and other hoisting equipment must be installed, erected, adjusted, climbed, inspected, maintained and dismantled in accordance with the manufacturer's requirements.

PERFORMANCE STANDARD

i) The installation and commissioning of a tower crane or other hoisting equipment requiring assembly must be reviewed and approved by a third party independent engineer prior to the first operational lift.
ii) A third party inspection regime must be implemented for selected lifting and hoisting equipment and included in the supply agreement. Where crane or other hoisting equipment is provided to Lendlease, suppliers must provide a complete set of the manufacturer's operating and maintenance instructions. Inspection and maintenance records must be kept with the equipment and conform to the requirements of the standards applicable to the region of operation and as per the manufacturer's requirements. All cranes and hoisting equipment must be installed, erected, adjusted, climbed, inspected, maintained and dismantled in accordance with the manufacturer's instructions.
iii) All tower cranes that store more than 75 gallons of diesel near the cab of the crane must ensure any diesel fuel supply lines and hydraulic oil supply lines are fire rated and that the crane is equipped with first response fire suppression capability, which can include an adequate fire suppression system and/or fire extinguishers in the cabin and on the machine deck.
iv) Any paneling or modification for access or for weather protection to the crane or hoisting equipment (e.g. personnel and material hoists) shall be designed for internal fixing application only. The modifications must be installed and verified by the manufacturer or its representative.

4.6.4 OVERSIGHT

CONTROL

All crane and hoisting equipment must be maintained and operated in accordance with the manufacturer's operating instructions.

PERFORMANCE STANDARD

i) A hoisting or crane lifting coordinator must oversee and manage the use of all crane and hoisting equipment at the operation. The hoisting or crane lifting coordinator can be a supplier's employee or a member of the crane crew. More than one coordinator may be required at a large site.
ii) All operations with tower cranes in use are required to provide a crane management plan that outlines all tower crane operations on a project including crane locations, operating radius, exclusion zones, loading zones, overhead protection, crane climbs and the appointment of a hoisting or crane lifting coordinator to oversee inspection and maintenance to the requirements of the standards applicable to the region of operation.
iii) All hoisting or crane lifting coordinators must have formal training in rigging applicable to their region of operation and a minimum of two years' experience as a hoisting or crane lifting coordinator if they are to work without a frontline leader.
iv) Where required, supervision of an inexperienced hoisting or crane lifting coordinator must be provided by another hoisting or crane lifting coordinator with more than four years' experience and formal training in rigging or equivalent formal training relevant to the region of operation.
v) The manufacturer's operating instructions must be readily available to the operator of all crane and hoisting equipment.

4.6.5 TOWER CRANE ACCESS AND SECURITY

CONTROL

Security precautions must guard against unauthorized access to tower cranes.

PERFORMANCE STANDARD

i) Access systems for all procured tower cranes must have offset ladders designed to prevent the fall from height by a person whilst climbing or descending a tower crane.
ii) Tower cranes and crane access towers or ramps must have security measures to guard against unauthorized access from ground level or other elevations, including anti-climb (i.e. no hand or foot holds such as plywood or fine mesh paneling) and hoarding to a minimum height of ten feet at the base.
iii) A self-closing access door or gate must be in place with a combination lock or other security locks for secure access. The door or gate access lock is to be operable from the inside without a key to enable safe egress in an emergency and have minimal gaps to the access frame surround to prevent levering and compromising the locking mechanism
at the base or other intermediate access locations.

iv) Movement detectors must be fitted to the crane tower with operable intruder strobe lights and back to base monitoring, camera and text message alert including a backup battery in the event of a power failure.
v) Anti-climb mesh to a minimum height of ten feet in the horizontal and vertical plane above tie or access points must be used.
vi) Any basement or floor levels where a tower crane penetration exists must include full floor to soffit protection.

4.6.6 GROUND CONDITIONS

CONTROL

All cranes must be established and set up on approved ground conditions.

PERFORMANCE STANDARD

i) Tower cranes require a competent engineer to design the crane base and to complete any interim checks during installation, provide approval for the crane to be installed and provide written confirmation that the base is fit for purpose. The crane base must then be reviewed and certified by a third party independent engineer.
ii) For planned mobile crane lifts, special lifts or crane lifts which require a lift plan to be approved by a qualified engineer as defined in 4.6.2, or where the crane lift supervisor is not satisfied with the adequacy of the ground condition's bearing capacity, the California bearing ratio (CBR) or equivalent testing certified by a geotechnical engineer must be completed and the results communicated and confirmed by the supplier before the lift.
iii) The crane lift plan must define the dimensions and type of outrigger mats to be installed where applicable and the structural properties of the mats verified.
iv) If a severe weather event occurs (e.g. significant rainfall within 48 hours of the mobile crane lift) the adequacy of the ground conditions must be re-assessed and the CBR or equivalent test repeated if necessary, with results communicated and the lift delayed until this is complete.

4.6.7 FATIGUE MANAGEMENT

CONTROL

A fatigue management program must be in place for crane/hoist operators.

PERFORMANCE STANDARD

i) For all crane and hoisting equipment, suppliers or employers must outline how the potential for fatigue will be managed regarding the operator of the equipment and all fatigue management plans must ensure all local regulations are adhered to. In normal operating circumstances the operator's working hours must not exceed 60 hours per week and rest periods between shifts must not be less than 12 hours per day.
ii) Details must be provided in relation to the operating hours per day and rest breaks consistent with not exceeding a 10 hour day (exclusive of breaks) and include the length and frequency of breaks, hydration, management of travel time to and from home, shift and rest pattern requirements and the application of fatigue recognition technology where available or installed.
iii) Where a shift exceeds the parameters outlined above, fatigue management controls can include shift rotation, split shifts, late starts and additional time off.
iv) A record must be kept for each operator to confirm individual fatigue management requirements and protocols are in place.

4.6.8 PREVENTING PLANT COLLISIONS

CONTROL

Install hard barriers (tower crane), exclusion zones (mobile crane) or other barriers to prevent plant collisions.

PERFORMANCE STANDARD

i) Provide engineered barrier protection for cranes or hoists that are risk assessed as having the potential to be struck by mobile plant or vehicles. The energy involved in any potential collision with that barrier must be absorbed or deflected.
ii) Effective measures (e.g. zoning, spotters or a combination of these and other controls) must be implemented to prevent cranes coming into contact with overhead power lines or underground services, other cranes or structures.
iii) Automated anti-collision systems must be installed on tower cranes and gantry cranes when multiple cranes are in use and their lifting radii interface or overlap with other cranes, or when encroachment over a protected area such as a rail corridor must be prevented.
iv) A competent third party independent engineer must review and approve the out of service storage requirements for all luffing tower cranes and large mobile cranes greater than 200 tons. These out of service requirements must comply with the guidelines of the manufacturer and must be available at the site to prepare for a weather related event.

4.6.9 HANDLING OBJECTS

CONTROL

Uncontrolled movement of objects must not occur.

PERFORMANCE STANDARD

i) All loads to be slung, hoisted, lifted, transported, stored or unloaded must have no uncontrolled movement or loss of the load. This can involve redundant slinging or secondary containment for small objects.
ii) Slinging methods must manage any expected dynamic load forces (e.g. wind or sudden crane halt).
iii) All hoisting or lifting must be completed with the slung object's center of gravity lower than the sling attachment points where practicable.
iv) All loads suspended by hoisting or lifting equipment must be landed onto an adequate load bearing surface and be stable (i.e. cannot roll or fall) before unslinging the hoisting or lifting gear.
v) Objects transported through site must be adequately restrained to prevent uncontrolled movement.
vi) Deliveries where the load has the potential to fall or roll when unshackled must be inspected by a competent person (i.e. rigger, or equivalent) and restrained before removal (e.g. chocked or slung with hoisting or lifting gear).
vii) All lifting gear and tackle (e.g. chains, wire ropes, slings and rubbish removal containers) must be inspected before use and must be structurally sound, fit for purpose, designed for lifting with certified lifting points and the rated capacity or safe working load clearly displayed.
viii) While working, all cranes, loaders, back-hoes or other heavy equipment will remain a minimum of 20ft. away from overhead electrical lines. For voltages 50kV or greater, a distance of 20ft. plus 4 inches for every 10kV over 50kV. When required to work within 20ft., shielding will be required as per a SWMS.
ix) When hoisting materials over occupied buildings, precautions must be taken to evacuate part or all of the building based on a site specific risk assessment. Any risk assessment which results in the evacuation of a building must be reviewed by the Lend Lease Construction Manager and the Director of EH&S prior to work commencing.

4.7 IMPACT FROM MOVING PARTS OF MACHINES

RISK EVENT PREVENTATIVE CONTROLS AND PERFORMANCE STANDARDS

4.7.1 GUARDING

CONTROL

Implement robust machine operating guarding standards for hazardous equipment.

PERFORMANCE STANDARD

i) Ensure guarded moving parts are retained by fasteners that adequately secure the guarding that requires the use of a tool to install and remove.
ii) Support maintenance and troubleshooting with a documented isolation system involving personal isolation locks.
iii) Check the guard fully protects the moving part and can withstand applied forces without dislodgement.
iv) Identify and assess the risk of troubleshooting, cleaning and maintenance tasks that bring people in proximity to exposed energized machine components.
v) Establish the presence and functionality of guards with regular inspections involving the machine operator.

4.7.2 PREVENTING ACCESS

CONTROL

Appropriate physical and non-physical security must be in place to prevent access to specific areas with hazardous equipment where guarding cannot be provided.

PERFORMANCE STANDARD

i) Identify energy sources with the potential for fatal outcomes that are unable to be guarded prior to commencing the operation. Identify, implement, communicate and verify alternate controls.
ii) Check exclusion zones use suitable physical distance, barrier type and stability to prevent accidental, unintended and casual interaction with the moving parts.
iii) Lock access to equipment with moving parts and energy sources representing a fatality risk when usage for that day or shift ceases.
iv) Ensure operational personnel with responsibility for access administration (e.g. security) have a list of authorized key users. Check equipment is locked and has the capacity to prevent equipment use if found unlocked.

4.7.3 LARGE MOBILE EQUIPMENT MAINTENANCE

CONTROL
Implement and monitor an appropriate maintenance regime for the equipment.
PERFORMANCE STANDARD
i) Ensure all equipment is registered using unique identifiers.
ii) Check maintenance is in accordance with manufacturer's recommendations or at shorter intervals if required and that maintenance manuals are provided prior to equipment arriving on site where under a supplier contract.
iii) Ensure inspection records remain with the machine.
iv) Check third party and manufacturer's use requirements and risk assessments are kept in the machine.
v) If earthmoving equipment is being operated with quick hitch devices there must be a safe system of work adopted. It is essential that mechanical locking pins are used to prevent uncontrolled release.

RISK EVENT MITIGATING CONTROLS AND PERFORMANCE STANDARDS
4.7.4 ACTIVATIONS (CONTROLS) AND EMERGENCY STOPS
CONTROL
Equipment must be of a design that allows emergency stopping by trip devices and has manual controls that prevent hazardous and inadvertent machine operation.
PERFORMANCE STANDARD
i) Review equipment brought to site to determine if it is equipped with a suitable number, type and location of trip devices or emergency stops.
ii) Ensure manual controls are:
• Clearly visible, identifiable and marked.
• Their movement is consistent with their effect on machine operation.
• In the appropriate language.
iii) Establish an audible warning signal of sufficient duration and intensity for start-up where it is not possible to see all danger zones from the operator's console.
iv) Check the design of machine controls prevents inadvertent or unexpected start-up.
v) Routinely test emergency stop or trip devices.

4.8 EXCAVATION AND STOCKPILE COLLAPSE
RISK EVENT PREVENTATIVE CONTROLS AND PERFORMANCE STANDARDS
4.8.1 GROUND CONDITIONS
CONTROL
All excavations and stockpiles must be managed in accordance with known geological conditions.
PERFORMANCE STANDARD
i) Identify ground and underlying conditions and hazards and ensure geotechnical engineered solutions are comparable with the risk.
ii) Assess the area for any underground services and identify as per GMRs 4.4.8 underground services and 4.15.4 underground services (non-electrical).
iii) Agree a comprehensive plan prior to beginning physical works. The plan must cover construction methodology, support mechanisms, sequencing, use of plant and equipment to ensure stability of excavations and stockpiles.

4.8.2 EXCAVATION MANAGEMENT
CONTROL
All excavations must consider safe angles, access and structural integrity.
PERFORMANCE STANDARD
i) Excavations greater than 4ft. must be benched, shored, battered back or sloped to a safe angle as determined by the qualified engineer in the excavation design process. An angle of repose of 45 degrees must not be exceeded unless designed and certified by a geotechnical engineer.
ii) Where benching or battering is not possible, trenches and excavations must be mechanically shored to prevent collapse.
iii) Adjacent structures, roads and sidewalks must be supported or protected where necessary to prevent collapse.
iv) Materials and equipment must be placed at a safe distance from the edge of excavations.
v) Adequate signage, physical barriers and lighting must be provided to prevent falls into excavations, especially for plant working on those excavations and vehicles or plant from adjacent thoroughfares. Temporary stairs must be installed to provide safe access into excavations where appropriate.

vi) Water ingress into excavations must be controlled to ensure stability and where water is present in deep excavations an appropriate dewatering program must be in place.
vii) Daily inspections of all excavations must be undertaken.
viii) Robust barriers will be used in lieu of plastic Caution tape.
ix) All excavations within the fenced heavy construction area will, at a minimum, be protected by fiber reinforced caution tape Excavations that will be open for extended periods require construction fence at a minimum.
x) A trench and excavation permit will be completed prior to all trenching and excavation operations.
xi) All trenches of 4' or greater shall be benched and/or sloped.
xii) All pins, stakes, etc. used during concrete forming operations will be capped to prevent an impalement hazard.

4.8.3 STOCKPILE MANAGEMENT

CONTROL

All stockpiles must consider safe angles, access and structural integrity.

PERFORMANCE STANDARD

i) Maximum stockpile height must be determined by an engineer and not exceeded.
ii) All people must be excluded from the active loading or dumping area.

4.9 FAILURE OF STRUCTURE (TEMPORARY OR PERMANENT)

RISK EVENT PREVENTATIVE CONTROLS AND PERFORMANCE STANDARDS

4.9.1 STRUCTURAL INTEGRITY

CONTROL

Appropriate methods for adjusting temporary and permanent structures must be in place.

PERFORMANCE STANDARD

i) Ensure suppliers and installers of both temporary and permanent structures consider engineering solutions that provide the highest degree of certainty relating to structural integrity and have it independently verified by a qualified and registered structural engineer.
ii) Pursue and implement methodologies, systems, technology or equipment that can provide early warning of any impending structural failure.
iii) Proprietary or engineered systems certified by a qualified and registered structural engineer must be used at all times and all elements must be installed without variance to any agreed methodology and engineering tolerances.
iv) Temporary and permanent multi-story structures must take into consideration all climatic possibilities, ground conditions and geology including earthquake risk.

4.9.2 INSTALLATION

CONTROL

The installation of structural elements must be subject to quality management rigor and certification.

PERFORMANCE STANDARD

i) All temporary works must be designed by a qualified, competent and registered engineer according to its intended use and be reviewed by a qualified, competent and independently registered engineer. Once installed, erected or after a change to the design, the temporary works must be verified by a qualified, competent and independently registered engineer to ensure the design intent is met.
ii) All proprietary systems must be in accordance with the manufacturer's recommendations. The mixing of components from different proprietary systems is not permitted unless the system is approved by a qualified and registered structural engineer.
iii) Any calculations and drawings must clearly communicate requirements to those checking and constructing temporary works, including safe loading limits.
iv) All floors under construction must ensure the maximum applicable loads that will be experienced on each floor during the construction phase (e.g. from material storage, lifting operations and waste) is considered when calculations for loading thresholds are applied.
v) All scaffolds must be stable and secure to prevent movement and collapse. Scaffolds must be plumb, have adequate cross-bracing, sound footings and be tied into structure where height or base ratio is greater than 2:1.
Before use scaffolds must be inspected by a qualified scaffolder and be tagged to show the inspection status.
vi) All temporary works platforms and associated access must be planned and documented by a competent person to ensure equipment is appropriate for the specific use and is erected, altered or dismantled by competent people following safe methods of work.

vii) All demolition work involving structural removal must be subject to approval from a structural engineer where any structural elements are proposed to be removed.
viii) All temporary works must be protected to prevent impact from vehicles and plant.
ix) Under no circumstances must any temporary works structure be modified without going through the same process as outlined in this performance standard.

RISK EVENT MITIGATING CONTROLS AND PERFORMANCE STANDARDS
4.9.3 EXCLUSION ZONES/OVERHEAD PROTECTION

CONTROL

An adequate exclusion zone or overhead protection must be in place for demolition works or any other controlled method of structural deconstruction where there is a risk of structural collapse beyond the applicable area.

PERFORMANCE STANDARD

i) Ensure exclusion zones are of adequate size, taking into account the risks including potential arc of fall, deflections and bounce distances, are delineated by physical barriers and have clear signage prohibiting unauthorized entry where there is a likely risk of harm. The integrity of any exclusion zones must be regularly checked.
ii) Ensure planning for both construction and asset works identify any scenarios where overhead protection must be installed, particularly where people below cannot be completely excluded. Overhead protection must be in place before the activity begins. Any overhead protection cannot allow for failure due to the impact from an object it is designed to intercept.

4.10 OCCUPATIONAL HEALTH EXPOSURE

RISK EVENT PREVENTATIVE CONTROLS AND PERFORMANCE STANDARDS

4.10.1 HAZARDOUS SUBSTANCE AND HAZARDOUS MATERIALS IDENTIFICATION

CONTROL

Ensure Lendlease is knowledgeable of any known hazardous substances or hazardous materials and the implications for future management of the asset.

PERFORMANCE STANDARD

i) When acquiring an asset, identify retained hazardous substances and hazardous materials on site and the need for their use in managing the asset.

ii) Identify in pre-construction reviews any hazardous substances proposed for construction or final use. Only accept hazardous substances where no effective less hazardous alternative can be demonstrated.

iii) The following substances and materials are hazardous and their use, handling or storage is not permitted in new designs. Any of these substances must be treated as high risk if encountered:

- Asbestos or asbestos containing products
- Lead, or materials containing lead that may be ingested, inhaled or absorbed
- Paints or treatments that contain arsenic, lead, copper or chromium
- Equipment or components containing Chlorofluorocarbons (CFCs), Hydro chlorofluorocarbons (HCFCs) or Halons
- Pesticides or herbicides containing or0ganophosphate or organochlorines
- Pentachlorophenol or timber treated with Pentachlorophenol
- Polychlorinated Biphenyls (PCBs) and Polychlorinated Terphenyls (PCTs)
- Synthetic mineral fibers
- Lindane (gamma-HCH)
- Tributyltin (TBT)
- Antimony
- Arsenic
- Benzene
- Beryllium
- Cadmium
- Carbon disulphide
- Chromate
- Chromium
- Cobalt
- Free silica
- Tetrachloroethane
- Other hazardous materials, substances and chemicals banned or restricted by law

4.10.2 STORAGE AND MINIMISATION

CONTROL

Hazardous substances, dangerous goods and hazardous materials must not be stored on site except for small volumes in purpose built structures.

PERFORMANCE STANDARD

i) Only minimum amounts of hazardous substances, dangerous goods and hazardous materials are to be used. Suppliers must state why it is needed, what the minimum amount is and provide the full Safety Data Sheet (SDS).

ii) Ensure hazardous substances, dangerous goods and hazardous materials (e.g. fuels, oils, chemicals, solvents, pesticides and fertilizers) are not stored on-site except for small volumes stored within a well-ventilated, purpose built structure with roof cover. The store must have a concrete sealed or equivalent impervious floor with bunding, isolated drainage, signage and security fencing. Position hazardous substances and dangerous goods storage locations away from high traffic areas, pedestrian zones and environmentally sensitive areas such as waterways or natural habitats.

iii) Ensure all operations with hazardous substances and dangerous goods storage have appropriate spill kit materials and firefighting equipment and Safety Data Sheets (SDS) readily available along with adequately trained safety and first aid professionals.

iv) Ensure operations with hazardous materials such as asbestos or lead clearly identify and label such materials and isolate and safely secure (e.g. encapsulate) any areas where hazardous materials have been damaged until a licensed contractor can remove the materials and reinstate a non-hazardous alternative.

v) No new underground bulk fuel storage tanks are to be installed on Lendlease owned sites. Existing redundant underground storage tanks and above ground storage tanks must be decommissioned and removed by an appropriately licensed contractor in accordance with regulatory requirements.
vi) Identify, secure and maintain existing underground or above ground fuel tanks still in use on the site in accordance with regulatory requirements.

4.10.3 ASBESTOS REGISTER AND MAINTENANCE PLAN

CONTROL

Ensure Lendlease is aware of the extent of asbestos so that an informed decision can be made on the acquisition and future management of the asset.

PERFORMANCE STANDARD

i) Ensure that a hazardous materials survey is carried out for all assets prior to acquisition.
ii) Ensure an asbestos register and asbestos management plan for asbestos containing material (ACM) is readily available to all inspection and maintenance people, tenants or other groups, is in place before commencement of works at the operation and is reviewed and updated annually.
iii) Ensure all workers where ACM is present receive awareness training that addresses the type, quantity and location of ACM and its health effects, safe working practices including PPE and the combined effects of smoking and asbestos.
iv) Ensure appropriate licenses for the location and regulatory requirements are held for repairers, maintainers and removalists where needed.
v) Ensure all people working on ACM are explicitly authorized, either by Lendlease or a supplier. The design of processes for working with ACM must include methods to prevent the creation of airborne fibers.
vi) Where a product is identified that may contain ACM, precautions must be taken until a registered hygienist or independent testing authority confirms no ACM is present or that the ACM can be encapsulated.
vii) Ensure suppliers proposed to work on or remove naturally occurring asbestos (NOA) or ACM demonstrate experience relating to the volume of NOA/ACM to be removed, location sensitivity (i.e. proximity to people), type of NOA/ACM to be removed and the size of the site where the scale of one or more of these determinants creates the need for particular asbestos management or removal experience.
viii) Perform air monitoring whenever ACM and NOA is being removed or handled.

4.10.4 HEALTH MONITORING

CONTROL

Health monitoring must be completed for all workers specifically handling or removing ACM, NOA or other hazardous material.

PERFORMANCE STANDARD

i) Record each worker’s history of estimated and known exposure to ACM or other hazardous material as part of medical examinations.
ii) Ensure all workers coming into the operations to handle or remove ACM, NOA or other hazardous material such as lead have up to date medical examinations.
iii) Ensure all workers who work regularly and on an ongoing basis with ACM, NOA or other hazardous material have a biannual medical examination involving a lung function test.

4.10.5 WORK IN EXTREME TEMPERATURES

CONTROL

Any work conducted in a natural or artificial environment of extreme temperatures must be proactively managed to eliminate the risk of temperature related injury or illness.

PERFORMANCE STANDARD

i) For areas or equipment where extreme temperatures are planned (e.g. freezers or boiler rooms) ensure adequate security and controlled access is in place.
ii) Establish and implement a maintenance, inspection and testing program for heating, ventilation and cooling equipment.
iii) For work in extreme temperatures consider remote or robotic working, equipment and materials that could artificially alter the surrounding temperature, minimizing exposure to extreme temperatures (e.g. rest breaks), job rotation, undertaking work at cooler or warmer times, emergency contact and alarm systems, heat or cold management plans, monitoring of environmental conditions and weather and providing adequate clothing that protects from the elements.

4.10.6 INTERACTION WITH FLORA, FAUNA AND ALLERGENS

CONTROL

Risks associated with potential interaction with dangerous plants and animals must be managed to minimize the risk of harm.

PERFORMANCE STANDARD

i) Before acquiring an asset or business or agreeing a contract for construction areas must be reviewed where people could be exposed to dangerous plants and animals. Ensure the review is both desktop and physically undertaken on site.
ii) Where practicable, remove any dangerous plants and animals before commencing the work such as clearing poisonous plants before demolition.
iii) Where dangerous plants or animals have been identified and cannot be removed (e.g. known poisonous snake habitats) consider relocation of fauna where possible, exclusion of some work areas including blocking off (e.g. long grass areas where snakes may be present) correct selection and use of PPE such as overalls and general awareness training to reduce risk of exposure.

RISK EVENT MITIGATING CONTROLS AND PERFORMANCE STANDARDS

4.10.7 OCCUPATIONAL HEALTH EXPOSURE RESPONSE

CONTROL

Response mechanisms must be in place should an occupational health exposure event occur.

PERFORMANCE STANDARD

i) Emergency response and first aid requirements must be in place with trained first aiders available.
ii) Appropriate facilities must be in place for washing and decontamination where such risks apply.
iii) Contingency plans must be in place should an occupational health exposure event occur.

4.11 PUBLIC HEALTH EXPOSURE

RISK EVENT PREVENTATIVE CONTROLS

4.11.1 FOOD POISONING

i) Where higher standards of hygiene are required such as in food preparation areas, medical care and treatment areas effective infection control cleaning regimes must be implemented with clear responsibilities assigned, training provided, accurate records kept and regular audits undertaken. Basic catering such as workplace BBQs must maintain general hygiene standards and food safety precautions such as adequate refrigeration of high risk foods, use of gloves and other general hygiene precautions.
ii) Procure food and food provision services from suppliers who have recognized local or international food safety standards certification (e.g. from the local authority, HACCP or ISO 22000). This includes chain of custody food safety provisions where operations provide high risk food and drink as part of employee or customer entertainment in external venues.
iii) Ensure commercial operations supplying food prepared and stored by Lendlease directly hold a current third party certified food safety certification.

4.11.2 LEGIONELLA AND WATERBORNE ORGANISM CONTROL

i) Water supply systems must minimize the health risks from waterborne organisms in water systems (e.g. by avoiding any unused portion of piping such as dead legs where there is potential for the formation of biofilm).
ii) Wet cooling towers must be located away from publicly accessible areas and be assessed with consideration of the surrounding areas to avoid vulnerable groups (e.g. playgrounds, aged care facilities and hospitals).
iii) All water systems must be maintained, upgraded and monitored to prevent the growth and spread of waterborne organisms such as Legionella through regular dosing, inspection, cleaning, disinfection and temperature control.
A water quality testing regime consistent with best practice must be implemented with appropriate records maintained.
iv) All monitoring and maintenance must be planned and conducted by a competent person familiar with Legionella and other waterborne organisms. Effective protective clothing or equipment must be used and the correct plant maintenance safety procedures must be observed. Adverse test results must be recorded as an incident in the EH&S reporting system, acted on immediately and re-tested until safe tolerances are achieved.

4.11.3 AVOIDANCE OF CRUSH FROM CROWDS

i) Ensure all buildings have enough space for the anticipated number of people.
ii) Minimize pinch points and bottlenecks for the movement of people and demonstrate as suitable for the building or event.
iii) Ensure all operations allowing public access have effective means of safely keeping people outside the building and securing access.

iv) Identify doors and equipment that are needed to manage crowds. Proactively check for correct function and that they are on a planned preventative maintenance schedule.
v) Train security staff in emergency response for crowd management, de-escalation of aggressive or violent visitors and the first aid treatment of crush and overheating injuries.
vi) Complete regular scenario planning for large crowd numbers and adjust procedures to meet these needs.

RISK EVENT MITIGATING CONTROLS

4.11.4 DISEASE/PANDEMIC EXPOSURE

i) Subscribe to available international alert systems such as International SOS to monitor any outbreak of a potentially fatal pathogen.
ii) Where an outbreak of a potentially fatal pathogen has been declared in the same country as any operation, create a specific local management plan to minimize the risk of exposure to all workers including at risk workers such as those who are immunity deficient or pregnant.
iii) Provide general awareness information about the signs and symptoms of both local seasonal pathogens and outbreaks of other public health issues in areas of travel.
iv) Communicate specific steps to be taken should people suffer from symptoms of potentially fatal pathogens and provide workers with education to recognize signs and symptoms in others.

4.12 MENTAL HEALTH AND FATIGUE

RISK EVENT PREVENTATIVE CONTROLS

4.12.1 TASKS AND WORKLOAD

i) Establish the numbers of personnel, both Lendlease and suppliers, required for the safe and effective management of all activities within the operation so that the required workload does not exceed 60 hours per week. All overtime must be voluntary and appropriate safeguards must be in place to protect the physical and mental health and wellbeing of workers at all times This limit includes office based and frontline personnel. Further consideration must be given to any additional time spent working while commuting or driving between workplaces or sites. For remote projects on a FIFO roster, the maximum work hours are not to exceed an average of 60 hours per week assessed over the whole roster cycle.
ii) Identify key tasks where worker fatigue could lead to mistakes that could cause the fatal injury of any person such as a crane or plant operator, driver or other safety critical role. Specify clear limits on weekly and daily working hours for these tasks and what rest breaks are required.
iii) Proactively monitor actual hours spent working.
iv) Specify and procure fatigue detection equipment where available for any vehicle, mobile plant and equipment.

4.12.2 WORK AND REST AREAS

i) Provide suitable working areas to minimize fatigue, including but not limited to the provision of sufficient light, ventilation and air and ergonomically suitable furniture for work tasks.
ii) Provide suitable rest areas to minimize fatigue, including but not limited to placement away from the work task in a quiet area clearly marked as a break out/rest area with sufficient seating and rest areas for peak numbers of workers.

RISK EVENT MITIGATING CONTROLS

4.12.3 MENTAL HEALTH SUPPORT

i) Provide an Employee Assistance Program (EAP), independent counselling and support for employees feeling stressed or suffering from other mental health issues.
ii) Provide general awareness of mental health issues to employees and suppliers working for Lendlease as appropriate to their role and duration of employment.
iii) Establish Mental Health First Aiders or equivalent employees trained to identify the likely signs of poor mental health in colleagues and suppliers and who are able to intervene and direct individuals showing signs of mental health issues to available support services.

4.13 DEGREDATION OR POLLUTION OF THE ENVIRONMENT

RISK EVENT PREVENTATIVE CONTROLS

4.13.1 STORMWATER, SEDIMENT AND EROSION CONTROL

i) Ensure that all activities where land is cleared, excavated or disturbed have sediment and erosion control devices implemented and maintained. These devices prevent topsoil loss, land degradation as well as the export of soil, silt or sediment off-site.
ii) Stormwater and sediment control risks must be controlled with solutions appropriately designed and maintained to prevent uncontrolled discharges to air, land or water. Provide on-site treatment of any stormwater runoff where required.

iii) Implement adequate controls on all operations to prevent water pollution and any pollutants from entering adjacent drainage areas such as watercourses, water bodies, bays or other marine environments and stormwater systems through uncontrolled discharges.
iv) Ensure all wastewater discharged from operations such as sediment impacted stormwater or process water but excluding sewage is in accordance with any applicable planning and license conditions (e.g. controlled discharge points where testing and monitoring is conducted). Maintain all water quality testing and individual discharge records for audit purposes.

4.13.2 AIR, NOISE AND VIBRATION EMISSIONS

i) Determine preventative controls for all activities involving excavation, disturbance of soils or vegetation and then implement physical controls such as covering of stockpiles or water spraying to eliminate or minimize the generation of dust and to eliminate or minimize dust being introduced to the atmosphere.
ii) Assess and implement mitigation measures for all noise and vibration related impacts on occupants, visitors, surrounding activities and owners where required to ensure operations do not adversely impact them.
iii) Ensure all industrial process facilities or site based plant and equipment are serviced regularly in accordance with manufacturer guidelines so that noise, exhaust or other emissions generated are within the specified standards to prevent harm to people and the environment.

4.13.3 SOILS AND GROUNDWATER CONTAMINATION

i) Identify, signpost and segregate from site activities any known contaminated soils or groundwater on the site likely to cause risk to health, safety or the environment. Erect physical barriers to prevent unauthorized entry, exposure and cross contamination.
ii) Cease any site activities that involve soil or groundwater disturbance where the contamination levels of the soil and groundwater are either unknown or where evidence of possible contamination is presented, until a competent person is able to determine the contamination status or risk.
iii) Plan and conduct all excavation, movement, treatment, processing or remediation of contaminated soils or groundwater in accordance with the requirements of high risk activities.
iv) Ensure all site remediation activities are conducted in accordance with regulatory requirements including provision for any decontamination and wash/disposal facilities.

4.13.4 BIODIVERSITY AND NATURAL HABITATS

i) Areas designated by regulatory authorities as protected habitats, including water bodies and designated habitats or wildlife corridors within the area of any operations, must be identified, signposted and protected from operational activity, including uncontrolled pedestrian access.
ii) All operations within or immediately adjacent to areas of protected habitat must be planned and conducted in accordance with the requirements for high risk activities and include a risk assessment and description of any actions required to protect flora and fauna consistent with the findings of any ecological site assessment and regulatory requirements.
iii) All landscaping and site grounds must be appropriately managed to prevent uncontrolled discharges and land degradation including avoiding the spread of weeds or invasive species. Where invasive species exist, physical removal or isolation is the preferred option rather than the use of non-toxic herbicides.

4.13.5 HERITAGE AND ARTEFACTS

i) Ensure all items of heritage, cultural or archaeological significance are included on construction plans, signposted and protected in accordance with regulatory requirements.
ii) Ensure any excavations, intrusive works or other operations that have the potential to impact areas of known heritage, cultural or archaeological significance are performed in accordance with a heritage assessment and any regulatory requirements. This may include a dilapidation survey, supervision of works by a competent person and vibration monitoring.
iii) Signpost and segregate any such areas by erecting physical barriers to prevent unauthorized entry. Plan and conduct all activities potentially impacting known areas in accordance with the requirements of high risk activities.
iv) Cease any activities that involve the discovery of items that may be of cultural or archaeological significance until a competent person is able to determine the status of any potential artefact(s).

4.14 VEHICLE AND EQUIPMENT INCIDENTS (PUBLIC AREAS)

RISK EVENT PREVENTATIVE CONTROLS

4.14.1 TRAFFIC PLANNING

i) Ensure any applicable traffic management plans or regulatory required traffic management protocols are current and define the controls to minimize the risk of vehicles striking another vehicle, structure or pedestrian.

ii) Controls to manage any interface with public roads must provide effective signs and traffic control aids addressing prohibited vehicles, access points, routes for different vehicles types and reversing requirements.

4.14.2 PEDESTRIAN AND VEHICLE SEGREGATION

i) All locations must assess the risks presented by the movement of pedestrians and vehicles around or next to the site and implement appropriate controls to eliminate or minimize these risks.
ii) Route sightlines must be unobstructed and adequately lit to ensure good visibility. Blind spots and corners must be avoided, or where they do exist, have mirrors or other controls installed.
iii) Signage and road markings must provide clear instructions to pedestrian and vehicle route users and be located in positions which allow users to see them and have time to respond.
iv) Loading and unloading areas for commercial vehicles (e.g. delivery trucks) must be clearly defined for loading
or unloading.
v) Speed limits must be determined to reduce the risks associated with pedestrian movements, the local environment and authority standards. Speed calming measures such as raised crossings, humps on approach to crossings and rumble strips must be implemented in areas where pedestrians and vehicles could interface.
vi) In locations where vehicles and pedestrians are in close proximity (e.g. security entrance points or where doors open directly onto vehicle routes) engineering controls must be provided to keep pedestrians and vehicles apart (e.g. by fitting physical barriers or providing separate routes).
vii) Where shared zones for traffic and pedestrians are in place, speed limits must be reduced to less than 6 miles per hour and signage and traffic calming devices must be in place where building entry and exit points lead onto any area where vehicles can operate.
viii) Six foot chain link construction fencing must be installed prior to any work commencing.
ix) All construction entrances must have a gate attendant or other means to control access to the worksite.

4.14.3 PARKING AND TRAFFIC ROUTES

i) Traffic routes and parking arrangements must be in place to avoid vehicle-to-vehicle and vehicle-to-pedestrian conflicts.
ii) Provide clear signage in car parks to indicate location information, speed limits, operating hours and conditions and any other hazards and precautions.
iii) Provide clearly defined pedestrian routes within car parks to facilitate safe access and egress.
iv) Locate height bars and signage to car park entrances to warn drivers of height limits. Provide safe exit routes for oversize vehicles.
v) Use controls to manage reversing for trucks and delivery vehicles where through flow or one way systems cannot be achieved. Where reversing needs to occur, use suitable controls in response to the level of risk encountered including pedestrian exclusion zones, mirrors or traffic signalers.

4.14.4 SAFE VEHICLE USAGE

i) Vehicles used as a tool of trade by Lendlease personnel must be operated in a safe manner at all times.
ii) Light vehicles on operations should be of a high visibility color (e.g. white) and have reflective taping, flashing lights, a first aid kit, a fire extinguisher, a spill kit and survival or emergency equipment suitable for the operating environment.
iii) Vehicles provided by Lendlease as a tool of trade shall be fitted with in vehicle management systems, reversing cameras and hand brake warning systems.
iv) Seatbelts must be used at all times by all occupants and drivers of vehicles.
v) Vehicle journeys of two hours or more continual driving must be planned to ensure adequate rest breaks are in place and that there is provision to manage fatigue.
vi) Mobile phones, whether hands free or not, must only be used by the driver of a tool of trade vehicle whilst the vehicle is stationary and in a parked safe location. The exception to this is for emergency and incident response vehicles, using hands free communications in a response situation where alternate communications are not available.
vii) All drivers must be appropriately licensed for the vehicle being operated and be fit for work (i.e. not impaired by medication, drugs or alcohol).

viii) When parked all vehicles must be fundamentally stable with the engine turned off, handbrake effectively applied, placed in gear and on level ground. Wheels should be situated in spoon drains, gutters or against wheel stops.
If fundamentally stable parking cannot be achieved appropriately sized wheel chocks must be available and implemented.
ix) All Lendlease vehicles must have inspection and maintenance protocols in place for all safety related items
such as wheels and tires, steering, suspension and braking systems, seats and seat belts, lamps, indicators, mirrors and reflectors, windscreen and windows including windscreen wipers and washers, the vehicle structure itself and any other safety related item on the vehicle body, chassis or engine including instrumentation.
x) Pre-start inspections must be completed to ensure the lighting and braking systems are in proper working order.
xi) Vehicles must not be used above the manufacturer defined maximum load limit.
xii) Wheel nut indicators must be fitted to all vehicle wheels.
xiii) An onsite speed limit of 15MPH will be enforced.
xiv) Personally owned vehicles allowed on site will be minimized. Motorcycles and bicycles must be parked in the designated parking areas and will not be used as transportation within the construction area.
xv) Adequate fall protection must be used when offloading from the back of vehicles in line with the hierarch of fall prevention.
xvi) The use of cell phones, smart phones, etc. or any in ear audio device while operating vehicles or equipment on site is prohibited.

4.15 UNCONTROLLED RELEASE OF STORED ENERGY (NON-ELECTRICAL)

RISK EVENT PREVENTATIVE CONTROLS

4.15.1 ISOLATION

i) Before undertaking work on systems that contain stored energy, the energy must be released (e.g. draining fluids from pipes and releasing tension in belt systems).
ii) To prevent inadvertent or unintentional movement of mechanical systems a lock out system such as the use of keyed padlocks, belt clamps or the use of chains to secure items against movement must be implemented.
iii) Isolation of hydraulic and gas systems is required using a physical keyed lock out isolation system and a danger tag/out of service tag with personal locks on all valves.

4.15.2 EQUIPMENT TYPES

i) Use the smallest available unit that can complete the task when procuring portable or temporary systems (e.g.
portable compressors).
ii) Ensure systems are able to withstand specific local environmental conditions and hazards.
iii) Select technology that provides the highest level of structural and mechanical integrity for containment of stored energy.

4.15.3 IDENTIFICATION AND MAINTENANCE

i) When acquiring an asset, identify all stored energy systems and demonstrate their current condition and safety status. Where no records are available or where they are incomplete, provide them within three months of the transaction.
ii) Develop a maintenance and mechanical integrity program for all stored energy systems suitable for the system, including periodic third party inspection and examination. This includes portable storage systems under the control of the operation.
iii) Perform maintenance of portable stored energy systems in a safe location away from the workforce.

iv) Undertake a review of all stored energy systems to identify and implement controls required to reduce the likelihood of uncontrolled release. Consider all third party external risks or events that could impact the stored energy system. Ensure written procedures are in place for the operation and maintenance of stored energy systems.
v) Ensure procedures include methods for safe energy discharge, isolation and demonstration that energy has been removed before invasive maintenance takes place.

4.15.4 QUALITY CONTROL

i) Implement quality control and quality assurance for the procurement and installation of any stored energy system to ensure that it meets design requirements.
ii) Implement quality control of the design and engineering of stored energy systems to ensure that the design is fit for purpose.
iii) All stored energy systems must be designed by a qualified, competent and registered engineer according to its intended use and be reviewed by a qualified, competent and independently registered engineer. Once installed, erected or after a change to the design the stored energy system must be verified by a qualified, competent and independently registered engineer to ensure the design intent is met.

4.15.5 UNDERGROUND SERVICES (NON-ELECTRICAL)

i) Ensure a register is in place for all buried services across all Lendlease controlled operations (e.g. gas). The register must include a plot drawing of the route of the service with grid references or other recognized location references, description of the depth and type of service and any auxiliary protection.
ii) Existing drawings and suitable location tools must be used to locate and mark underground services before works commence. Where any uncertainty exists regarding the location of underground services hand digging such as pot holing must be implemented to positively identify the services.
iii) Prior to the disturbance of ground where underground network assets such as electrical or gas may be present,
Lendlease operations must ensure that current diagrams and plans are available and obtained from the relevant authority.

4.15.6 REDUCE CONSEQUENCES OF RELEASE

i) Take all necessary actions to reduce the consequences of an uncontrolled release of stored energy (e.g. relocating the hazard, installing barriers or secondary containment).

4.16 TUNNEL COLLAPSE

RISK EVENT PREVENTATIVE CONTROLS

4.16.1 GEOLOGICAL HAZARDS

i) Identify geological hazards and ensure geotechnical engineered solutions are comparable with the risk.
ii) Ensure contractors, service providers or JV partners identify the plant and equipment intended for use.
iii) During procurement ensure contractors, service providers or JV partners demonstrate how their plan minimizes the exposure of people to potential collapse events.

4.16.2 MONITORING AND INSPECTION

i) Ensure ground support plans address geotechnical issues, describe and illustrate methods of ground support, clarify roles and responsibilities and address inspection regimes.
ii) Ensure engineered monitoring and warning systems are in place for tunnels where failure of the sides or roof could
lead to the entrapment of people.
iii) Ensure engineered monitoring and warning systems are supported by training people to make relevant geotechnical observations of impending failure.

4.16.3 UNAUTHORISED ACCESS

i) Ensure all work involving tunnels identifies the people, vehicles, plant or equipment authorized to access the tunnel.
Risk assessments must address unauthorized access.
ii) Prevent access wherever an unauthorized vehicle or person could damage critical infrastructure or where the unauthorized person could be fatally injured due to the hazards within the operational area.
Install physical barriers at operational perimeters and within discrete areas of the operation if required.

RISK EVENT MITIGATING CONTROLS

4.16.4 FALLING OBJECT PROTECTIVE STRUCTURE

i) Install Falling Object Protective Structure (FOPS) to all mobile plant and equipment working in tunnels, meeting
ISO 3449:2005 Level 1 or 2 or equivalent.

4.16.5 RESCUE CHAMBERS/SELF-RESCUERS

i) Ensure the emergency response plan for tunneling includes self-rescuers and rescue chambers.
ii) Prepare emergency response plans with the assistance of specific expertise. Plans must address the rescue equipment required, location plans of equipment in the tunnel, rescue chamber capacity including power, water, oxygen and food requirements, training, inspection and maintenance regimes.

4.16.6 EMERGENCY RESPONSE

i) The emergency response plan must be developed prior to work commencing and be resourced, implemented, verified and reviewed quarterly.
ii) The plan must address failure scenarios such as specific recovery equipment (e.g. type and location) and training requirements.
iii) Inductions must address the knowledge and skills of exposed workers to the emergency scenario.
iv) Emergency response plans are to be regularly practiced and evaluated.

4.17 FAILURES OF FIXTURES AND FITTINGS

RISK EVENT PREVENTATIVE CONTROLS

4.17.1 FIXTURES AND FITTINGS

i) If a building element could fall from its overhead positioning its fixings must be adequately engineered using, where possible, a tested proprietary system certified for its intended use.
ii) Ensure suppliers and installers of fixtures and fittings consider engineering solutions that provide the highest degree of certainty relating to structural integrity for both temporary and permanent structures in the installation of fixtures and fittings.

4.17.2 INSTALLATION

i) Install all elements without variance against agreed methodology and engineering tolerances.
ii) Quality management processes must be implemented to determine that structural components or fittings and fixtures are installed using the documented components, adequately tensioned or fixed, free of defects, with the allocated number and type of fasteners and complete with a record of inspection and testing.
iii) Confirm and complete inspection and testing plans where work or re-work requires approved activities to be conducted out of sequence from the original plan. This includes previously installed elements associated with or adjacent to the work area and ensuring that structural integrity has not been compromised.

RISK EVENT MITIGATING CONTROLS

4.17.3 EXCLUSION ZONES/OVERHEAD PROTECTION

i) Ensure exclusion zones are of adequate size taking into account the risks including potential arc of fall, deflections and bounce distances, are delineated by physical barriers and have clear warning signage prohibiting unauthorized entry where there is a likely risk of harm. The integrity of any exclusion zones must be regularly checked.
ii) Ensure planning for both construction and asset works identifies any scenarios where overhead protection must be installed, particularly where people below cannot be completely excluded. Overhead protection must be in place before the activity begins.

4.18 DROWNING

RISK EVENT PREVENTATIVE CONTROLS

4.18.1 WORK IN, ABOVE, OR ADJACENT TO WATER

i) Work activities above, in or adjacent to water (e.g. diving, work within stormwater and sewer systems, water body maintenance, boating or maritime operations, dredging, bridge and pier construction) are high risk activities and represent a drowning risk. Worker exposure to water must be assessed and minimized with work practices aligned to applicable codes and regulatory requirements.
ii) Proof of competency for divers and all maritime plant and equipment operators must be provided.
iii) Work activities reliant on favorable climatic conditions, flow shut-off protocols (within water and sewage treatment facilities) and monitoring equipment and protocols must not proceed if safeguards are compromised
in any way.
iv) All excavations, including piling operations, must be inspected after significant rainfall events (i.e. greater than
1 inch in 24 hours) to ensure that water ingress does not present a drowning risk. No further work is to proceed until the risk is eliminated and the removal of the excess water is complete.

4.18.2 SYSTEMS OF WORK

i) Develop and communicate a set of procedures for drowning prevention for all operations that have standing water. As a minimum, procedures must cover:
• Working and prefabricating components away from water wherever possible.
• Secondary barriers or nets to prevent contact with water if the normal barriers have to be worked beyond.
• Purpose designed and suitable gantries for safe transport of workers from vessel to vessel.
• Fit for purpose methods for the transfer of equipment and materials to and from vessels.
• Use of a spotter or buddy system when working near or over water and never allowing lone working near or in water.
• All workers wearing fully functioning personal floatation devices when working near or over water.
• Verifying that all workers are able to swim.
• Guidelines for crossing roads flooded with moving water and identifying driving protocols where this activity is proposed to be carried out.

4.18.3 MANAGEMENT AND CREATION OF WATER BODIES

i) All natural bodies of water (e.g. wetlands, lakes, watercourses, rivers or creeks) must be the subject of a risk assessment to determine if modifications are required to their surroundings to minimize risks to people, especially children or the elderly, or whether it would be more appropriate to preserve the natural surroundings.
ii) Purpose built structures interfacing with these water bodies such as bridges, walkways and boardwalks must provide protection against the fall of a person into the water. Where fencing or balustrades are installed they must not be climbable.
iii) The surroundings of all-purpose built water bodies (e.g. artificial lakes or storm water reservoirs) must be designed

or modified to minimize risks to people, especially children or the elderly. This must include controls to prevent public access if necessary.
iv) Water depths at the edges of artificial water bodies must be minimized by incorporating safety benches. These safety benches must have a water depth of 1 to 2 feet and extend at least 10 feet from the edge of the normal surface level of the water, except where transitions to culverts and other structures occur or where the water body is tidal.
v) All boardwalks, piers, bridges, jetties and harbor edges higher than three feet from the water surface must be risk assessed to determine if handrails should be installed.
vi) Signage communicating warnings, prohibitions and general EH&S related information must be provided using easily comprehensible words and pictograms. The placement and detail of signs must be based on a risk assessment and signage must be provided to alert people of the water hazard and the need for active supervision.

4.18.4 SWIMMING POOLS

i) Swimming pools and spas must be surrounded by a non-climbable child resistant barrier consisting of fencing or child safe windows and doors that open onto the swimming pool area and a self-closing and locking child resistant safety latch. These barriers and their associated locks and latches must be well maintained and in working order at all times and comply with all applicable local codes, standards and legislative requirements.
ii) Warning signage and notices which give a supervision warning and the details of resuscitation techniques and emergency contact numbers must be displayed in a prominent position within the immediate vicinity of a swimming pool.
iii) Filtration systems must be fitted with clearly defined and easily accessible emergency stop buttons or switches and their intakes guarded to eliminate the risk of entrapment.

RISK EVENT MITIGATING CONTROLS

4.18.5 RESCUE AND RESUSCITATION PROTOCOLS

i) Design and build in safe exit or life sustaining handles, rails or other access elements to allow people to readily climb out of the water.
ii) Ensure standby emergency flotation devices are readily available.
iii) Assess the requirement for the presence of professional life saving personnel when large numbers of workers or members of the public are in the water.
iv) Ensure emergency response contacts and protocols are made available.

4.19 CONFINED SPACE

RISK EVENT PREVENTATIVE CONTROLS

4.19.1 MINIMISATION AND CONTROLLED ACCESS

i) Identify at the acquisition of any asset any confined spaces or enclosed areas where hazards could cause the death of any person entering that area. Create and maintain the currency of a single register for future management of the asset.
ii) Control access to all confined spaces, install and maintain physical locks to all confined space access points and display warning signs against unauthorized entry.
iii) Any new equipment and appliances requiring access for maintenance must not be installed in a confined space. The requirement to access confined spaces must be eliminated.
iv) Priority must be given to avoid work inside a confined space through the design and use of alternative work methodologies such as the use of remote cameras for inspections. Where work in a confined space cannot be avoided, the operation must put in place a system of work that includes risk assessments, atmospheric monitoring, training, procedures, permits, PPE requirements, rescue and monitoring arrangements and equipment specifications.

4.19.2 SYSTEM OF WORK

i) Where any confined space is present it must be protected to prevent unauthorized access.
ii) Persons must only enter a confined space when no safer alternatives are available. All work in confined spaces must only be conducted by personnel who are trained to do so, including atmospheric monitoring, use of safety equipment and rescue procedures.
iii) A permit to work procedure must be implemented to effectively control any work in a confined space. The permit
to work must only be issued by a competent person, be valid for a maximum of one shift and require the following precautions to be checked and confirmed as in place before works commence:
• Appropriate measures to control entry and exit and which account for each person entering or leaving the space.
• Atmospheric monitoring and rescue equipment appropriate for the situation and that is in good working order.
• A competent person remaining on watch at all times when any person remains in a confined space to raise the alarm and provide assistance if needed and only if safe to do so.
• On completion of the works a process is in place ensuring the confined space is closed, secured and the permit is signed off and closed-out by the issuer.

4.20 ESSENTIAL SERVICE FAILURE
RISK EVENT PREVENTATIVE CONTROLS

4.20.1 IDENTIFICATION AND TESTING

i) All services that could pose a risk to life in the event of failure (e.g. electricity in hospitals and emergency lighting in offices) must be assessed and a back-up plan developed.
ii) When acquiring an asset, identify all essential services and back-up systems and verify their current condition and reliability. Where no records are available or they are incomplete, ensure these are provided within three months
of the transaction by testing back-up systems where needed.
iii) Ensure maintenance and testing programs are in place for all essential services and that the back-up system(s)
is suitable, including periodic third party inspection and examination.

4.20.2 INSTALLATION AND COMMISSIONING

i) Procure only from suppliers who can demonstrate a positive EH&S performance record for installation and commissioning of the type of system required.
ii) Ensure essential service systems are installed as designed and engineered with a suitable accompanying quality plan.

4.20.3 SYSTEM OF WORK

i) Manage the safety of maintenance and testing of essential services by following the controls specified in alignment with GMRs 4.4 uncontrolled release of electrical energy and 4.15 uncontrolled release of stored energy (non-electrical).

EXHIBIT Z

MAJOR SUBCONTRACTOR WARRANTY REQUIREMENTS

Equipment	Duration of Warranty
PV Modules	10 years (defects) / 25 year (power output)
Inverters	5 years
Racking System	20 years
12 kV Electric Gear	15 years
Other Electric Gear	1 years
Transformer	1 years
Other Equipment	Manufacturer's standard

All Manufacturer's Warranties shall be in accordance with industry customs and norms for such warranties in the marketplace, and shall, at a minimum:

- Be in effect for at least the minimum time periods stated in the table above.
- Not provide the supplier with sole or binding discretion to determine whether there in fact is or is not a defect or deficiency of the applicable Equipment.
- Provide as the only remedies for breaches of warranty that supplier, at supplier's option and supplier's sole cost and expense, either (i) repair the defective or deficient product so that it conforms to the warranted condition or performance (i.e., that no refund or credit will be acceptable as a remedy) or (ii) remove and replace the defective or deficient product.
- Allow for the assignment and transfer of warranties to Owner's successors and assigns.

EXHIBIT AA

OWNER DRAWING REQUIREMENTS

Final Design Drawings shall be developed on 30" X 42" size sheets unless specifically required otherwise by the State of Kentucky or any and all other governing federal, state, or local officials and / or agencies. Owner requires drawings to be developed on AutoCAD, .dwg format, or Approved Equal.

During project implementation, one copy of all design documents, including design drawings, shop drawings, specifications, and material and equipment submittals, shall be forwarded to Owner for review and approval during the design development phase(s) of the project.

In addition, one (1) copy of all engineering calculations including, but not limited to, the following systems: structural, foundation, electrical load calculations, solar and electrical component systems, and / or miscellaneous components for the project shall be submitted to Owner for review and file purposes.

Contractor is responsible for checking and approving all submittals, including shop drawings, prior to submitting them to Owner for review and approval. Review and approval of submittals by Owner or Owner's Engineer, shall not relieve Contractor of the ultimate responsibility of detailed design and engineering compliance.

At completion of the Project, Contractor shall furnish Owner "as-built" record drawings, prints and / or reproducible media. All drawings not developed using AutoCAD, or Approved Equal, shall be furnished on reproducible media (mylar or sepia). Such drawings to show all changes and / or modifications to the Project Documents, including those required and / or brought about by shop drawing changes. All underground utilities and new conductor runs associated with the project shall be precisely located.

EXHIBIT BB

OWNER'S CONTRACTOR SCHEDULING REQUIREMENTS

See attached.

East Kentucky Power Cooperative, Inc.

CONTRACTOR SCHEDULING REQUIREMENTS
TIER 2

Definitions:

- Activity: A discrete part of a contract that can be identified for planning, scheduling, monitoring, and controlling the construction or outage work. Activities included in a construction or outage schedule consume time and resources, but shall not include planned work stoppages. Activities shall not reflect the work of more than one craft. Activities shall not include steps. Critical activities are activities on the critical path, and must start and finish no later than the last start and finish times. Predecessor activity is an activity that must precede another activity in the network. Successor activity is an activity that must follow another activity in the network.

- Baseline Schedule is the schedule (plan) submitted and accepted by EKPC for the work to be performed.

- CPM (Critical Path Method) is planning and scheduling a construction or outage where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the longest path or critical path within the schedule.

- Critical Path is the path in the network where activities must start and finish no later than the last start and finish times.

- Float is the measure of leeway in starting and completing an activity. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity. Total float is the measure of leeway in starting or completing an activity without adversely affecting an intermediate deadline or the planned contract completion date. EKPC will own all float, and must approve changes in the plan that will affect float.

- Early Cumulative Curve is the incremental cumulative sum within a histogram of effort as calculated by the early dates. The contractor is required to execute and track their work to the early cumulative curve.

SCHEDULING REQUIREMENTS

Submittals and Staff:

- The Contractor shall submit a P6 schedule for approval per the Submittal Schedule. This schedule shall be free of negative float and contain no logic loops. The contractor schedule is to be an accurate plan of the intended execution of the project. The submitted schedule is to be reviewed in detail and accepted by all supervision and engineers in the field who will be executing the work. "Canned" schedules will not be accepted.

- The Contractor shall provide staff with sufficient prior experience in performing, planning, and scheduling the same nature and scope of work for the development of the schedule. The scheduler shall have significant experience in the use of CPM scheduling and reporting using P6 to develop their schedule. Contractor must have capability of producing CPM schedule reports and diagrams within 48 hours of EKPC request. The staff engaged in planning & scheduling shall be able to communicate in the English language.

- The Contractor shall work with the EKPC Project Manager and provide progress status of the schedule representing the entire scope of work, including all detailed activities, and logic for any and all suppliers, service providers, and/or subcontractors, including those that might occur off site. The Contractor shall be responsible for directly providing all activities and resource progress. No personnel employed by or representing the Contractor, a supplier, service provider and/or subcontractor will be allowed to access the EKPC database.

- The Contractor's on-site project leader shall attend daily and/or weekly project status meetings.

General Requirements:

- P6 software will be used to schedule all contracted work.

- The contractor will provide information to place logic ties to primary control milestones (used to control the project). Changes to primary control milestones will only be done by Change Order.

- All activities within the schedule shall be task dependent. Activities are to be broken down, reduced to the smallest reasonable increment for better control of the project. If activities are too large in scope or duration EKPC may require that they be broken down in greater detail.

- All activities and milestones within the schedule must be tied using predecessors and successors to produce a logic driven critical path method (CPM) of scheduling. There shall be no activity other than the start and finish that can be open ended and these must be tied to primary control

milestones. All activities and milestones must be tied in a logic CPM schedule to drive the primary control milestones.

- The Contractor schedule shall be submitted without logic loops.
- The Contractor will limit the use of constraints within the schedule to the fewest possible. The schedule is to be logic driven (CPM).
- Calendars within the Contractors schedule will be at the project level. Not EPS or Global. Contractor is responsible for calendar correctness which will include holidays, etc.
- Calendars will be activity calendars not resource calendars.
- Units within the schedule shall be defined and configured as hours unless otherwise directed by the EKPC scheduler.
- Activities names will be clear and describe the nature of the work. They shall fully describe the work to be done.
- After the Contractor schedule is approved it will be considered the base-line and will be considered the initial plan of how the contractor will execute the work. Any deviation from the base-line will be considered a variance. Once the initial plan/schedule is established there shall be no changes made to the schedule other than the daily status updating. Any changes from the approved base-line plan/schedule must be submitted and approved by EKPC.
- The status updates of the schedule are expected to reflect the status of the work to the data date. The status update and frequency of updating as well as the master schedule data date will be determined by the EKPC Project Manager.
- Retained logic will be used to progress all activities and milestones of the schedule.
- Total float will be computed as finish float equals late finish minus early finish.
- Early dates and times will be used to determine the dates and times to do an activity. Not late dates and times. The early dates and times should be pursued by the contractor as the best available dates and times to execute the activities within their schedule.
- Cumulative curves, histograms, and float will be used to measure progress and manage the schedule.
- The contractor is expected to perform to the early curve. The contractor shall configure their schedule so their curves actual will be in blue, base- line will be in red, and remaining shall be in green. In the execution of the project the

blue actual is to equal or exceed the red base-line histogram and cumulative curves of the approved base-line plan.

- The contractor is expected to work the approved plan/schedule as submitted to the early curve.

- The contractor execution of the plan/schedule is expected to follow the sequence of activities within their plan/schedule and early dates base- line cumulative curve with actual performance to the plan while maintaining positive total and free float on all activities and milestones tied in a network of activities to the primary control milestones.

Recovery Planning and Action:

- Any under-plan or variance from the early dates on the plan/schedule base-line is to be corrected. The contractor must submit for approval a recovery plan for variance from the plan/schedule base-line if asked to do so by EKPC Project Manager. The approved recovery plan shall be followed and the ongoing status reported until the variance is corrected. Workshops may be conducted as determined by EKPC management to correct variances from plan.

- If a schedule update reveals that, through no fault of EKPC, the work is pushing the primary control milestone negative and/or the actual (blue) is under plan of baseline (red) or that the remaining work (green) exceed or pushes out beyond the baseline (red) the contractor shall establish and provide a written plan for making up the lost time. The written plan shall include a date for implementing the plan and the expected date for recovery lost time and variance from the baseline plan/schedule. Plan changes can include, but not limited to the following:

    1. Increase number of workers.
    2. Increase amount or kinds of tools.
    3. Work overtime or additional shifts.
    4. A combination of the above.

Reporting:

- Minor changes to the Contractor schedule may be made, provided the schedule changes do not reflect a material change in the planned man-power requirements and the schedule changes reflect only minor changes to the plan. All such changes will be reported in regularly scheduled status meetings.

- As the work progresses, Contractor shall indicate earned completion percentages and remaining duration for each activity.

- Reporting shall include but not be limited to look ahead reports, near critical reports, negative float reports, full schedules, supervisor schedules, summary

reports, critical path activities and networks.

EXHIBIT CC

SUBMITTAL SCHEDULE

1.0 SCOPE

1.1 This document outlines the scope of work of Contractor Deliverables. The review matrices shall be used as the basis for submitting documents to Owner.

1.2 Following is a definition of the codes associated with each document:

1.2.1 **Issued for Owner Review (IOR):** Contractor shall submit documents to Owner for review and shall incorporate reasonable comments from Owner.

1.2.2 **Issued for Information (IFI):** Contractor shall submit documents to Owner for information only.

2.0 REQUIRED SUBMITTALS

Submittal Description	Code	Timing / Frequency
STUDIES, DESIGN PACKAGES, PERMITS		
Traffic Plan	IOR	As Issued
SWPPP (Storm Water Pollution Prevention Plan)	IFI	As Issued
Environmental Monitoring and Mitigation Plan	IFI	As Issued
Temporary Facilities Plan	IFI	As Issued
30% Design Package (one each for Facility or discipline) See Section 2.2	IOR	As Issued
90% Design Package (one each for Facility or discipline) See Section 2.3	IOR	As Issued
IFC Design Package (one each for Facility or discipline) See Section 2.1	IFI	As Issued
Contractor Acquired Permits	IFI	As Issued

OTHER DOCUMENTATION		
PV Module Data Sheet(s)	IFI	As Issued but no later than the 50% Submittals
Inverter Data Sheet and Installation Manual	IFI	As Issued but no later than the 50% Submittals
Inverter Factory Test Reports	IFI	As Issued
Certificates and key notices - Mechanical Completion - Substantial Completion - Final Completion	IOR	 Mechanical Completion Substantial Completion Final Completion
Instrumentation NIST certificates or equivalent	IFI	30 Days prior to scheduled commencement
Redline drawings including: ▪ Electrical schematics, including	IFI	At Substantial Completion

SCADA ▪ Civil drawings, including underground cabling ▪ Structural drawings ▪ Relay settings ▪ Meter calibration data ▪ Instrumentation drawings		
Record drawings in AutoCAD and native formats	IOR	60 Days following Substantial Completion
Facility Power Plant Controller Acceptance Test procedures.	IOR	30 Days prior to scheduled commencement
Commissioning Procedures (Per Exhibit O)	IOR	30 Days prior to scheduled commencement
Commissioning Requirements (Exhibit N)	IOR	As Issued
Notice of Commissioning Test	IFI	10 Days prior to scheduled commencement
Commissioning logs (Exhibit N)	IOR	As Issued
Commissioning Test (Exhibit N)	IOR	15 Days following test
Commissioning Manual (Exhibit N)	IFI	At final completion
Factory test reports	IFI	As Issued
Performance Test Procedures (Per Exhibit O)	IOR	30 Days prior to scheduled commencement
Performance Test Requirements (Exhibit O)	IOR	As Issued
Equipment and Factory O&M documentation	IFI	Substantial Completion for Equipment, Substantial Completion for other
Equipment Warranties	IFI	Substantial Completion for Equipment, Substantial Completion for other
QA/QC Manual QA/QC test reports QA/QC Manual (Final)	IOR IOR IOR	90% Submittal As Issued Substantial Completion
Construction Schedule	IOR	Weekly
Site specific Environmental Health and Safety Plan (Construction Safety Plan – Exhibit Y)	IOR	30 Days prior to mobilization
Engineering Change Notices (ECNs)	IOR	As Issued
Document Control Plan	IOR	30 Days after FNTP
Vendor drawings as applicable	IFI	As Issued
Non-proprietary calculations (upon request)	IFI	As Issued
Module list showing power ratings and serial number of modules by inverter	IFI	Substantial Completion
Module map showing approximate location of modules by Serial number	IFI	Substantial Completion

Module flash test reports	IFI	As Issued
Electrical: - IEEE 80 Study (grounding study) - Cable Schedule and ampacity calculation - Equipment performance data sheets - Arc Flash Study and labels (AC and DC)	 IOR IOR IFI IFI	 30 Days prior to commissioning As Issued As Issued 30 Days prior to commissioning
Weekly Progress Reports	IFI	Thursday of each week
Monthly Progress Reports	IFI	NLT 10th of each month
Equipment Data Books	IFI	At Final Completion
System Turn-over Record Books - O&M Manuals for Facility and for Substation - Includes Operation and Maintenance Manuals List - Contractor Operation and Maintenance Manuals - Supplier Operation and Maintenance Manuals - One hard copy and one electronic copy shall be provided for each item. o MV breakers, relay settings o Equipment testing documentation o MV transformers at inverters o MV components: ▪ Switchgear ▪ MV energy meters o SCADA equipment o Inverters o Combiner boxes o Meteorological station components o Warranty documentation o List of equipment suppliers and subcontractors o AC components not previously mentioned - Any other documents need to comply with the turnover package requirement in the Owner's operations and maintenance (O&M) agreement with the O&M provider.	IFI	At Final Completion
Software licenses and electronic installation files as applicable	IFI	At Final Completion
Passwords set up for any of the software	IFI	At Substantial Completion
Spare Parts and special tools needed to perform the work (Exhibit W)	IOR	At Substantial Completion
Training schedule and course outline	IFI	30 Days prior to scheduled commencement of operator training
Training manual	IFI	30 Days prior to scheduled

		commencement of operator training
Preventative Maintenance Plan	IFI	30 Days prior to Substantial Completion
The following will need to be reported upon each occurrence: • An initial notice of a safety recordable o To be followed up by an RCA (root cause analysis) and report • Any OSHA visit and/or fines • Any reportable safety spills • Any visits by environmental monitors or organizations and especially in the event of a notice of violation • Any take of an environmentally sensitive species to include a root cause analysis • Any security breach including theft/vandalism	IFI	Within 24 hours of occurrence

2.1 Contractor shall develop a comprehensive design package consisting of drawings generated in AutoCAD 2012 or later. Contractor shall submit a complete drawing package which shall include the following:

2.1.1 Cover sheet

2.1.2 Site plan

2.1.3 Grading and drainage plan

2.1.4 Soil erosion and sediment control

2.1.5 Symbols, abbreviations and notes

2.1.6 Foundation plans and details

2.1.7 Structural plans, details and elevations, and calculations

2.1.8 Array layout and corresponding PVsyst shading inputs and outputs with shading diagrams

2.1.9 Single-line electrical diagrams

2.1.10 Three-line electrical diagrams

2.1.11 Electrical schematic diagrams

2.1.12 Point to point power and control wiring, including AC and DC systems, with cable schedules

2.1.13 Power Conversion Skid enclosure drawings, where applicable

2.1.14 Switchgear drawings and schematics, where applicable

2.1.15 Inverter installation plans

2.1.16 Grounding plans

2.1.17 Facility DAS/SCADA system and networking architecture.

2.1.18 Site fencing drawing

2.1.19 Communication Enclosure drawings and submittals, where applicable.

2.1.20 Equipment procurement specifications for major components such as main power transformer(s), MV cable, MV terminations, inverters, MV transformers, combiner boxes, MV and HV switchgear, relays, CTs and PTs, etc.

2.1.21 Grounding calculation and ground grid design in accordance with IEEE Standard 80

2.1.22 Protective device coordination study and short circuit analysis that begins at the POI and ends at the AC output of the inverters

2.1.23 Underground cable and conduit installation drawings

2.1.24 Arc Flash study in accordance with NFPA 70E.

2.1.25 Load flow and voltage drop calculations.

2.1.26 Conductor ampacity calculations.

2.2 The thirty percent (30%) design package shall consist of, at a minimum, the following design documents:

2.2.1 Array Layout with Major Equipment Locations

2.2.2 Conceptual Site Plan Layout

2.2.3 Conceptual Distribution Feeder Layout

2.2.4 AC Single Line(s)

2.2.5 DC Single Line(s)

2.2.6 Grounding Plan

2.2.7 Conceptual Inverter Pad Layout

2.2.8 Switchgear drawings and schematics, where applicable.

2.2.9 Communication Enclosure drawings and submittals, where applicable.

2.2.10 Conceptual Grading and Drainage Plan

2.2.11 Conceptual Stormwater Pollution Prevention Plan

2.2.12 Instrumentation and Control Block Diagram

2.2.13 Monitored Points List

2.2.14 Site Logistics Plan

2.2.15 Equipment Specification List

2.2.16 Purchase Specifications for:

a) MV (Inverter) Transformer

b) Inverter

c) Medium Voltage Cable

d) SCADA and Networking Equipment

e) Underground Distribution Cable

f) DC Combiner Boxes

g) MV switchgear

2.2.17 Control System Narratives / Logic Diagrams

2.2.18 Preliminary Grounding Study and Calculations

2.2.19 Access Road plan, cross sections, and details.

2.2.20 Meteorological Stations

2.2.21 Contractor's Corrosion Study

2.2.22 Contractor's Survey

2.3 The 90% design package shall consist of, at a minimum, the following design documents:

2.3.1 Array Layout w/Major Equipment Locations

2.3.2 Site Plan Layout

2.3.3 Underground Distribution Feeder Design

2.3.4 AC Single-line Drawing(s)

2.3.5 AC Three-line Drawing(s) will be provided for the collector system where metering or ground-fault protection may be present, such as at the Switchgear.

2.3.6 DC Single–line Drawing(s)

2.3.7 Grounding Plan

2.3.8 Inverter Pad Layout and Details

2.3.9 Switchgear drawings and schematics, where applicable.

2.3.10 Communication Enclosure drawings and submittals, where applicable.

2.3.11 Grading and Drainage Plan

2.3.12 Storm Water Pollution Prevention Plan

2.3.13 Instrumentation and Control Block Diagram

2.3.14 Monitored Points List

2.3.15 Site Logistics Plan

2.3.16 Equipment Specification List

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a) Inverter Transformer

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2.3.18 Control System Narratives / Logic Diagrams

2.3.19 Performance Test Procedures

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2.3.23 Meteorological Stations

2.3.24 Site Fencing Drawing

2.3.25 Inverter Shelter Drawings (if applicable)

2.3.26 IEEE 80 Study

2.3.27 Load Flow and Voltage Drop Calculations

2.3.28 Equivalent Circuit Diagram and Values

2.3.29 Equipment List

3.0 MISCELLANEOUS

3.1 **Outage Plan**: Contractor shall prepare an outage plan for all scheduled interruptions of electrical power or other utilities-interference that would affect the Owner or third parties. This plan shall be submitted by Contractor to Owner and the affected parties at least thirty (30) Days prior to outage.

EXHIBIT DD

OWNER'S BEST MANAGEMENT PRACTICES PLAN

See attached.

Best Management Practices (BMPs) for Controlling Erosion, Sediment, and Pollutant Runoff from Construction Sites

Planning and Technical Specifications Manual for Stormwater Pollution Prevention Plans

UK
UNIVERSITY OF KENTUCKY
Kentucky Transportation Center

Kentucky Erosion Prevention and Sediment Control

Best Management Practices (BMPs) for Controlling Erosion, Sediment, and Pollutant Runoff from Construction Sites

Revised October 2009

This publication was first developed in 2004 with guidance and assistance from the Technical Review Committee listed on page 249 which also gives background information. The publication has been revised to reflect recent changes in US EPA and Kentucky stormwater regulations.

Funding to revise and publish the manual has been provided by the Compliance Assistance Project, a joint effort of the University of Kentucky and the Kentucky Department for Environmental Protection.

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Contents

Appendices

1. Introduction

This Planning and Technical Specifications Manual contains information on Best Management Practices (BMPs) for preventing, reducing, and controlling erosion, sediment, and pollutant runoff from construction sites and other cleared, excavated, or filled areas. The manual was developed to help engineers, landscape architects, developers, construction managers, and others plan and implement measures that reduce harmful water quality impacts from construction projects and other land-clearing activities. The manual begins by explaining potential water quality impacts from construction and development, then summarizes applicable federal, state, and local regulations. The next sections explain basic principles for selecting, designing, and implementing construction site BMPs and provide detailed information on the most commonly used BMPs.

The information in this manual can be used to select, install, and maintain BMPs on construction sites and to develop Stormwater Pollution Prevention Plans (SWPPPs) to manage runoff from those sites. SWPPPs are required in Kentucky and other states for all construction projects that expose one acre or more of bare soil. This includes stripping or clearing vegetation, excavation, or placement of fill dirt.

Best Management Practices (BMPs) are planning/operational approaches, structural installations, and other field practices for reducing erosion, sediment loss, and polluted runoff from construction sites or other areas.

The manual is consistent with other Kentucky state and local guides that contain information on controlling polluted runoff from construction sites (see **www.water.ky.gov/permitting/wastewaterpermitting/KPDES/storm/**). Some state agency and local government guides contain additional information that might be helpful in complying with contract terms, local ordinances, regulations, or other requirements. For example, the Kentucky Transportation Cabinet (KYTC) *Specifications for Road and Bridge Construction* should be consulted by those working on state highway projects. Sections 212, 213, and 214 address erosion control, water pollution control, and geotextile construction, respectively (see **www.kytc.state.ky.us/construction/spec/2004/2004_Division200.pdf**). KYTC stormwater management and other water pollution control resources can be found at **www.kytc.state.ky.us/EnvAnalysis/Stormwaterquality/Default.htm**. Projects in Jefferson County should comply with the Louisville-Jefferson County Metropolitan Sewer District *Standard Drawings, Design Manual, and Specifications*, posted at **www.msdlouky.org/insidemsd/standard-drawings.htm**. Kentucky cities that are subject to U.S. Environmental Protection Agency (EPA) Stormwater Phase II requirements for urbanized areas operating municipal separate storm sewer systems (MS4s) can use the information in this manual, which is consistent with the *Kentucky Stormwater Consortium BMP Manual* posted at **www.bgky.org/publicworks/planningdesign/bmpindex.htm.** Timber harvest personnel should consult the *KY Forest Practice Guidelines for Water Quality Management*, the complete handbook of the Best Management Practices required under the Forest Conservation Act. The guidelines are posted at **www.ca.uky.edu/agc/PUBS/for/for67/intro.pdf**.

1.1 Purpose of the Manual

The purpose of this manual is to describe:

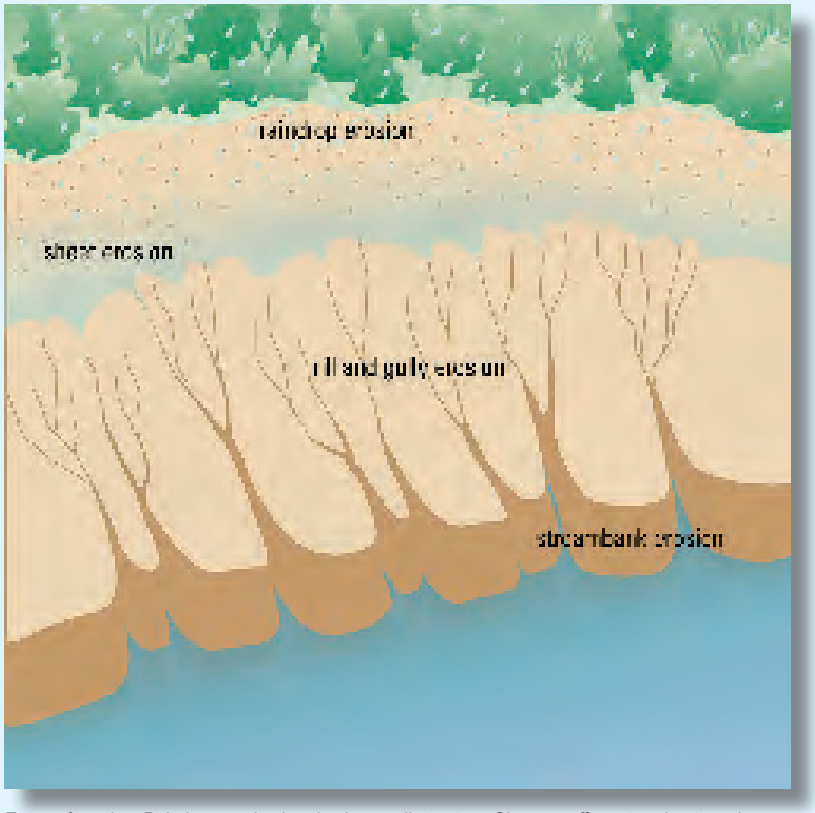
- Potential water quality impacts of construction and development activities
- Procedures for planning, designing, installing, and maintaining BMPs that control pollutants from construction activities and development sites
- Federal, state, and local regulations that apply to construction site runoff
- Technical information on specific BMPs

1.2 Water Quality Impacts During Construction

Clearing, grading, excavation, and placement of fill material expose soil to the weather. Sediment particles are then easily picked up by wind or water and washed away through erosion. When stormwater flows over an active construction site, it picks up other pollutants as well. As runoff velocities increase, the ability of water to dislodge and move larger soil particles and rock increases exponentially. High volumes of runoff water leaving a site can also cause stream bank erosion and destroy downstream aquatic habitat. In addition to the environmental impact, uncontrolled erosion can have a significant financial impact on a construction project.

Stormwater Pollution Prevention Plans (SWPPPs) are written descriptions of construction sites, their soil and drainage characteristics, and how site operators will control erosion, sediment, and pollutant runoff through planning/operational approaches (e.g., prompt seeding and mulching) and structural field installations (e.g., silt fencing, ditch liners, sediment traps). SWPPPs and KPDES permits are required for all construction sites with one acre or more of exposed soil.

Sediment runoff from construction sites is a pollutant of concern in Kentucky causing widespread siltation of stream benthic habitat, increasing overall water column turbidity, and adding to sediment bed loads. According to the *2008 Kentucky Report to Congress on Water Quality and Sedimentation*, siltation is the leading cause of impairment to rivers and streams in the state. Suspended solids, also attributable in part to construction site runoff, are among the leading causes of lake impairments, according to the report. Nutrient loading, which can be caused or worsened by construction site runoff, is the third leading cause of river, stream, and lake impairment.



Types of erosion. Raindrop erosion breaks down soil structure. Slope runoff creates sheet erosion, which can lead to the formation of small rill channels and larger gullies. Erosion of unprotected stream banks can be caused by removing vegetation and higher flows caused by runoff from pavement, sidewalks, and roofs in newly developed areas.

Leading Causes of Pollution in Kentucky Streams and Rivers

Cause	Miles Affected
Sedimentation/Siltation	3,003.67
Fecal coliform + *E. coli* (pathogen indicators)	2,955.75
Nutrient/eutrophication biological indicators	1,525.20
Habitat Assessment (streams)	999.07
Cause unknown	730.35
Organic enrichment (sewage) biological indicators	721.75
Total dissolved solids	704.62
Physical substrate habitat alterations	478.40

Source: Kentucky Division of Water, 305(b) Report

Leading Causes of Pollution in Kentucky Lakes

Cause	Acreage Affected
Methylmercury	78,313
Mercury in Fish Tissue	14,142
Nutrient/Eutrophication Biological Indicators	9,724
pH	8,489
Oxygen, Dissolved	8,388
PCB in Fish Tissue	8,210
Dissolved Gas Supersaturation	3,864
Total Suspended Solids (TSS)	3,040
Sedimentation/Siltation	2,417

Source: Kentucky Division of Water, 305(b) Report

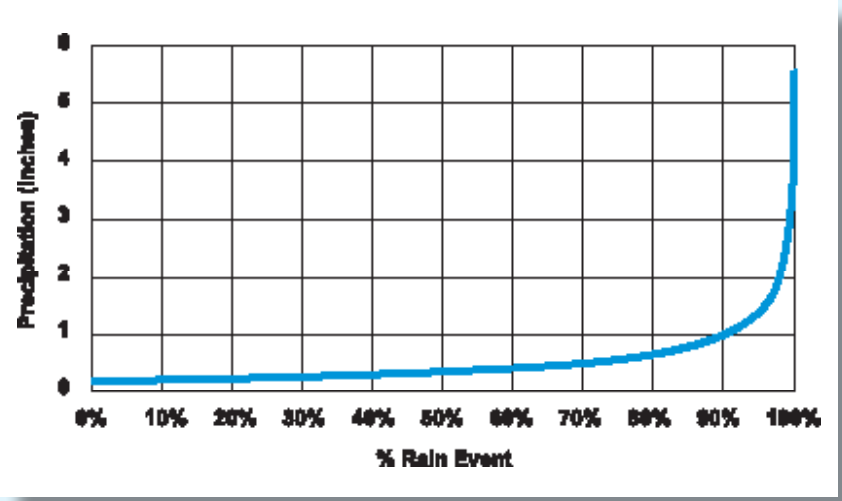
The sources of siltation, suspended solids, and nutrient loads are many, and it is not clear what portion of the problem can be directly attributable to sediment and erosion from construction sites. Sources of siltation, suspended solids, and nutrients vary significantly across the Commonwealth because of land use variability and other factors, but it is generally recognized that new development and construction sites contribute to siltation and nutrient enrichment of surface waters.

It costs money and takes time to repair gullies, replace vegetation, clean sediment-clogged storm drains, replace poorly installed BMPs, and mitigate damage to downstream property or to natural resources. **Preventing soil erosion, sedimentation, and runoff of other pollutants like concrete wastes, paint wash water, trash, and so on, is an important responsibility at all construction sites.** Sediment is most frequently associated with stormwater runoff from construction sites. Other pollutants of concern, such as nutrients; metals; pesticides; oil; grease and fuel; toxic chemicals; and general solid waste such as litter originate from common construction activities and can be discharged during rain events.

1.3 Construction Site Pollutants of Concern

A variety of substances and materials found on construction sites can become pollutants of concern if they are washed into nearby water bodies, dumped onto porous soils, or discharged directly to surface waters or groundwater. The following subsections summarize these potential pollutants.

Sediment—According to the *2008 Kentucky Report to Congress on Water Quality*, siltation is the leading cause of impairment to rivers and streams in the state. Suspended solids, also attributable in part to construction site runoff, are a leading cause of lake impairments, according to the same report.



Rainfall frequency distribution for a typical eastern U.S. city. Runoff controls that target small and medium-sized storms—up to 1.5 inches over a 24 hour period—can make a big impact, because most storms fall within this range.

Research over the past three decades has found that erosion rates from construction sites are **an order of magnitude greater** than those measured on row crop lands and several orders of magnitude larger than erosion rates on well-vegetated lands. Soil loss from new development can range from 20–150 tons per acre per year; the national average for soil erosion from crop lands is about 8 tons per acre per year. Sedimentation of streams and rivers from road construction can reduce aquatic insect and fish communities by up to 85 and 40 percent respectively, according to a 1997 study. Other research has found construction-related sediment impacts on small creeks extending as far as 4.8–5.6 kilometers downstream of active construction sites. Siltation is the second leading cause of impaired water quality in rivers and lakes nationally.

Nutrients—Two primary nutrients, phosphorus and nitrogen, are generated by a number of activities on construction sites, such as the application of fertilizer. Sediment, other construction chemicals, and wastes might contain nutrients as well. Discharge of excess nutrients into waterways can result in accelerated growth of vegetation or algae. The decomposition of this vegetation by aerobic bacteria can deplete the oxygen dissolved in the water and cause fish kills. Nutrient loading is the sixth leading cause of river and stream impairment in Kentucky and the third leading cause of lake impairment.

Metals—Metals can become mixed with construction site runoff in a number of ways. They can be washed from surfaces such as treated lumber, paint, or metal materials. Metals also are associated with the operation and maintenance of cars, truck, and other equipment used on construction sites. Concrete mixer truck wash water contains elevated concentrations of hexavalent chromium. Metal molecules commonly attach to sediment particles and are washed away through erosion, which occurs during construction. Heavy metals are toxic to aquatic organisms, can accumulate in fish tissue, and have the potential to contaminate drinking water supplies.

Pesticides—Herbicides, insecticides, and rodenticides are commonly used on construction sites. If pesticides are applied improperly or in excess, they can contaminate waterways, kill aquatic organisms and vegetation, and contaminate drinking water. Pesticides can enter waterways through direct contact (improper application or spills), by drifting in the air and settling in water, or through the erosion of soil particles that have come in contact with the chemical.

Oil, grease, and fuels—Various types of equipment that require maintenance and fuel are used on construction projects. Leaks, spills, and dumping are primary sources of these contaminants on construction sites. Asphalt can be a source of oil in runoff as well. Just one quart of oil can produce a 2-acre oil slick on a pond, lake, or river. One gallon of oil can make one million gallons of water too contaminated to drink, and 35 parts per million of oil will kill fish. Other hydrocarbons generally associated with petroleum products (e.g., gasoline, kerosene, asphalt) can be toxic and might be carcinogenic.

Toxics—The construction of buildings and roads requires the use, storage, and disposal of toxic or hazardous materials such as sealants, concrete, cleaners, adhesives, and solvents. Improper storage and handling of these materials can cause spills and leaks, which can be washed into neighboring waterways during heavy rains. Many of these items contain metals or other toxics that might be harmful to fish and humans.

Solid Waste—A large amount of solid waste is generated at construction sites including concrete waste, mulch, wood material, paper waste, and miscellaneous litter caused by workers. This waste can contribute various pollutants of concern when in contact with runoff water, or the debris can be washed into waterways becoming pollution itself. Solid waste from construction projects can clog waterways or become floating pollution, resulting in aesthetic impacts, public complaints, fines, and other regulatory action.

1.4 Water Quality Impacts after Construction

Unfortunately, the potential for water quality impacts from polluted or accelerated precipitation runoff does not end when construction ends. Increased impervious area (i.e. driveways, parking lots, rooftops) can dramatically alter how runoff flows and how fast it flows over the land. When water can no longer filter into the ground, it must go overland into the nearest storm drain, ditch, or stream. As it flows, the water picks up pollutants and heat from parking lots, lawns, rooftops, or other surfaces. Many of the same pollutants present during construction can also be potential pollutants of concern after construction. Nutrients and pesticides can be used on lawns or landscaping, and metals, oil, grease, and other toxic materials can drip and settle onto parking lots and driveways. Litter or other debris might also be present, depending upon the type of development. All these materials can be picked up by storm runoff and washed into nearby waterways, becoming nonpoint source pollution after construction is complete.

Increased imperviousness also can cause a greater volume of water to leave a site at higher velocities than before development. This runoff can cause damaging erosion on the site and farther downstream, carrying high loads of sediment to receiving water bodies. The water also can scour streambanks, causing damage to property and aquatic habitat. Increased volume and speed of runoff water also can increase the likelihood of flooding on adjacent and downstream properties.

1.5 General Approach to Stormwater Management

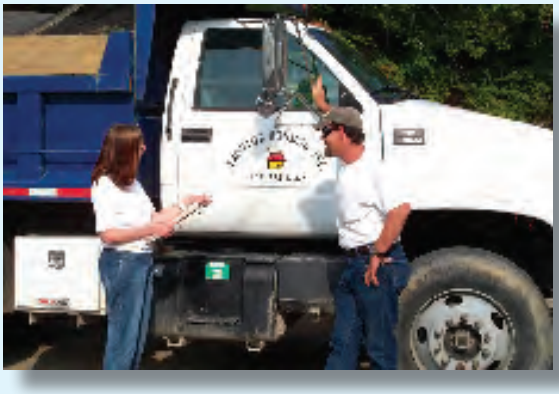
Stormwater Pollution Prevention Plans (SWPPPs) can provide guidance for field activities, but even the best plans cannot compensate for field personnel who don't know the basics of controlling stormwater. SWPPPs and field activities to control erosion, sedimentation, and other runoff pollutants should focus on the following common sense principles:

- ***Fit the project to the site*** by retaining the existing drainage system (if it is stable), minimizing clearing and grading, and maximizing infiltration of precipitation.
- ***Minimize the amount of bare soil exposed*** and the duration of exposure by phasing the project, limiting clearing and grading to what can be handled during a three week period, and seeding or mulching promptly.
- ***Before clearing and grading begins***, install silt fences, sediment traps/basins, upland clear water diversions, and other BMPs. Get to final grade quickly, then seed or mulch.
- ***Maintain BMPs*** until the grass is up and the ditches are stable. Deal with ruts and washouts promptly. Keep potential pollutants out of the weather and clean up spills promptly.

2. Regulatory Considerations

This manual focuses on BMPs for all construction sites, no matter how large or small. However, it should be noted that construction sites with a disturbed area (i.e., bare soil exposure) of one acre or more are subject to state and federal stormwater regulations. Local regulations may also affect projects that are much smaller than an acre. The following sections summarize some of these statutory and regulatory provisions.

2.1 KPDES Stormwater Permitting



Stormwater pollution prevention (BMP) plans and KPDES permit coverage are required for all construction sites once acre or larger under 2003 regulations. Plans must be kept on-site and available for inspections.

Public agencies at the federal, state, and local levels have implemented rules to deal with impacts from the polluted construction site runoff issues summarized in the preceding section. These rules depend heavily on proper construction planning, knowledgeable field personnel, and common sense implementation of polluted runoff controls (i.e., BMPs).

EPA regulations at Title 40 of the *Code of Federal Regulations* (CFR) 122.26(b)(14)(x) and 122.26(b)(15) require National Pollution Discharge Elimination System (NPDES) permit coverage for stormwater discharges from construction activities that disturb one or more acres. These regulations are implemented by general NPDES permits issued by EPA and authorized, in Kentucky, by the Kentucky Division of Water. The Kentucky Pollution Discharge Elimination System (KPDES) Construction General Permit meets all federal permit requirements.

KPDES permits are required for all construction sites that disturb one or more acres. The KPDES Construction General Permit (KYR10) does not cover sites that drain into sediment-impaired waters with approved Total Maximum Daily Loads, waters designated as cold-water aquatic habitat, exceptional waters, outstanding state resource waters, sites with individual KPDES permits, or sites requiring additional stormwater controls due to antidegradation considerations. Individual KPDES permits are required for sites that do not qualify for General Permit coverage. An online KPDES Permit application is available at www.water.ky.gov/permitting/wastewaterpermitting/KPDES/residences.

The KPDES Permit covers all stormwater discharges associated with construction activity that disturbs one acre or more. This "one acre rule" includes all lots—even those smaller than an acre—in subdivisions or developments that will have more one acre or more of total disturbance, and long narrow projects such as buried pipelines/conduits/sewer lines if the construction width multiplied by the length would equal or exceed one acre. The area of disturbance is defined as only that portion of the site where ground cover or topsoil is removed. The definition of construction site applies equally to rural, suburban or urban areas but does not include tilled agricultural fields. The main goal of the KPDES permit program is to keep sediment and other pollutants out of lakes, rivers, streams, and wetlands. KDOW can require an individual permit if it would better address the discharges from the site.

Basically, the KPDES construction general permit requires operators of construction projects in Kentucky disturbing one acre or more to

- Develop a SWPPP and submit an online or paper-form Notice of Intent (NOI) to Kentucky Division of Water and receive KDOW approval to proceed before land disturbing activity begins.

- Submit a copy of the NOI to the operator of any MS4 into which the site discharges before land disturbing activity begins.
- Implement and continuously update the written Stormwater Pollution Prevention Plan.
- Inspect and document the condition of runoff controls every 7 days, or every 14 days and within 24 hours after each rain of 0.5 inch or more.
- Submit a signed Notice of Termination (NOT) form to Kentucky Division of Water after the site has been finally stabilized.

The construction site operator must apply for the KPDES permit on sites with a disturbed area of one acre or more. In general, the "operator" is the person who has operational control over plans and specifications, or day-to-day control over site activities. The operator is usually the general contractor, developer, or site owner.

The SWPPP must be developed in accordance with good practices, and must identify expected sources of pollution and describe how they will be controlled. The SWPPP is completed before construction begins, signed, and kept on-site (note: this can be in a vehicle if there is no office or other suitable location at the site). SWPPPs required by KPDES permits are considered reports that must be made available to the public, upon written request, in accordance with section 308(b) of the Clean Water Act. Deficient plans might require modification upon notification by the Kentucky Division of Water or local regulatory authority. Additional information on construction site SWPPPs can be found in section 3.

2.2. Local Erosion Prevention and Sediment Control Programs

Cities in Kentucky that have a population of 10,000 or more and those that have polluted runoff problems associated with construction and other urban pollutants are subject to additional stormwater permitting requirements overseen by state water agencies and EPA. This stormwater permit program requires these cities to have ordinances and programs to **control construction site runoff and post-construction runoff impacts**, such as increased stormwater velocity, elevated temperatures, oil and grease contamination, trash, and so on.

Construction site operators (e.g., general contractors, developers, site owners) are responsible for understanding and complying with local ordinances as well as the state KPDES permit program. Most local and state requirements are very similar, but there are some significant differences in Jefferson, Fayette, and northern Kentucky counties. Check with each local government before construction to determine what local regulations and requirements might apply. Below is a summary of local regulations and requirements in addition to those required by the state KPDES permit.

Louisville-Jefferson County Metropolitan Sewer District (MSD)

The Jefferson County Erosion Prevention and Sediment Control Ordinance applies to all land disturbing activities in Jefferson County that are in excess of 5,000 square feet or that require a building permit. All erosion protection and sediment control (EPSC) measures must be designed and installed to accomplish an 80 percent design removal efficiency goal for total suspended solids, using a 10-year, 24-hour storm event design. The MSD Design Manual, Standard Drawings, and Standard Specifications (Chapter 12) contains approved structural and non-structural BMPs for use in achieving this standard.

Structural BMPs include sediment trapping devices, inlet protection measures, perimeter controls and construction entrances. Non-structural methods include phasing a project into manageable pieces, scheduling activities within each phase to minimize amount of disturbed area and provisions for temporary and final stabilization.

The permittee or designee is required to conduct inspections of all EPSC measures and perform any modifications, maintenance or repairs as necessary, every 7 calendar days and within 24 hours of each storm event that produces 0.5 inch or more of precipitation. Records of these inspections must be kept on-site at all times for review by the appropriate compliance enforcement agency. Records must be kept on the Self-Inspection Form with approved construction drawings. MSD has a network of rain gauges that can be queried to determine the amount of rain recorded for a section of the county. MSD will conduct compliance inspections of land disturbing activities and may refer potential violations to MSD for follow-up and enforcement action. For more information and to access the *MSD Design Manual*: **www.msdlouky.org/insidemsd/epsc.htm**.

Lexington-Fayette Urban County Government (LFUCG)

An erosion and sediment control plan is required for all construction with land disturbing activity of one acre or greater (per the KPDES general permit). The plan must be approved before obtaining a grading permit from LFUCG. In addition, land disturbance on a single residential lot, regardless of size, must comply with erosion and sediment control requirements. Home builders who fail to install the erosion and sediment controls will be issued a notice of violation. The plan must be developed and signed by a professional engineer or landscape architect licensed in Kentucky. All hydrologic, hydraulic, structural, and geotechnical design work included in the plan must be done and signed by a professional engineer licensed in Kentucky. Plans must integrate nonstructural and structural practices and procedures to control erosion and sediment loss. Once the erosion and sediment control practices have been constructed, a grading permit can be obtained. The erosion control permit remains in effect throughout the construction project, including the homebuilding phase of construction for residential subdivisions. Land disturbances for the construction of a structure on a single residential lot are permitted through the building permit process and must comply with LFUCG requirements.

A home builder in the Lexington-Fayette urban area is required to install the erosion and sediment controls listed below to minimize the sediment washing into streets, inlets, stormwater pipes, open channels, and adjacent lots:

- Silt fence
- Construction entrance
- Seed, sod, and mulch
- Disposal of trash
- Curb inlet protection
- Surface inlet protection
- Inspection of sediment controls
- Street cleaning
- Drainage system alterations prohibited
- Snow fence

An operation and maintenance plan must be developed that provides a schedule for inspection, maintenance and repair of BMPs during construction activities. A maintenance schedule must also be provided to ensure that permanent measures such as vegetation are properly established after construction is complete. All erosion and sediment controls that are identified in the erosion and sediment control plan (ESCP) must be inspected and maintained. Any erosion and sediment control devices that are damaged must be repaired or replaced immediately. For more information, see the LFUCG Stormwater Manual at **www.lexingtonky.gov/index.aspx?page=780**.

Sanitation District # 1 (SD1)

Sanitation District # 1 serves 33 communities in Boone, Campbell, and Kenton Counties of northern Kentucky. SD1 has established a permitting system to control stormwater runoff from construction sites and post-construction stormwater management for new developments and redevelopments. The permits are required for construction activity of one acre or larger in Boone, Campbell, and Kenton Counties and the municipalities in those counties covered by the KPDES Small MS4 Stormwater Permit (with the exception of the city of Florence). The land disturbing activity, development activity, or redevelopment activity cannot commence until the District has issued a clearing, grading, or land disturbance permit.

The land disturbance permit is required for (1) any alteration of the earth's surface where natural or man-made ground cover is altered and for which the applicant has not received a clearing or grading

permit and/or (2) the installation of any storm sewer systems (including storm sewer structures and pipes, detention ponds, and so on). The land disturbance permit must also include activities covered by a clearing or grading permit if the applicant did not obtain a separate clearing or grading permit.

The grading permit is required for grading activities on a property. Grading activities include excavation, filling, stockpiling, or other earth moving activities, and any combination thereof. The grading permit may include the construction of sanitary sewers and other utility infrastructure (e.g., water, gas, electric). The installation of storm sewer systems (including storm sewer structures and pipes, detention ponds, and so on) require a land disturbance permit and will not be approved as part of a grading permit. A grading permit is not required if the property owner/applicant receives a land disturbance permit for the property covering the same activity.

The clearing permit is required for clearing activities on a property. Clearing activities include stripping and cutting of trees and ground cover and the removal of roots and associated material. The clearing permit does not include any earth moving activities, including rough shaping of the site. A clearing permit is not required if the property owner/applicant receives a grading or land disturbance permit for the property covering the same activity. Application forms and checklists can be found in the *Northern Kentucky Regional Stormwater Management Program Rules and Regulations* posted at **www.sd1.org**.

2.3 Utility Construction Requirements

In general, utility construction crews and other subcontractors are responsible for their own erosion and sediment controls. General contractors should make sure that all utilities and subcontractors use rock pad construction entrances or other measures to prevent movement of soil onto public roadways. **Tracking mud out onto paved roads can lead to legal liabilities.** If crews disturb areas that have already been stabilized, they should replace any mulch, sod, seed, blanket, matting, rock, silt fencing, or other material disturbed. Failure to properly grade, seed, and stabilize work sites can violate permit requirements. If your project is larger than one acre and covered under a KPDES Stormwater Permit, it is recommended that subcontractors and others conducting excavation or fill activities sign an agreement stating that they will comply with the SWPPP. If utility projects cross or are conducted in or near streams, Clean Water Act section 404 permit coverage may be required (See Section 2.5).

2.4 Kentucky Transportation Cabinet (KYTC) Requirements

The KYTC inspection performance standard for erosion and sediment control is that no sediment should leave the site. **All KYTC projects are subject to KPDES Stormwater Permit requirements.** KYTC requires that slopes 4:1 or steeper with upland runoff areas exceeding 100 feet and all channels be lined with erosion control blankets. KYTC requires disturbed drainage areas (DDAs) to be identified in construction plans and managed to ensure that no adverse runoff impacts occur. If transportation projects are conducted in or near streams, Clean Water Act section 404 permit coverage may be required (see Section 2.5). KYTC standards also limit the total amount of disturbed area to 750,000 square feet (about 17.2 acres). Written approval from the district engineer is required for exceeding this limit. Bridge construction or repair and other work near streams require substantial erosion and sediment control efforts. KYTC projects are required to establish final grade quickly on as much of the site as possible, then stabilize with seed, mulch, blankets, or matting. Bare soil areas at temporary grade must be seeded and mulched after 14 days if they will not be worked during the following week (i.e., stabilization required after 21 consecutive days).

The KYTC Division of Design prepares the initial SWPPP for highway construction projects as part of the construction specifications. The final plan is completed with input from the resident engineer and contractor. KYTC also files the NOI for KPDES permit coverage. Contractors and subcontractors are required to review, amend, and sign the SWPPP and overall erosion and sediment control measures. Erosion control and water pollution control BMPs to be used on KYTC projects are outlined in the *KYTC Specifications Manual* in sections 212 and 213. The manual can be accessed at: **http://transportation.ky.gov/construction**.

2.5 Clean Water Act Sections 401 and 404 Requirements

Federal and state agencies both have additional requirements for projects that impact regulated water bodies, which can range from a large river or lake to a small channel that flows only for a few days after a rain. Any clearing, grading, excavation, or placement of fill material on or near the banks or channel will likely involve added measures to reduce water quality impacts, as summarized below.

Section 404 permits for work in regulated waters

Section 404 of the Clean Water Act regulates the discharges of dredged or fill materials into the waters of the United States, including small streams and wetlands adjacent or connected to regulated waters. These discharges include return water from dredged material disposed of on the upland and generally any fill material (e.g., rock, sand, dirt) used to construct land for site development, roadways, erosion protection, and so on. Basically, if equipment will be operating in or through a creek, wetland, or river, permit coverage is required.

The U.S. Army Corps of Engineers (USACE) administers the permit program dealing with these activities, in cooperation with EPA and in consultation with the U.S. Forest Service and the National Marine Fisheries Service. Individual permits are issued for activities with significant impacts, and nationwide or regional general permits are issued for activities with impacts not deemed to be significant.

For minor activities covered under section 404 nationwide permits (e.g., road culvert installation, utility line activities, bank stabilization), permit requirements are typically deemed to be met if activities result in only short-term, limited effects and if all appropriate and reasonable measures related to erosion and sediment control, project seeding and stabilization, and prevention of water quality degradation (e.g., working during low-flow conditions) are applied and maintained. A general condition of the 2002 nationwide permit is that, “appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high-water mark or high line, must be permanently stabilized at the earliest practicable date.”

Contact information for USACE District Offices serving Kentucky:

Huntington District
502 8th Street, Huntington, WV 25701-2070
Tel: 304-399-5353
Web site: **www.lrh.usace.army.mil**

Louisville District
PO Box 59, Louisville, KY 40401-0059
Tel: 502-315-6692
Web site: **www.lrl.usace.army.mil**

Memphis District
Clifford Davis Federal Bldg, Room B-202,
Memphis, TN 38103-1894
Tel: 901-544-3471
Web site: **www.mvm.usace.army.mil**

Nashville District
3701 Bell Road, Nashville, TN 37214
Tel: 615-369-7500
Web site: **www.lrn.usace.army.mil**

Overview of Common Nationwide Permits in Kentucky

Nationwide Permit	Activity Covered by the Permit
NWP 3 – Maintenance	Removal of sediment and debris within 200 feet of a structure
NWP 7 – Outfall structures and maintenance	Construction of outfalls and dredging of accumulated sediments
NWP 12 – Utility Line Activities	Activity that fills less than ½ acre of stream or wetland
NWP 13 – Bank Stabilization	Bank stabilization less than 500 feet and less than 1 cubic yard of fill per running foot
NWP 14 – Linear Transportation Facilities	Activity that fills less than ½ acre of stream or wetland
NWP 18 – Minor Discharges	Activity with less than 25 cubic yards of fill (1/10 acre in special aquatic sites)
NWP 19 – Minor Dredging	Activity that dredges less than 25 cubic yards
NWP 21 – Surface Coal Mining	Activities related to mining that have been approved by state and federal agencies
NWP 27 – Auquatic Habitat Restoration	Restoring, establishing, enhancing aquatic habitat
NWP 29 – Residential Development	Activity that fills less than ½ acre of stream or wetland and less than 300 linear feet of stream
NWP 35 – Maintenance Dredging of Existing Basins	Dredging to previously authorized depths
NWP 40 – Agricultural Activities	Activity that fills less than ½ acre of stream or wetland and less than 300 linear feet of stream
NWP 41 – Reshaping Existing Drainage Ditches	Activities that impact less than 500 feet of stream
NWP 42 – Recreational Facilities	Activity that fills less than ½ acre of stream or wetland and less than 300 linear feet of stream
NWP 43 – Stormwater Management Facilities	Activity that fills less than ½ acre of stream or wetland and less than 300 linear feet of stream
NWP 44 – Mining Activities	Activity that fills less than ½ acre of stream or wetland

If the construction is not covered by a nationwide permit, an individual permit must be obtained from the USACE before beginning work. Processing such permits involves evaluation of individual, project specific applications in what can be considered three steps: pre-application consultation (for major projects), formal project review, and decision making. For more information, see Appendix E and **www.usace.army.mil/Pages/default.aspx**.

Section 401 Water Quality Certification

Activities that result in physical disturbances to wetlands or streams are regulated by the USACE under Clean Water Act section 404 and require a Clean Water Act section 401 Water Quality Certification (WQC) issued by the Kentucky Division of Water. WQC helps ensure that activities that could involve a discharge into waters of the state are consistent with Kentucky's water quality standards in Title 401, Chapter 5 of the Kentucky Administrative Regulations. Examples of activities that may require a USACE section 404 permit and KY Division of Water section 401 water quality certification include:

Listing the construction site operator and posting applicable permits makes it easy for inspectors to quickly check whether or not a site is in compliance with various state and federal regulations.

- stream relocations
- road crossings
- stream bank protection
- construction of boat ramps
- placing fill
- grading
- dredging
- ditching
- mechanically clearing a wetland
- building in a wetland
- constructing a dam or dike
- stream diversions

For wetland-related impacts involving greater than one acre of wetland loss, the applicant should follow the Wetland Mitigation Requirements when applying for a WQC. Wetland losses involving less than one acre may be regulated by the USACE. The USACE is responsible for making official, jurisdictional wetland determinations.

For stream-related impacts that involve more than 200 linear feet of stream disturbance, the applicant should submit detailed plan and profile drawings along with the application (see draft Stream Mitigation Guidelines on Web site below). Impacts in streams or lakes designated as Special Use Waters require an individual WQC and special attention must be paid to the sediment and erosion control plan. For more information, go to **www.water.ky.gov/permitting/wqcert/**.

2.6 Kentucky Floodplain Construction Permits

The Kentucky Division of Water Floodplain Management Section has the primary responsibility for the approval or denial of proposed construction and other activities in the 100-year floodplain of all streams in the Commonwealth. Typical activities permitted are dams, bridges, culverts, residential and commercial buildings, placement of fill, stream alterations or relocations, small impoundments, and water and wastewater treatment plants.

Applicants must submit a completed application with a location map, plans of the proposed construction, and the addressing of public notice. If the proposed construction lies in an area where there is no existing floodplain information, hydrologic and hydraulic analysis may need to be performed.

KDOW engineers will perform the analysis when required provided the Applicant supplies them with the floodplain geometry in the form of cross sections, preferably tabulated on an Excel Spreadsheet. This analysis determines the effects the proposed construction has on existing flood conditions and determine the expected 100-year flood heights and the delineation of the floodway (a portion of the natural floodplain that is restricted to little or no construction).

From this analysis, construction limits for fills and buildings and required elevations for finished floors or floodproofing can be provided. For all construction, especially bridges and culverts, a check is made to ensure that the project has only minimal impacts on existing flood levels. For more information, see http://www.water.ky.gov/floodplainmanagement/floodplainconstruction/

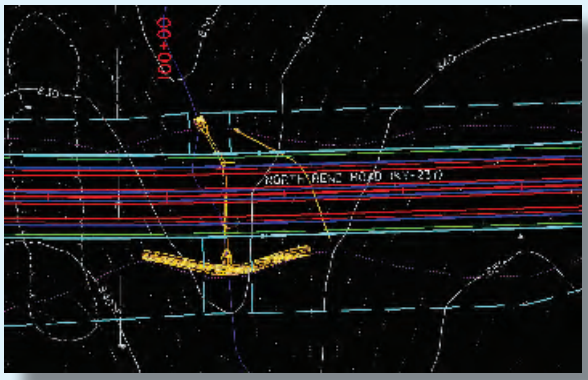
For more information, see **www.water.ky.gov/permitting**.

Case Study: Organizing and Phasing Large Projects—The Kentucky Transportation Cabinet Approach

Large construction projects should be organized via a logical sequence and phased to simplify and reduce management needs for controlling polluted runoff. This approach requires an analysis of the job site to identify work zones, activity sequences, and project phases. The KYTC has developed a procedure for organizing and phasing roadway construction that provides an excellent example of how this approach can be implemented.

Linear construction sites require special attention to drainage within—and into—the construction zone.

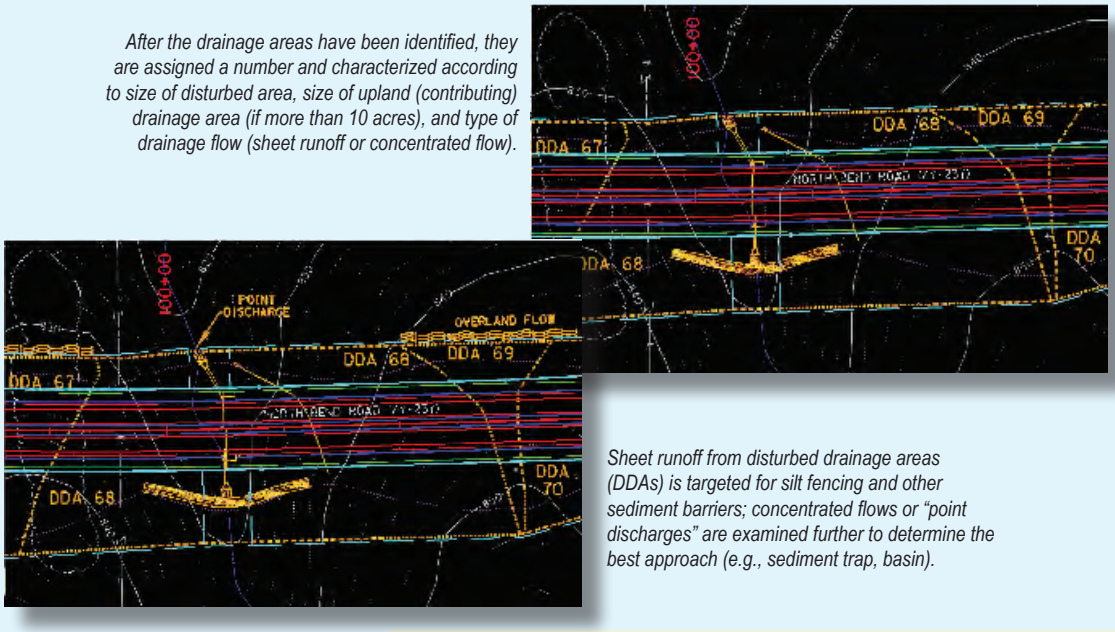
Erosion control plans are developed that show existing conditions overlaid with proposed construction grades and features—roadways, shoulders, and ditches, in this case. Designers are able to identify individual drainage areas along the right-of-way that will potentially be disturbed as construction proceeds. These so-called *disturbed drainage areas* (DDAs) are easily distinguished because they simply outline drainage catchments within the project area. After the DDAs are identified, designers will calculate the disturbed and upland drainage area within each and note whether they drain via sheet flow or concentrated flow. This information provides the basis for selecting appropriate BMPs—rock checks, traps, and basins for concentrated flows, and silt fencing, brush barriers, or other sediment controls for sheet flow.



The first step in developing an erosion and sediment control plan for highway corridors is to identify disturbed drainage areas along the right-of-way by analyzing topography and general drainage patterns.

DDA area (size), flow pattern, and BMP selection are then incorporated into the site SWPPP. Traps and basins are sized to provide 3,600 cubic feet of total storage per disturbed acre. Areas that drain 10 or more acres require additional analysis to determine whether site-level controls can handle the volume of runoff (i.e., 10-year storm) that might pass through the site. This analysis could indicate that clean water diversions, a larger sediment pond, or more sediment traps installed in series are needed.

After the drainage areas have been identified, they are assigned a number and characterized according to size of disturbed area, size of upland (contributing) drainage area (if more than 10 acres), and type of drainage flow (sheet runoff or concentrated flow).



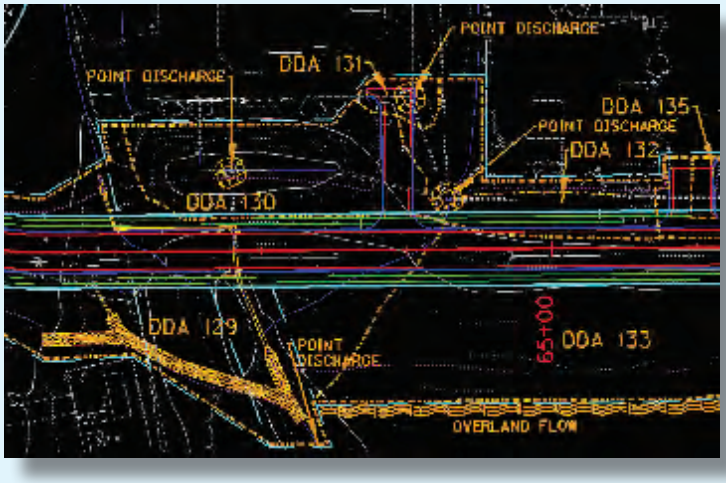
Sheet runoff from disturbed drainage areas (DDAs) is targeted for silt fencing and other sediment barriers; concentrated flows or "point discharges" are examined further to determine the best approach (e.g., sediment trap, basin).

In addition to site-level sediment management, the DDA approach also provides a basis for project phasing. DDAs along the right-of-way are designated for clearing/grubbing according to a logical analysis of how many can be adequately managed at one time. As a group of DDAs is stripped and graded and subjected to BMP controls, the next group is assessed and planned for in project stormwater KPDES permit documents (e.g., the SWPPP). KYTC phasing requirements limit the DDA total to 750,000 sqare feet (~17 acres).

SECTION	DISTURBED AREA (ACRES)	MAXIMUM SEDIMENT VOLUME (CU FT)
DDA 67	2.01	7,236
DDA 68	1.37	4,932
DDA 69	0.14	504
DDA 70	6.72	24,192
DDA 72	0.52	1,872
DDA 73	8.34	30,024

Potential sediment volumes are calculated for DDAs to facilitate sizing of traps and basins.

The final step in the DDA runoff control process is to determine the type of BMPs needed for each DDA, their locations, and any special considerations beyond the standard notes information.



Linear construction projects, like highway corridors, require special consideration of stream crossings and the unique nature of each piece of the site drainage puzzle. The KY TC "designated drainage area" approach offers a logical process for dealing with these challenging sites. (Images courtesy of Burgess and Niple, the Kentucky Transportation Cabinet, and Tetra Tech.)

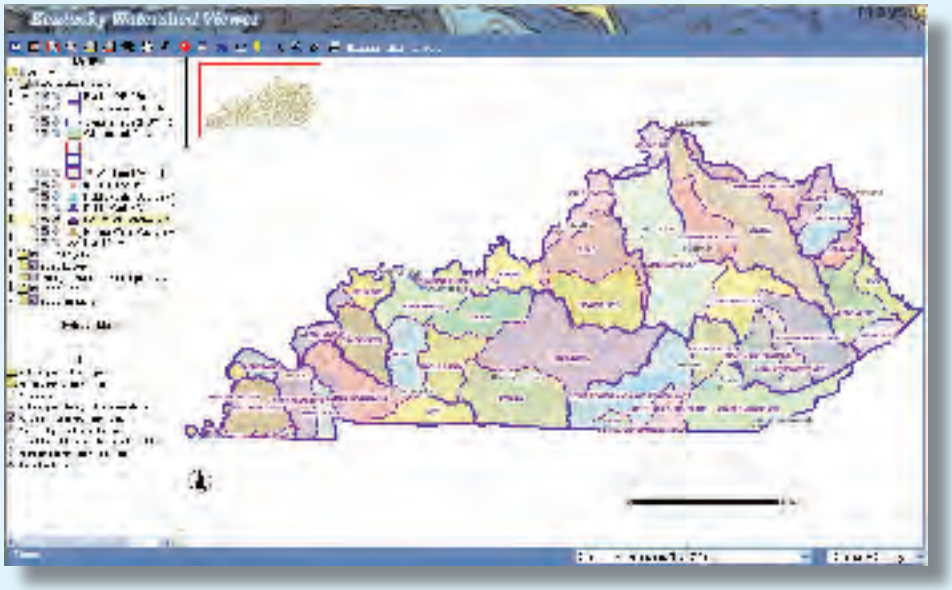
2.7 Integrating Large Projects with Watershed Management Objectives

With proper planning, design, and construction management, large development projects can have a minimal impact on water quality. The Commonwealth of Kentucky supports a wide range of mapping and other tools that provide important project planning data on drainage patterns, water quality, drinking water intakes, treatment facility discharge points, wildlife management areas, mining sites, karst flow zones, and so on. These tools are available through the Watershed Viewer and other tools posted at www.watersheds.ky.gov.

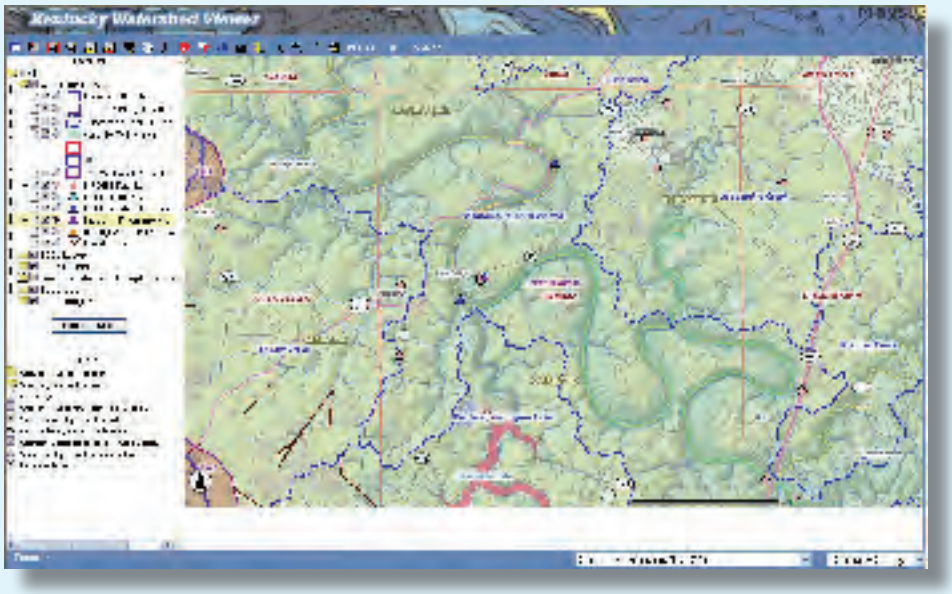
The tools are in the form of interactive global information system (GIS) maps that display a wide range of features. Interactive maps allow users to view GIS or mapped data in their home or office, thus eliminating a trip to an agency to find information. Each interactive map communicates a different theme, for example, Kentucky's Base Map, Oil and Gas Wells, Six-Year Highway Plan, Mined Out Areas, and so forth focus on a certain topic. Interactive mapping sites allow users to integrate local data sources with Internet data sources for display, query, and analysis in an easy-to-use Web browser. Any computer with an Internet connection can access interactive maps about Kentucky, but a high-speed connection is highly recommended

There are many GIS Internet viewers active within Kentucky. They are available for many separate mapping applications and have been developed to allow the staff and the public to view maps and the associated feature attribute data. Although the viewers are very similar, the data presented is different in each instance. Map information is arranged by *layer*. Each layer can be turned on or off and can be selected as the *active* layer. The scale at which each layer becomes visible varies according to its suitability for viewing at a particular scale.

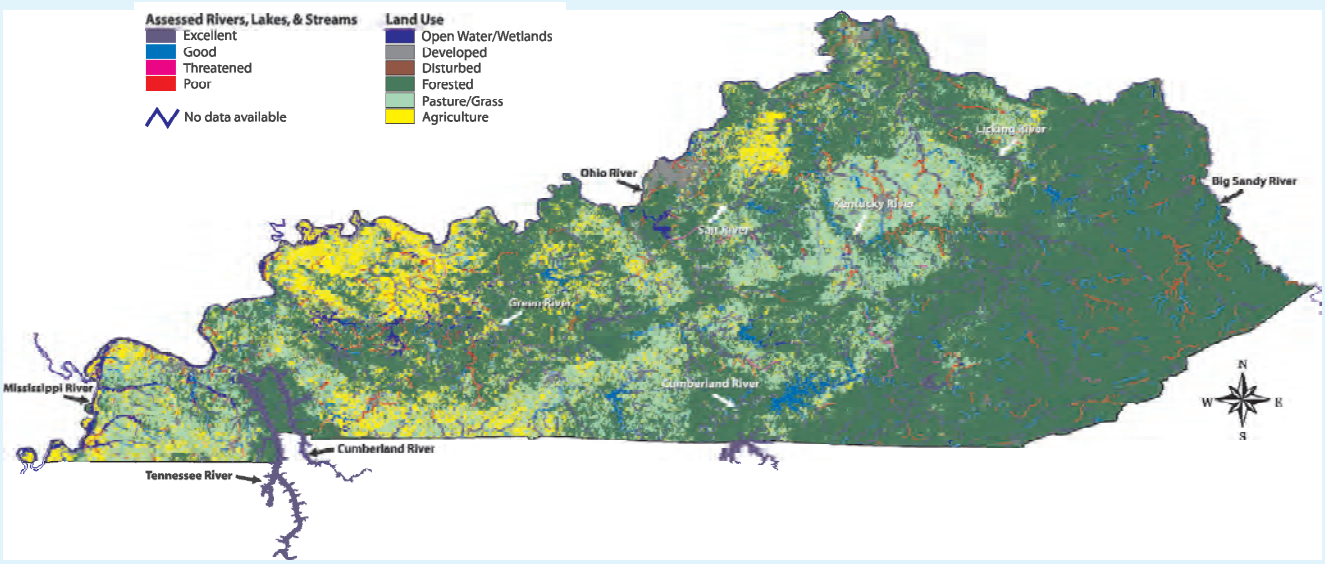
Note that when the user first accesses the site the layer menu is *collapsed*. Also make note of the Help section just below the layer listing. This Help section shows the different layer icons and what they indicate. Simply click on a closed group or folder and it will expand showing the map layers available in that group.



The Kentucky Division of Water, Transportation Cabinet, and other state agencies and university departments support GIS spatial viewers with overlays describing key construction planning inputs (e.g., drainage patterns, stream and river quality, soils, topography). For a full listing of these mapping tools, see the "Watershed Viewer" at ***www.watersheds.ky.gov Click on "305b layers" and zoom in to view impaired waters (i.e., "not supporting")****.*



Zoom and overlay features make the GIS mapping tools a valuable asset in planning large projects. For example, designers wishing to promote on-site infiltration of runoff can consider existing topography, drainage features, and soils.



Every 2 years, the Kentucky Division of Water collects water samples from our streams, rivers, and lakes to determine which water bodies are healthy and which are polluted. This information is required by the Clean Water Act under section 305(b). In 2008, Kentucky reported that water quality in nearly half of all assessed waters was threatened or poor because of polluted runoff. The map above shows the health of Kentucky's streams, rivers, and lakes.

3. Developing a Stormwater Pollution Prevention Plan

SWPPPs describe the site and how it will be managed, list the erosion protection, sediment control, and housekeeping measures; and discuss how and when sediment and other controls will be applied as soils are exposed and site drainage is altered. SWPPPs are required for sites with a disturbed area of one acre or more, but they are a good idea for all projects. The following sequence of activities is common to the development and implementation of SWPPPs for all construction sites in Kentucky.

1 Site Evaluation and Assessment

- Collect site information (soils, slopes, drainage)
- Produce map or drawing of existing site
- Create final project design map or drawing
- Measure the site area and drainage area(s)

2 Selection of Controls (SWPPP Design)

- Review state and local requirements
- Select erosion and sediment controls
- Select controls for other runoff pollutants
- Indicate location of controls on map/drawing
- Identify the sequence of major activities
- Prepare the inspection and maintenance plan
- Identify all contractors and subcontractors

3 Permitting and Notification

- Assemble plan from previous activities
- Submit Notice of Intent (KPDES permit)
- Apply for and obtian local permits (if necessary)
- Distribute SWPPP to contractors and subs
- Prepare to commence construction activities

4 Construction of SWPPP Implementation

- Install basins, traps, drainage, sediment barriers
- Install exit, begin clearing and grading work
- Implement other controls as needed
- Inspect and maintain controls, document actions
- Stabilize disturbed areas within 14 days

5 Final Stabilization and Termination

- Stabilize all bare areas, slopes, and ditches
- Remove all temporary controls and trapped soil
- File Notice of Termination with KPDES
- Notify local government that work is complete

What contributes to erosion?

- Removing vegetation
- Removing topsoil and organic matter
- Reshaping the lay of the land
- Exposing subsoil to precipitation
- Failure to cover bare soil areas
- Allowing gullies to form and grow larger
- Removing vegetation along stream banks

Example site drawings and SWPPPs

For examples of site drawings and SWPPPs, see Appendix A and Appendix B. Plans are needed to comply with KPDES Stormwater Permit requirements.

Kentucky regulations require that existing vegetation must be preserved where possible. All disturbed areas of the site must be stabilized. Stabilization must begin within 14 days on areas of the site where construction activities have permanently or temporarily ceased. Stabilization practices include seeding, mulching, placing sod, planting trees or shrubs, and using geotextile fabrics and other appropriate measures, such as erosion control blankets, turf reinforcement mats, or hydromulching/hydroseeding.

The person responsible for developing the SWPPP **selects and applies relevant structural and nonstructural runoff controls, and organizes/schedules their installation, operation, and maintenance**. This task includes

- Evaluating and assessing the construction site
- Establishing goals for the site, based on local conditions
- Planning for the phases of construction activity
- Identifying erosion and sediment control BMPs
- Selecting good housekeeping or pollution prevention BMPs
- Identifying post-construction stormwater controls
- Describing plans to inspect and maintain BMPs
- Documenting certification, record-keeping, and other requirements.

The Five Ss of erosion and sediment control

***S**oak it in—maximize seeding, mulching, and infiltration*
***S**low it down—don't let gullies form or grow larger*
***S**ift it out—use silt fences or other sediment filters*
***S**pread it around—break up concentrated flows*
***S**ettle it out—use inlet dams and sediment traps/basins*

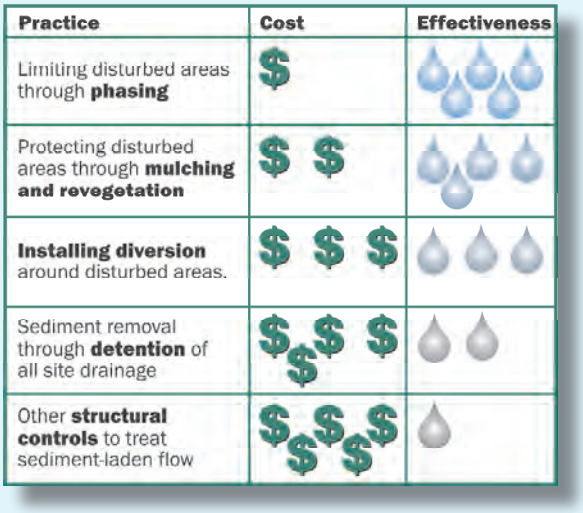
SWPPPs for small sites can be fairly short and simple; those for larger sites are usually more complex because of the greater variety or conditions typically encountered. This section provides a step-by-step review of how to develop a SWPPP. The next three subsections discuss broad considerations related to plan development. Section 3.5 contains an outline for a typical SWPPP that can be used as a template for site planning and BMP selection, scheduling, installation, and maintenance.

3.1 Erosion Prevention and Sediment Control

SWPPPs address two basic types of *muddy runoff* controls that must be used on a construction site to prevent soil (and attached pollutants) from leaving the site: **erosion prevention** and **sediment control**:

- Erosion prevention BMPs are designed to **keep sediment particles in place** at a construction site (e.g., seeding, mulching, erosion blankets or mats, phasing).
- Sediment control BMPs are design to **trap sediment particles** that have become dislodged during rainfall, before the sediment leaves the construction site.

Prioritization of erosion and sediment controls for construction sites

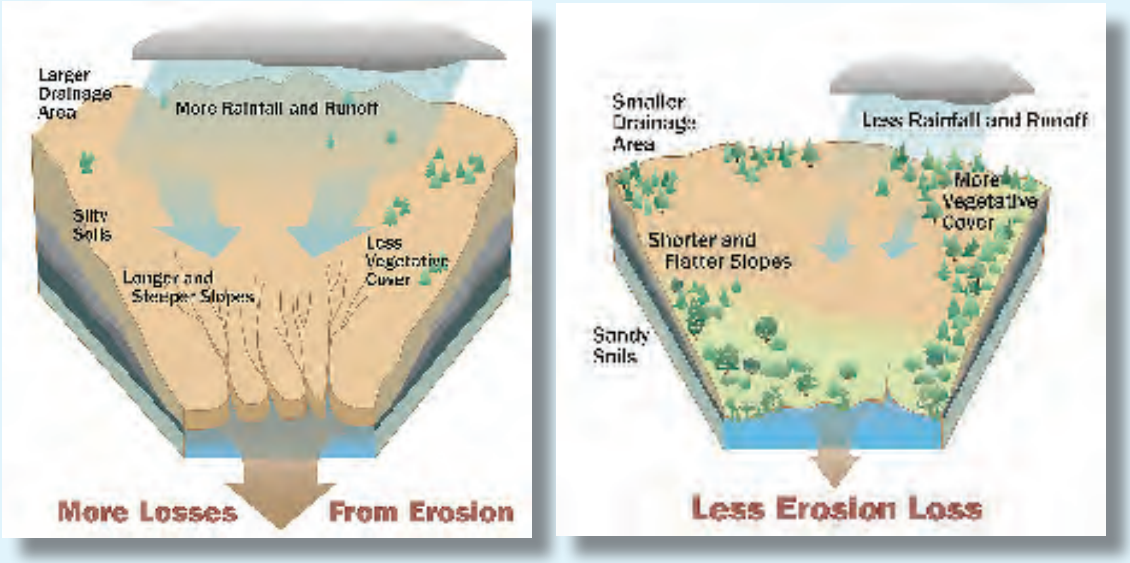


The cheapest erosion and sediment controls are the most effective. For example, limiting the amount of bare soil by phasing your project and preserving existing vegetation are less expensive and work better than installing large stormwater control basins or ponds.

In other words, erosion prevention BMPs try to minimize the movement of soil, and sediment control BMPs remove soil particles in runoff before they leave the site or enter a waterway. Many BMPs can serve both functions if designed and implemented properly (i.e. a grassy swale can filter runoff while directing it away from a denuded area). Erosion prevention BMPs should always be used first at a construction site where practical, because they work better and are much cheaper than sediment controls. However, a combination of both types of BMPs is normally required to adequately protect water quality.

Erosion prevention

The most important thing to remember when trying to prevent erosion on a construction site is to **minimize the amount and duration of soil exposure**. Maintaining existing cover will slow runoff, protect soil, and hold it in place. Preserving existing vegetation will also save money. Identify natural landscape features to keep, such as large trees, wildflower areas, and grasslands. Plan to fit the project around these features, so they remain in place after construction is completed. Also, try to preserve the existing site drainage system as much as possible, if it is stable. Do not clear vegetation or excavate areas near streams, rivers, lakes, or wetlands without getting the required state and federal permits (see Section 2).



What contributes to erosion? Heavy rainfall, steep slopes, removal of most existing vegetation, and erodible soils result in higher soil losses from erosion. Lower rainfall amounts, flatter slopes, preserving existing vegetation, and less erodible soils result in lower soil loss from erosion.

Most Kentucky cities with a population of 10,000 or more are subject to federal Stormwater Phase II requirements, which stipulate adoption of measures to manage construction site impacts and post-construction runoff.

Are you working in a "Stormwater Phase II City?"

Most Kentucky cities with a population of 10,000 or more have adopted new requirements for construction sites, which closely match the recommendations and information contained in this manual. For more information on the construction site erosion and sediment control procedures in specific Kentucky cities, visit www.kytc.state.ky.us/EnvAnalysis/Stormwaterquality/local_prog_links.htm

Is a KPDES Stormwater Permit Required for Your Construction Project?

To determine if your project requires a stormwater permit for construction activities, consider the following questions:

- *Will your construction project disturb one or more acres of land?*
- *Will your construction project disturb less than one acre of land but is part of a larger common plan of development or sale that will disturb a total of one or more acres of land?*
- *Will your construction project disturb less than one acre of land but is designated by the Kentucky Division of Water as a regulated construction activity?*
- *Will stormwater from the construction site flow to a municipal separate storm sewer system (MS4) or a ditch, swale, culvert, or pipe that eventually empties into a creek, stream, or other water of the United States?*

If you have answered "Yes" to any of the first three questions AND "Yes" to the fourth question, you need a stormwater permit for your construction activities. Please note that some municipalities also are required to implement stormwater control programs; therefore, check with your municipality for its own requirements. For more information on the EPA Stormwater Program go to: www.epa.gov/npdes/stormwater

Are you responsible for getting the KPDES permit?

EPA and the Kentucky Division of Water require each party who is considered a construction site "operator" to get permit coverage by submitting a Notice of Intent to the Division of Water. The owner, developer, general contractor, and architect could all be considered "operators" and may be required to obtain permit coverage. Before obtaining permit coverage, you will need to develop a SWPPP. You must obtain permit coverage if you meet either of the following criteria:

- *Do you have control of construction project plans and specifications, including the ability to make modifications to those plans and specifications?*
- *Do you have day-to-day control of those activities that are necessary to ensure compliance with a SWPPP for the site or other permit conditions (e.g., are you authorized to direct workers at a site to carry out activities required by the SWPPP or other permit conditions)?*

If you answer "Yes" to one or both of these questions, you are likely responsible for meeting the permit requirements. (Note: the Kentucky Transportation Cabinet is the KPDES permittee for all state road projects. SWPPP development and compliance is the responsibility of KYTC and the contractor. Changes to the SWPPP are made by the contractor.)

Land disturbance should be planned in phases to minimize the amount of area denuded at any one time. A detailed analysis of cuts or fills, soils, and overall site resources is highly recommended for large projects because it can help to divide the project into logical work phases, identify resources that should remain undisturbed, and identify soil, rock and other material or resources that can be used during construction. Ideally, phased zones can be identified that roughly balance cut or fill needs while accommodating the work schedule. Balancing cuts and fills helps minimize exposure and movement of soil and keeps the *working face* of the project at a manageable level.

Once the soil has been exposed, it is critical to **stabilize the area as quickly as possible** with vegetative (i.e. temporary or permanent seeding, sod, landscaping) or non-vegetative covers (i.e. mulch, erosion blankets, pavers, gravel). Stabilizing exposed soil is the most effective means for minimizing pollutant runoff from construction activities.

Structural BMPs can be used to prevent erosion as well. Controls should be installed before grading to divert, store or control runoff to protect vulnerable or denuded areas. Ditches, swales, berms, dikes, or pipes can be used to channel flow away from disturbed areas. These same types of controls can be used to direct any muddy runoff toward sediment control BMPs for pollutant removal.

Sediment control

Sediment control BMPs remove pollutants from runoff by (1) filtering the runoff to remove participles, or (2) slowing or trapping runoff to allow heavy particles to settle out. Some types of controls do both. For example, vegetation (i.e. grassy swales, buffers) filters pollutants from runoff as it flows overland and slows the flow, allowing heavy particles to fall out.

Structural controls can be designed to **trap runoff and promote settling** of suspended sediment. Sediment control can be accomplished with a small structure such as a check dam (i.e., ditch check), or by installing a large sedimentation basin. Care should be

taken in determining the locations for sediment control measures. Structures should receive only the volume and velocity of flow specified in the design (see Section 4). In addition, it is critical that sediment controls be placed at strategic locations throughout the site to micro-manage runoff and capitalize on sediment removal opportunities before ditches or other concentrated flows leave the site. These exits are the final sediment control points. If the site drains to a storm sewer system, the storm drain inlets must be protected.

Measures to prevent tracking of mud and debris off-site are important sediment control practices as well. Properly designed and installed rocky entry or exit pads, wash racks, or regular street sweeping might be necessary prevent streets from being covered with mud.

3.2 Housekeeping and Other Control Measures

SWPPPs also address other possible sources of contaminated runoff from construction sites, such as paint and concrete wastes, fuels and oils, spills, groundwater contamination, trash and litter, or other issues. The discharge of many construction site pollutants can be minimized or prevented by implementing good housekeeping practices and keeping a construction site clean. Proper storage and handling of oil, grease, paints, fuel, or other potentially toxic materials used during construction is critical to protect water quality. Whenever possible, maintain and fuel vehicles and equipment away from the site to minimize spills. While it is important to have spill kits and a formal plan in place should a spill occur, it is easier and less time-consuming to prevent leaks, spills, and dumping than cleaning up afterward. During construction, address solid waste storage and disposal, portable toilets (if needed), paint cleanup areas, wash racks, concrete washout locations, and other areas of concern to prevent polluted runoff or other harmful impacts.

Keep construction sites well-graded, clean, and store materials properly to eliminate contaminated runoff. Wash water, fuels, and other potentially hazardous liquids should be managed appropriately.

3.3 Post-Construction Management of Polluted Runoff

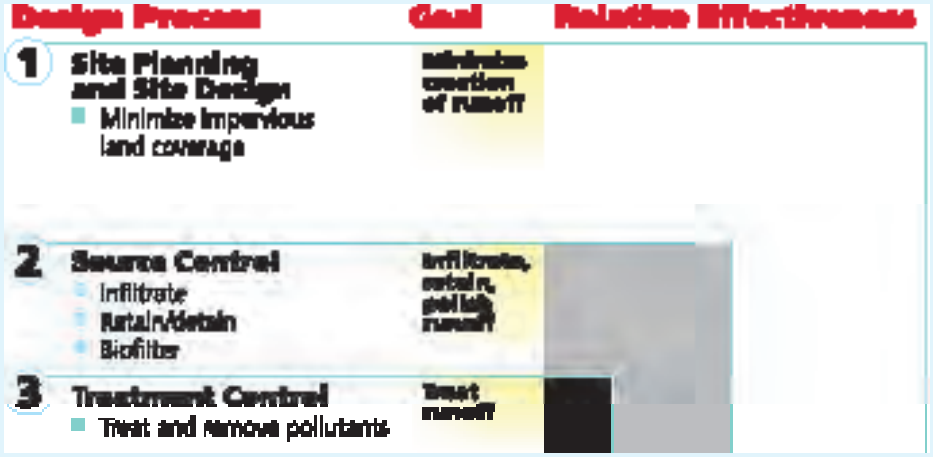
After construction is complete, the project might still have the potential for ongoing runoff of various pollutants unless appropriate post-construction management practices are implemented. For example, pollutants such as oil and grease could be discharged from a gas station while pollutants such as nutrients and pesticides could be discharged from a plant nursery. The potential pollutants generated on-site should be considered when determining the types of runoff water management devices necessary to control pollutants discharged after construction. An effective post-construction runoff management plan requires proper site design, pollutant source controls, and treatment controls to protect water quality. This section provides a very brief summary of some approaches for ensuring that post-construction runoff does not adversely affect water quality. Note that not all of this information is included in the SWPPP, but awareness of the principles outlined below can help to control future polluted runoff and meet regulatory requirements in municipalities subject to Stormwater Phase I and II permit programs, i.e., those with regulated municipal separate storm sewer systems (see www.epa.gov/owm and click on “stormwater”).

Plan preparation: Think about the types of runoff controls you’ll need. Key BMP selection factors are site size, amount of clearing/grading to be done, current land cover, steepness of slopes, and project type. See the technical specifications for planning in Chapter 4.

Site design

In the beginning stages of project planning, it is important to consider the ultimate impacts the site will have on water quality. Minimizing directly connected impervious areas and infiltrating runoff on-site rather than sending it downstream will improve the quality and decrease the quantity and velocity of stormwater runoff. In addition, runoff water management site design can promote groundwater recharge, filtration of sediment and other pollutants from runoff, and help to prevent flooding. There are a variety of measures that can be used to accomplish these goals; however, Low Impact Design (LID) is a popular site-planning approach for managing stormwater in new development. Much has been written about LID and related design approaches known as "Green Infrastructure;" it has been found to be cost effective for the developer while protecting the water quality of streams and lakes. More information on LID and Green Infrastructure can be found on EPA's Web site at **www.epa.gov/owow/nps/lid/**.

The goal of LID in new development is to **maintain the predevelopment hydrologic conditions**. This is accomplished by controlling runoff near its source and using practices that promote infiltration and evaporation. The LID Site Planning Process is based on the principles below (i.e., site planning and site design is considerably more effective in reducing pollution than pollutant source controls or polluted runoff treatment).



Site planning and design has the greatest potential for addressing polluted runoff. Source controls and treatment for polluted runoff can help, but cannot match the benefits offered by minimizing changes to the existing site drainage.

1. Identify and protect riparian areas during construction, including floodplains, stream buffers, wetlands, woodlands, steep slopes, highly permeable soils, and highly erosive soils. Kentucky requires a 25-50 ft. "no disturbance" buffer between construction activities and all surface waters.
2. Minimize clearing and grading by:
   - Restricting grading to the smallest possible area
   - Locating development away from floodplains, steep slopes, and wetlands
   - Minimizing construction easements
   - Preserving existing trees
   - Minimizing impervious surfaces
   - Disconnecting impervious surfaces to increase infiltration
3. Use hydrology as a design element when considering the location of park and play areas, potential building sites, and drainage paths.
4. Minimize total impervious area by considering
   - Roadway layouts that require less linear feet of streets
   - Narrow road sections and sidewalks on only one side of the road

- Pervious pavement for roads and parking lots
- Reduced on street parking and shared driveways
- Vertical construction of buildings to minimize roof area
- Limiting driveway widths to 9 feet
- Reduced building setback to shorten driveway length

Low impact development design seeks to capture and infiltrate runoff close to the source area. Small, strategically placed "rain gardens" and other dedicated and managed infiltration sites reduce runoff volumes and remove potential pollutants.

5. Minimize directly connected impervious areas by directing runoff from roof drains, driveway, and other paved surfaces to vegetated areas.

6. Maximize the hydrologic time of concentration by

   - Increasing overland sheet flow by letting the runoff spread out into grassy areas before reaching the stream
   - Increase the drainage flow path by directing runoff into bioretention and infiltration areas before it leaves the lot
   - Lengthen and flatten slopes on lots; increase vegetation overall
   - Use vegetated swales instead of pipes

For more information on LID and Green Infrastructure

For more on Low Impact Development and Green Infrastructure design strategies, see

www.epa.gov/owow/nps/lid/lidnatl.pdf

http://cfpub.epa.gov/npdes/home.cfm?program_id=298

For a builder's guide to low impact development, see

www.lowimpactdevelopment.org/lid%20articles/Builder_LID.pdf

www.lowimpactdevelopment.org/publications.htm

Source control

Pollutant source control (pollution prevention) measures aim to **reduce or eliminate** the sources or exposure of pollutants to prevent contaminated runoff. If pollutants are prevented from getting into runoff, the project can minimize the size and extent of post-construction control practices. Source control BMPs include general housekeeping (i.e., preventing spills, covering trashcans, and proper chemical storage), reduction of dry-weather flows (i.e., irrigation and washing of vehicles, sidewalks, or buildings) that can suspend pollutants in water, and educational efforts (i.e., storm drain stenciling, employee training programs). It is best to have a plan outlining proposed source control BMPs at the onset of the project as certain items might need to be considered or designed in advance (i.e., covered, locked trash enclosure).

Treatment and flow controls

Development of a site often changes the characteristics of the land, such as increasing imperviousness and altering drainage patterns. In addition, the ultimate use of the land can result in higher polluted discharges. Treatment controls attempt to remove pollutants from stormwater, thereby limiting the impact on water quality. Treatment controls can include infiltration devices or sites (preferred), filtration

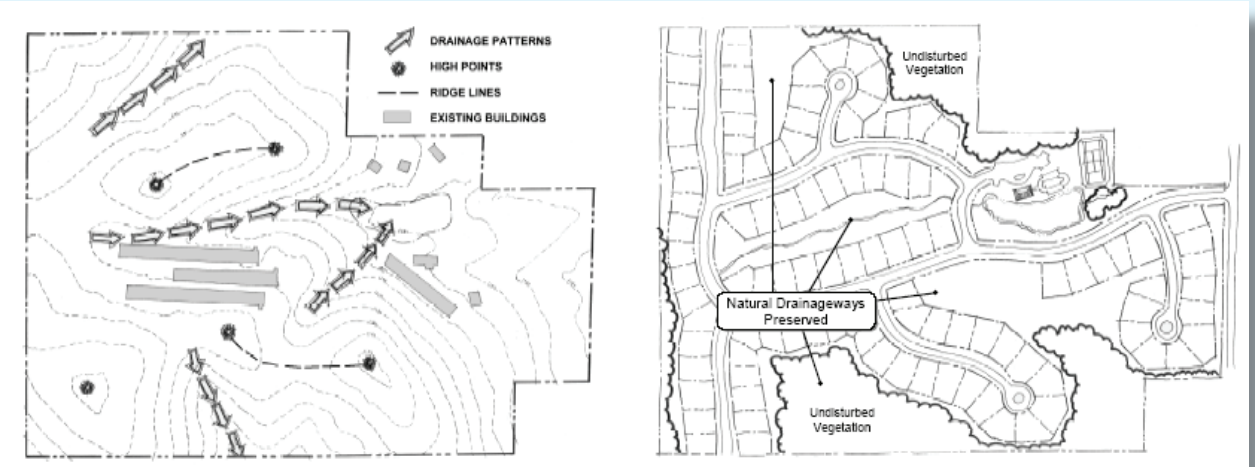


Figure 1.4.2-29 Example of a Subdivision Using Natural Drainageways for Stormwater Conveyance and Management

Fitting the project to the site: work around natural drainage features

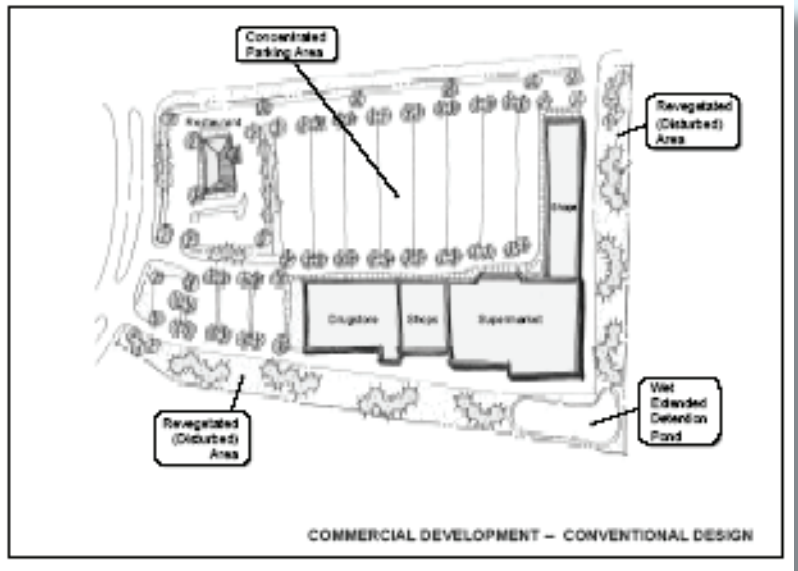
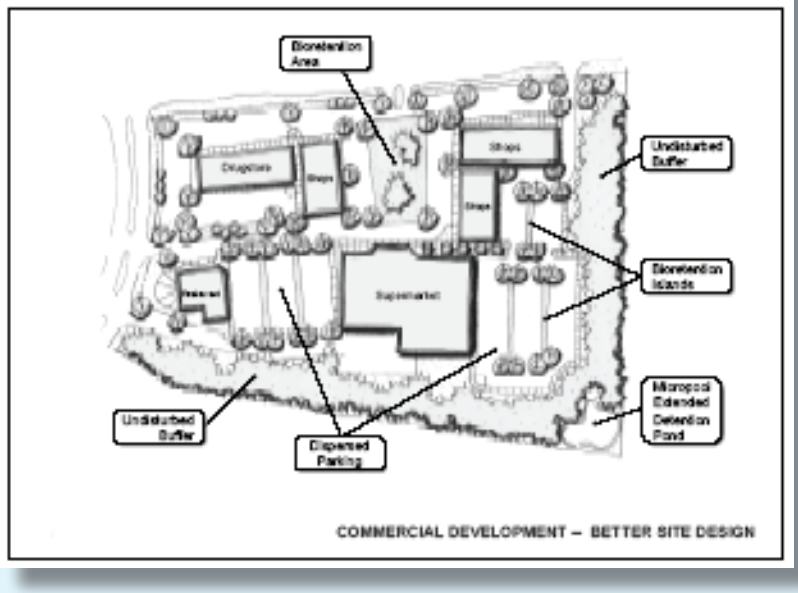


Figure 1.4.3-3 Comparison of a Traditional Commercial Development (above) with an Innovative Site Plan Developed Using Better Site Design Practices (below).



Increasing infiltration areas, trees, and landscaping improves the "look and feel" of a development and keeps runoff clean. In this example, the parking lot has been broken up into separate units surrounded by infiltration (bioretention) areas. Trees and vegetated buffer strips have been added to improve site aesthetics, summertime cooling, and surface runoff treatment. The entire development becomes more inviting, softer, and appealing because of the increase in vegetation and reduction of large expanses of "hard" surfaces.

devices, and retention or detention facilities. Treatment control BMPs should be considered the final line in the post-construction stormwater management line of defense. The use of treatment controls alone can be more expensive and less effective than using a combination of site design, source controls, and treatment controls. Without site design features that reduce the amount of flow and source controls to minimize pollutants entering the runoff flow, treatment controls typically cannot perform adequately. It is critical that post-construction controls are inspected and maintained regularly if they are to function effectively over the long term.

3.4 Principles for Selecting Runoff Controls

SWPPPs identify controls that will be used during various stages of the project—clearing or stripping, grading, utility installation, facility construction, and closeout. The best and most efficient and economical approach is to **divide the project into logical phases, focus construction and runoff controls on the active work zone, and get to final grade, seed, and mulch** as soon as practicable. The table below identifies BMPs that address various objectives, which emerge as the project unfolds.

BMP Principle	Applicable BMPs
1. Minimize needless clearing, grading, and destruction of natural vegetation • *Establish limits of grading on plans* • *Mark or flag clearing limits in the field* • *Phase clearing and grading activities to minimize the amount of land disturbed at any one time*	Setbacks from Waterways Vegetated Buffer Strips
2. Divert runoff and protect waterways/ wetlands • *Divert runoff away from disturbed areas* • *Create setbacks to protect waterways and wetlands* • *Establish vegetated buffer strips to help filter runoff*	Diversion Channel or Berm Setbacks from Waterways Vegetated Buffer Strip Stream Crossing Bioengineered Streambank Stabilization
3. Protect storm drain inlets and channels • *Protect all storm drain inlets receiving runoff from the construction site* • *Create small ponding areas for silt to settle out before entering inlets and pipes* • *Stabilize ditches at pipe outlets* • *Stabilize ditches to minimize erosion*	Inlet Sediment Barrier Pipe Outlet Energy Dissipater Rock Lined Channel Grass Lined Channel Check Dam
4. Protect slopes and disturbed areas • *Cover bare soil with vegetation* • *Use erosion control blankets on steep slopes and in ditches/channels to promote the growth of grass* • *Protect steep slopes from erosion*	Seed, Mulch, and Sod Topsoil Stockpiling, Dust Control Blankets and Mats Surface Roughening Slope Drain, Gabion Cellular Confinement Systems Polyacrylamides
5. Establish stabilized construction entrances to minimize tracking of sediment	Construction Entrance
6. Install sediment barriers on contour and at site perimeter to filter sediments	Silt Fence Brush, Rock, and Commercial Sediment Barriers
7. Use dewatering practices when necessary	Dewatering Structure
8. Control runoff using sediment traps or basins to remove settleable solids	Sediment Trap and Basin

9.	Control waste and other pollutants • *Provide cover for all chemicals, liquid products and other materials that could contaminate runoff* • *Provide adequate trash receptacles and debris removal* • *Provide concrete truck washouts* • *Protect fueling and equipment repair areas from runoff water*	Good Housekeeping Practices i. Debris and Trash Management ii. Chemical Management iii. Concrete Waste Management iv. Sanitary Facilities v. Material Delivery, Storage, and Use vi. Employee Training vii. Vehicle/Equipment Fueling/Maintenance viii. Spill Prevention and Control
10.	Install, inspect, and maintain BMPs • *Train construction site workers on the purpose of BMPs, installation techniques, and maintenance requirements* • *Install BMPs and implement the SWPPP* • *Inspect BMPs every 7 days or every 14 days (and within 24 hours of every rainfall of 0.5 inch or greater)* • *Maintain BMPs*	Covered in the SWPPP: • *Identify and select appropriate BMPs* • *Locate and label BMP sites* • *Provide BMP installation schedule* • *Describe inspection/maintenance program*

- *Preserve existing vegetation*
- *Divert upland runoff around exposed soil*
- *Seed/mulch/cover bare soil immediately*
- *Use sediment barriers to trap soil in runoff*
- *Protect slopes and channels from gullying*
- *Install sediment traps and settling basins*
- *Preserve vegetation near all waterways*

Think about how runoff will move onto, through, and off the site. This exercise will provide the information needed to identify, select, schedule, and maintain the necessary BMPs. An uphill-to-downhill assessment of the site also helps define the best approach for controlling polluted runoff.

3.5 SWPPP Contents

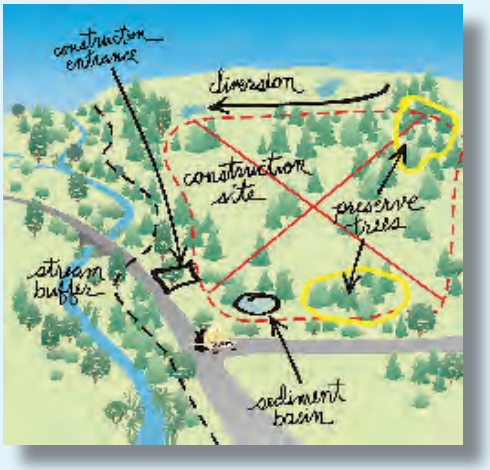
Several different types of controls must be considered when planning a development project. Measures must be planned to minimize erosion and remove pollutants from runoff during construction. In addition, ways to direct flows towards areas that will allow infiltration into the ground and treat runoff before it leaves a site after construction must be considered during the early phases of planning. Trying to retrofit construction or development plans to mitigate water quality impacts late in the process can be expensive and time consuming. Planning to include appropriate erosion prevention, sediment control, good housekeeping and stormwater management controls at the outset can help to ensure the protection of water quality and property as well as regulatory compliance. Section 4 of this manual provides specific examples of each type of control measure.

As discussed in Section 2.1, construction activity that disturbs one acre or more is required to obtain a KPDES permit and develop a SWPPP (**See Appendix B and C for examples**). The Kentucky Division of Water's KYR10 Construction Stormwater General Permit contains the requirements for SWPPPs. Below are the requirements from the permit:

The permittee shall develop a Stormwater Pollution Prevention Plan (SWPPP) and implement the SWPPP at the commencement of construction disturbance. All operators working on this project are required to comply with the SWPPP or obtain separate coverage under this permit. The SWPPP shall include erosion prevention measures, sediment controls measures, and other site management practices necessary to prevent the discharge of sediment and other pollutants into waters of the Commonwealth that are adequately protective to minimize receiving waters from being degraded and failing to supportive their designated uses. These sediment controls measures including retention basins, erosion control measures, and other site management practices are required to be properly selected based on site-specific conditions, and installed and maintained to effectively minimize such discharges for storm events up to and including a 2-year, 24- hour event. Permittees are encouraged to design the site, the erosion prevention measures, sediment controls measures, and other site management practices with an eye toward minimizing post-construction stormwater runoff, including facilitating the use of low-impact technologies. The Stormwater Pollution Prevention Plan (SWPPP) shall contain the following: 1) A site description that identifies sources of pollution to stormwater discharges associated with construction activity on site; and 2) A description of the erosion prevention measures, sediment controls measures, and other site management practices

used at the site to prevent or reduce pollutants in stormwater discharges to ensure compliance with the terms and conditions of this permit. All stormwater controls shall be developed and implemented in accordance with sound practices and shall be developed specific to the site. The goal of these devices should be 80% removal of Total Suspended Solids that exceed predevelopment levels. For a common plan of development a comprehensive SWPPP shall be prepared that addresses all construction activities within the common plan of development. Each individual site operator shall be a signatory of the SWPPP and shall not conduct activities that are not consistent with the SWPPP or result in the failure or ineffectiveness of the sediment controls measures, erosion control measures, and other site management practices implemented. Otherwise, an operator not utilizing the SWPPP for the common plan of development shall seek coverage under this permit or an individual permit and develop a SWPPP for those separate activities.

Site Description—The SWPPP shall be based on an accurate assessment of the potential for generating and discharging pollutants from the site. Hence, the permit requires a description of the site and intended construction activities in the SWPPP in order to provide a better understanding of the characteristics of site runoff. At a minimum, the SWPPP shall describe the nature of the construction activity, including: a) The function of the project (e.g., box store, strip mall, shopping mall, school, electrical transmission line, oil or natural gas pipeline, factory, industrial park, residential development, transportation construction, etc.); b) The intended significant activities, presented sequentially, that disturb soil over major portions of the site (e.g., grubbing, excavation, grading); c) Estimates of the total area of the site and the total area of the site that is expected to be disturbed by excavation, grading or other activities, including off-site borrow/fill areas; and d) Provide a description of the water quality classification of the receiving water(s).



Identify drainage areas and drainage ditches and channels. Install diversions, grassed channels, sediment traps/basins, downslope sediment barriers, and rock construction entrance before beginning work.

Site Map—The SWPPP shall contain a legible site map of sufficient scale to depict the following: a) Property boundary of the project, If subdivided, show all lots and indicate on which lots construction activities will occur. b) Anticipated drainage patterns and slopes after major grading activities, including impervious structures; c) Areas of soil disturbance and areas that will not be disturbed including fill and borrow areas; d) Locations and types of sediment control measures, erosion control measures, planned stabilization measures, and other site management practices; e) Locations of surface waters, including wetlands, and riparian zones; f) Locations of karst features such as sinkholes, springs, etc.; g) Locations of discharge points; h) Locations of equipment storage areas, materials storage areas including but not limited to top soil; storage, fuels, fertilizers, herbicides, etc.; i) Location of concrete wash out areas, waste management areas, area of site egress; j) If applicable, locations where final stabilization has been accomplished and no further construction-phase permit requirements apply; and k) Other major features and potential pollutant sources. For KYTC projects which have Roadway Plans, locations of BMPs may be recorded and off-set as the BMPs are installed.

Other Industrial Activities—The SWPPP shall provide a description of any discharge associated with industrial activity other than construction (including stormwater discharges from dedicated asphalt plants, concrete plants, etc.) and the location of that activity on the construction site.

Documentation of Stormwater Controls to Reduce Pollutants—The SWPPP shall include documentation of the erosion prevention measures, sediment controls measures, and other site management practices designed to site-specific conditions that will be implemented to reduce the

pollutants in stormwater discharges from the site and assure compliance with the conditions of the permit. It is imperative that stabilization be employed as soon as practicable in critical areas. Erosion prevention measures, sediment controls measures, and other site management practices shall be properly selected based on site-specific conditions, and installed and maintained in accordance with sound sediment controls, erosion prevention, or other site management practices and relevant manufacturers' specifications. The SWPPP shall include a description of the general location of, and how and where the following erosion controls measures will be implemented: I) The plan to minimize disturbance and the period of time the disturbed area is exposed without stabilization practices, including: 1) Minimizing the overall area of disturbed acreage; 2) Phasing construction so that only a portion of the site is disturbed at any one time; or 3) Scheduling clearing and grading events to reduce the probability that bare soils will be exposed to rainfall. II) Managing stormwater flows on the site to avoid stormwater contact with disturbed areas by: 1) Diversion berms; 2) Conveyance channels; 3) Vegetated buffers; 4) Slope drains; or 5) Other adequately protective alternate practices. III) Using energy dissipation approaches to prevent high velocity runoff and concentrated flows that are erosive, by: 1) Use of vegetated filter strips; or 2) Other adequately protective alternate practices; IV) The practices to be used to minimize exposure of bare soils by covering and stabilization, including: 1) Vegetative stabilization with annual grasses or other plants; 2) Geotextiles; 3) Straw; 4) Rolled erosion control mats or other products; 5) Mulch; or 6) Other adequately protective alternate practices. Sediment control measures are used to control and trap sediment that is entrained in stormwater runoff. The SWPPP shall include a description of how and where the following sediment controls measures will be implemented: I) Sediment Barriers 1) Silt fences constructed with filter fabric; 2) Fiber rolls; or 3) Other adequately protective alternate practices II) Slope Protection 1) Tread tracking; 2) Erosion blankets; 3) Mulching; or 4) Other adequately protective alternate practices III) Conduit/ Ditch Protection 1) Inlet protection; 2) Outlet protection; 3) Other adequately protective alternate practices IV) Stabilizing Drainage Ditches 1) Check dams; 2) Lining deep ditches; or 3) Other protective equivalent practices V) Sediment trapping devices used to settle out sediment eroded from disturbed areas, including: 1) Sediment traps; 2) Basins; or 3) Any performance enhancement practices that will be used, such as: a) Baffles; b) Skimmers; c) Electro coagulation; d) Filtration; e) Chemically enhanced settling (e.g. polymers); or f) Other adequately protective alternate practices; or 4) Other adequately protective alternate practices. VI) Perimeter controls, such as: 1) Silt fences; 2) Berms; 3) Swales; or 4) Other adequately protective alternate practices. Construction activity generates a variety of wastes and wastewater, including concrete truck rinsate, municipal solid waste, trash, and other pollutants. Construction materials shall be handled, stored, maintained, and disposed of properly to avoid contamination of runoff to the maximum extent practicable and as noted below. The SWPPP shall describe which practices will be implemented to manage construction and development site wastes and prevent or minimize discharges to surface water, including: a) Protecting construction materials, chemicals, and lubricants from exposure to rainfall; b) Preventing litter, construction debris, and construction chemicals from entering receiving water. c) Limiting exposure of freshly placed concrete to exposure to rainfall that results in runoff; d) Segregating stormwaters and other wastewaters from fuels, lubricants, sanitary wastes, and other chemicals such as pesticides, herbicides, and fertilizers to prevent runoff being contaminated; e) Neat and orderly storage of chemicals, pesticides, herbicides, fertilizers and fuels that are being stored on the site; f) Prompt collection and management of trash and sanitary waste; g) Prompt cleanup of spills of liquids and solid materials that could pose a pollutant risk; h) Regular removal of off-site accumulations of sediment to minimize the potential for discharge; and i) Other adequately protective alternate practices. Also to be included are a description of the intended sequence of major stormwater controls and an implementation schedule in relation to the construction process; a description of interim and permanent stabilization practices, including a schedule of their implementation; the proposed location(s)

Minimize Size and Duration of Disturbance

The permittee shall at all times minimize disturbance and the period of time that the disturbed area is exposed without stabilization practices. In "critical areas," erosion prevention measures such as erosion control mats/blankets, mulch, or other measures shall be implemented on disturbed areas within 24 hours or as soon as practical.

Stabilization Requirements

Final stabilization practices on those portions of the project where construction activities have permanently ceased shall be initiated within fourteen (14) days of the date of cessation of construction activities. Temporary stabilization practices on those portions of the project where construction activities have temporarily ceased shall be initiated within fourteen (14) days of the date of cessation of construction activities.

of off-site equipment storage, material storage, waste storage and borrow/fill areas; a proposed construction schedule as a means for the operator(s) and KDOW to determine applicability and implementation status of SWPPP requirements; an explanation of practices employed to reduce pollutants from construction-related materials that are stored on site, including: a) A description of said construction materials (with updates as appropriate); b) A description of pollutant sources from areas untouched by construction; and c) A description of stormwater controls that will be implemented in those areas

Maintenance of Stormwater Controls—Erosion prevention measures, sediment controls measures, and other site management practices are required to be maintained in an effective, operating condition. The permittee shall develop a schedule of maintenance activities to ensure the proper function of these devices. The USEPA recommends that sediment control devices be maintained at no more than 1/3 capacity to allow for sediment capture.

Non-Stormwater Discharge Management—The SWPPP shall identify appropriate pollution prevention measures for each of the following eligible non-stormwater components of the discharge authorized under this permit, when combined with stormwater discharges associated with construction activity. a) Discharges from fire-fighting activities; b) Fire hydrant flushing; c) Waters used for vehicle washing where detergents are not used; d) Water used for dust control; e) Potable water including uncontaminated water-line flushing; f) Routine external building wash down that does not use detergents; g) Pavement wash waters where spills or leaks or toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used; h) Landscape irrigation; I) Clean, non-turbid water-well discharges of groundwater; and j. Construction dewatering provided the requirements of this permit are met.

Inspections: Permittee Conducted—Permittees shall provide for regular inspections of the site. For purposes of this part, DOW defines "regularly" to mean either I) At least once every seven (7) calendar days, or II) At least once every fourteen (14) calendar days, and within 24 hours after any storm event of 0.5 inch or greater. (DOW recommends that the permit holder perform a "walk through" inspection of the construction site before anticipated storm events.) For areas of the site that have undergone temporary or final stabilization inspections shall be conducted at least once a month until the coverage is terminated. Inspections shall be performed by personnel knowledgeable and skilled in assessing conditions at the construction site that could impact stormwater quality and assessing the effectiveness of erosion prevention measures, sediment controls measures, and other site management practices chosen to control the quality of the stormwater discharges. Inspectors shall have training in stormwater construction management such as KEPSC, CEPSC, CPSWQ, TNEPSC, CESSWI, or other similar training. Inspectors shall conduct visual inspections to determine: I) Whether erosion prevention measures, sediment controls measures, and other site management practices are: a) properly installed; b) properly maintained; c) effective in minimizing discharges to the receiving water; and II) Whether excessive pollutants are entering the drainage system. Visual inspections shall comprise, at a minimum: I) Erosion prevention measures; II) Sediment controls measures; III) Other site management

Buffer Zone

For discharges to waters categorized as High Quality Waters or Impaired Waters (Non-construction related impairment) permittees are required maintain at a minimum a 25-foot buffer zone between any disturbance and all edges of the receiving water. For discharges to waters categorized as Impaired Waters (sediment impaired, but no TMDL), permittees are required maintain at a minimum a 50-foot buffer zone between any disturbance and all edges of the receiving water. If the buffer zone between any disturbance and the edge of the receiving water cannot be maintained, an adequately protective alternate practices may be employed. The SWPPP shall explain any alternate practices and how these practices are adequately protective. Such cases include but are not limited to stream crossings and dredge and fill areas. In these cases the permittee shall minimize disturbances in the buffer zones by using hand held or other low-impact equipment.

practices and points of site egress; IV) Disturbed areas; V) Areas used for storage of materials exposed to precipitation; VI) Discharge points shall be inspected to ascertain whether erosion prevention measures, sediment controls measures, other site management practices and points of site egress are effective in preventing impacts to waters of the Commonwealth. Inspection reports shall be prepared for all inspections and shall be retained with the SWPPP. Inspection reports should include: I) The date and of inspection; II) The name and title of the inspector; III) A synopsis of weather information for the period since the last inspection (or since commencement of construction activity of the initial inspection performed) including a best estimate of the beginning of each storm event, the duration of each storm event, and the approximate amount of rainfall for each storm event (in inches); IV) Weather conditions and a description of any discharges occurring at the time of the inspection; V) Location(s) of discharges of sediment or other pollutants from the site; VI) Location(s) of sediment controls measures, erosion control measures, or other site management practices that require maintenance; VII) Location(s) of any erosion prevention measures, sediment controls measures, or other site management practices that failed to operate as designed or proved inadequate for a particular location; VIII) Location(s) where additional erosion prevention measures, sediment controls measures, or other site management practices are needed. Identify any actions taken in response to inspection findings; and identify any incidents of non-compliance with the SWPPP. If no incidents of non-compliance with the SWPPP were identified, the report shall contain a certification that the site is in compliance with the SWPPP. The inspection report shall be signed in accordance with the signatory requirements in 401 KAR 5:065, Section 1(11).

Maintaining an Updated Plan—Stormwater Pollution Prevention Plans (SWPPPs) shall be revised whenever erosion prevention measures, sediment controls measures, or other site management practices are significantly modified in response to a change in design, construction method, operation, maintenance procedure, etc., that may cause a significant effect on the discharge of pollutants to receiving waters or municipal separate storm sewer systems. The SWPPP shall be amended if inspections or investigations by site staff or by local, state, or federal officials determine that the existing site management practices are ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the construction site. If an inspection reveals design inadequacies, the site description and sediment controls measures, erosion control measures, or other site management practices identified in the SWPPP shall be revised. All necessary modifications to the SWPPP shall be made within seven (7) calendar days following the inspection. If existing practices need to be modified or if additional sediment controls measures, erosion control measures, or other practices are necessary, implementation shall be completed before the next storm event whenever practicable. If implementation before the next storm event is impracticable, the situation should be documented in the SWPPP and the changes shall be implemented as soon as practicable.

Signature, Plan Review, and Making Plans Available—The SWPPP shall be signed and certified in accordance with the signatory requirements in 401 KAR 5:065, Section 1(11). A current copy of the SWPPP shall be readily available to the construction site from the date of project initiation to the date of Notice of Termination. The person with day-to-day operational control over the plan's implementation shall keep a copy of the SWPPP readily available whenever on site (a central location accessible by all on-site operators is sufficient for sites that are part of a common plan of development). If an on-site location is unavailable to store the SWPPP when no personnel are present, notice of the plan's location shall be posted near the main entrance at the construction site.

Stormwater Pollution Prevention Plan Checklist

Item	SWPPP Elements	Compliance		
		Good	Fair	Poor
Site Description	• *Nature and type of construction activity*	❍	❍	❍
	• *Sequence of major soil disturbing activities (clearing, grading)*	❍	❍	❍
	• *Estimates of the total project area and the total disturbed area*	❍	❍	❍
	• *Receiving water name, water quality classification and distance*	❍	❍	❍
	• *Soil types and locations*	❍	❍	❍
	• *Construction area, time period, and general schedule*	❍	❍	❍
	• *Location of BMPs and schedule for installation*	❍	❍	❍
Site Map	• *Legend; property lines; existing/proposed contours; utilities*	❍	❍	❍
	• *Ditches, streams, sinkholes, wetlands, lakes, and critical areas*	❍	❍	❍
	• *Limits of construction and areas of no disturbance*	❍	❍	❍
	• *Trees to be preserved*	❍	❍	❍
	• *Existing and proposed buildings*	❍	❍	❍
	• *Existing and proposed paved areas*	❍	❍	❍
	• *Proposed pipes, inlets, and open channels*	❍	❍	❍
	• *Location of sheet/concentrated discharges and streams/lakes/wetlands*	❍	❍	❍
	• *Construction entrances*	❍	❍	❍
	• *Location of equipment storage areas*	❍	❍	❍
	• *Location of soil stockpiles and borrow/fill areas*	❍	❍	❍
	• *Sediment basins and sediment traps*	❍	❍	❍
	• *Silt fence and other sediment barriers*	❍	❍	❍
	• *Diversion channels or berms upgradient of site*	❍	❍	❍
	• *Other BMPs to be used on site*	❍	❍	❍
	• *Inspection and maintenance notes*	❍	❍	❍
Erosion Prevention and Sediment Control Measures	*Soil Stabilization (e.g., seed, mulch)*			
	• *Seed and mulch specifications*	❍	❍	❍
	• *Bare areas idle for 14 days to be seeded/mulched*	❍	❍	❍
	Perimeter Controls (e.g., silt fence, sediment ponds)			
	• *Drawings and specifications showing dimensions and materials*	❍	❍	❍
	• *Design criteria and calculations*	❍	❍	❍
	• *Sediment basin for all areas draining 10 acres of disturbed area. (Sediment storage capacity must equal 134 cubic yards per disturbed acre)*	❍	❍	❍
	Stormwater Management Devices after construction is completed			
	• *Measures to prevent erosion at culvert outlets and in channels/ditches*			
	• *Measures to remove 80% of the TSS that exceeds predevelopment levels*	❍	❍	❍
		❍	❍	❍
Other Control Measures	• *Measures to prevent discharge of debris and building materials*	❍	❍	❍
	• *Measures to prevent off-site tracking of sediment*	❍	❍	❍
	• *Measure to prevent dust generation*	❍	❍	❍
	• *Other good housekeeping measures*	❍	❍	❍
Other State or Local Plans	• *Identify local or other regulatory requirements*	❍	❍	❍
	• *Demonstrate compliance with local requirements*	❍	❍	❍
Maintenance	• *Description of BMP maintenance program*	❍	❍	❍
Inspections	• *Frequency of inspection (every 7 days or every 14 days--if 14 day cycle, then also after every rainfall of 0.5" or greater)*	❍	❍	❍
	• *Documentation procedures for inspections*	❍	❍	❍
	• *Documentation procedures for making repairs to BMPs*	❍	❍	❍
Non-Stormwater Discharges	• *Pollution prevention controls (e.g. gasoline or diesel fuel spills)*	❍	❍	❍
	• *Good housekeeping measures*	❍	❍	❍
	• *Disposal procedures for trapped sediment*	❍	❍	❍
Contractor and Subcontractor	• *Name, address, and phone number of contractor & subcontractors*	❍	❍	❍
	• *Certification statement from each subcontractor*	❍	❍	❍

3.6 Standard Notes for SWPPPs

SWPPPs are intended to organize, schedule, and guide runoff controls and site development work. The best SWPPPs will accurately and effectively forecast contractor needs for controlling runoff during clearing, grading, site stabilization, and construction. However, it is difficult to predict how a project will unfold under active field conditions—some areas scheduled for work might not be ready, subcontractors might not finish project phases on schedule, and other challenges might result in changes to the original SWPPP and schedule.

To establish some common, standard practices regarding typical grading, clearing, excavation, and fill activities, SWPPP preparers should adopt a system of standard notes for drawings and plans. These standard notes will convey important information regarding how to accommodate frequently encountered situations, like soil stockpiling, dewatering, unanticipated erosion after heavy rains, temporary sediment trap installation, and so forth. The notes will also provide clear authority for field personnel to identify, assess, and act upon conditions that could require immediate attention, such as severe rutting on slopes. The following series of standard notes should be considered for inclusion in all SWPPPs as appropriate:

- The SWPPP must be developed and implemented before any land-disturbing activities. Sediment controls such as rock site exit pads, traps, and silt fences must be installed before land clearing, excavation, or placement of fill material.
- Detention basins, if used, must be constructed first and must perform as sediment basins until the contributing drainage area is seeded and stabilized. Outlets must be modified, if necessary, to maximize detention and sediment removal during construction.
- Temporary sediment traps with rock or earthen dikes or other approved controls must be installed as needed, downgradient of heavily eroded areas as needed to prevent sediment from leaving the site.
- Install construction exit to minimize the tracking of mud, soil, and rock from construction areas onto public roadways. Soil and rock tracked onto the roadway must be removed daily.
- Soil stockpiles must be located away from streams, ponds, swales and catch basins. Stockpiles must be seeded, mulched, and adequately contained through the use of silt fence.
- All stream crossings must use properly designed low-water crossing structures authorized under a USACE Clean Water Act section 404 permit.
- Sediment-laden water encountered during trenching, boring, or other excavation activities must be pumped to a sediment trapping or filtering device and cleaned before being discharged. Discharges to storm drains, ditches, or water bodies must be covered under a KPDES permit.
- All bare soil areas not subject to active clearing, excavation, grading, or fill activities must be stabilized with temporary or permanent seeding or mulching within 14 days.
- All areas within 25 to 50 ft. of streams, rivers, lakes, wetlands, and sinkholes must be flagged as off-limits to vehicles, equipment, and soil disturbance activities.
- Good housekeeping practices must be applied to prevent contaminated runoff or other impacts from paint or concrete wastes, fuels and oils, trash and litter, or other materials.
- Silt fences, ditch checks, non-permanent sediment traps, and other temporary controls must be removed after vegetation in upgradient areas is established and ditches are stable.
- Good housekeeping measures for materials storage and handling, vehicle fueling and maintenance, spill response and cleanup, and waste management must be followed to ensure that runoff from the site is free of contaminants.

- All BMPs will be selected, installed, operated, and maintained according to KY DOW guidelines, manufacturer's requirements, or standard industry practice, as appropriate.

3.7 Inspections and Maintenance

Erosion and sediment controls must be inspected every seven days or every 14 days (if 14 day cycle then after each rain exceeding 0.5 inch). Inspections should be conducted by qualified personnel, and should follow the recommended sequence below:

"Qualified personnel" means a person knowledgeable in the principles and practice of erosion, sediment, and stormwater control who possesses the skills to assess site conditions and the effectiveness of control measures selected to control the quality of stormwater discharges.

Plan the inspection

Develop a checklist or report to document the inspection, including name and qualifications of the personnel making the inspection, date of the inspection, major observations relating to the implementation of the SWPPP, and any corrective actions taken. Use the SWPPP and site map to identify areas and BMPs that need to be inspected. Make sure that copies of required paperwork—permits, NOIs, the SWPPP, subcontractor certifications, prior inspection reports, USACE 404 permits, and so on—are on hand.

Inspect discharge locations and vehicle exits

Inspect accessible discharge locations (i.e., where ditches or sheet runoff leaves the site) to ensure that velocity dissipation devices or sediment barriers are effective in preventing significant impacts to receiving waters. Inspect all vehicle exit locations for evidence of off-site sediment tracking. Also, inspect all storm drain inlet protection controls to ensure that they are effective and note any that need maintenance.

Inspect disturbed areas

Inspect disturbed areas for evidence of pollutants entering the drainage system or moving off-site. Runoff from disturbed areas should be treated by erosion controls, sediment controls, or a combination of controls before entering the drainage system. Note any disturbed areas with excessive erosion that might need additional controls.

Inspect control measures

Inspect all control measures that are listed in the SWPPP to ensure correct operation. Inspect the control measures to evaluate whether they have been adequately installed and are effective. Note any controls that need maintenance.

Inspect material storage areas

Inspect all material storage areas exposed to precipitation for any potential for pollutants to enter the drainage system. Note any areas where potential pollutants are exposed or areas where material needs to be covered or contained.

Inspect temporary or permanent stabilized areas at least once a month

Areas that are temporarily or permanently stabilized must be inspected at least once a month to verify that erosion controls are in place. Inspections should also verify that active construction activity is not occurring in these areas. A checklist providing field indicators to assist during inspections is included in the following table.

Kentucky Construction Site Stormwater Inspection Report

General Information			
Project Name			
KPDES Tracking No.		**Location**	
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Info			
Inspector's Qualifications			
Describe present work phase			
Type of Inspection: ❑Regular Weekly ❑Regular Bi-Weekly ❑Pre-Storm Event ❑During Storm ❑Post-Storm Event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑Clear ❑Cloudy ❑Rain ❑Sleet ❑Fog ❑Snowing ❑High Winds ❑Other Temperature: _____			
Have any discharges of sediment or other pollutants occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges of sediment or pollutants at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary. Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.

	BMP Type or Name	BMP Installed?	Maintenance Required?	Corrective Action Needed and Notes
1		❑Yes ❑No	❑Yes ❑No	
2		❑Yes ❑No	❑Yes ❑No	
3		❑Yes ❑No	❑Yes ❑No	
4		❑Yes ❑No	❑Yes ❑No	
5		❑Yes ❑No	❑Yes ❑No	
6		❑Yes ❑No	❑Yes ❑No	
7		❑Yes ❑No	❑Yes ❑No	
8		❑Yes ❑No	❑Yes ❑No	
9		❑Yes ❑No	❑Yes ❑No	
10		❑Yes ❑No	❑Yes ❑No	
11		❑Yes ❑No	❑Yes ❑No	
12		❑Yes ❑No	❑Yes ❑No	
13		❑Yes ❑No	❑Yes ❑No	
14		❑Yes ❑No	❑Yes ❑No	
15		❑Yes ❑No	❑Yes ❑No	
16		❑Yes ❑No	❑Yes ❑No	
17		❑Yes ❑No	❑Yes ❑No	
18		❑Yes ❑No	❑Yes ❑No	
19		❑Yes ❑No	❑Yes ❑No	
20		❑Yes ❑No	❑Yes ❑No	

Overall Site Issues: Note BMPs, Implementation, Maintenance and Corrective Action Needs.

BMP/activity	Installed?	Maintenance Required?	Corrective Action Needed and Notes
Are all slopes and disturbed areas not being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
Are streams, wetlands, mature trees, etc. protected with barriers or BMPs?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
Are storm drain inlets properly protected?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
Is trash/litter from work areas collected and placed in covered waste containers?	❑Yes ❑No	❑Yes ❑No	
Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other material?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Other management practices inspected or needed (explain):			

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature:_____ **Date:**_____

4. Technical Specifications for BMPs

BMPs must be selected, installed, and maintained in a manner appropriate for both the BMP and the unique conditions of the site. This section provides technical specifications for selecting, designing, and installing (or implementing) BMPs. In general, BMPs should be designed to remove 80 percent of the sediment in the runoff and should ensure that water quality standards and public safety are not jeopardized.

It should be noted that while SWPPPs will identify the primary controls needed during each phase of construction, field personnel should be aware of how to select, adapt, operate, and maintain BMPs cited on plans or installed as a result of corrective actions stemming from field observations. The importance of this concept cannot be overstated.

4.1 BMP Selection Guidelines

General guidelines for selecting BMPs for construction sites are contained in the tables on the following pages, and in the Fact Sheets accompanying each BMP. BMPs are organized according to the following categories. Use these categories to find, scan through, and select BMPs that apply to your site:

- Site Preparation: Initial clearing and grading
- Soil Stabilization: Seeding, mulching, and sodding
- Slope Protection: Silt fences, blankets, mats, gabions
- Drainage System Controls: Inlet and outlet protection, ditches
- Sediment Traps/Basins: Small and large settling *ponds*
- Stream and Wetland Protection: Preserving and restoring waterways
- Good Housekeeping: Prevention of other types of polluted runoff

BMPs can also be selected based on their relative cost and effectiveness. In the table that follows, each BMP in the categories above is listed along with its purpose and application, relative effectiveness, and relative cost of installation and maintenance. For more details on BMP applications, including specific purpose, design criteria, construction specifications, and inspection and maintenance information, see each BMP Fact Sheet in this section. The page numbers in the table can be used to locate each Fact Sheet.

The Fact Sheets in this section are mostly focused on erosion and sediment control, but there are other types of runoff pollutants on a construction site that can be washed into nearby waterways after rain storms or during snowmelt. The table also summarizes BMP effectiveness in treating, removing, or immobilizing various pollutants found at construction sites, including sediment.

The reader is also encouraged to review the *Kentucky Erosion Prevention and Sediment Control Field Guide*. The guide describes the erosion and sediment control process, beginning with sections on pre-project planning and operational activities. The rest of the guide discusses erosion prevention and sediment control by starting at the top of the hill, above the project site, and proceeding down the slope through the bare soil area, ditches and channels, traps and basins, and on down to the waterways below. The field guide and other information on the Kentucky stormwater program is posted at **www.water.ky.gov/permitting/wastewaterpermitting/KPDES/storm/**.

BMP Purpose, Effectiveness, and Relative Costs for Various Construction Site Runoff Pollutants

Ref. No.	BMP Categories & Specific Practices	Purpose and Application	Relative Effectiveness	Relative Installation & Maintenance Costs	Sediment	Oil/ Grease	Nutrients	Toxics	Waste
4.3 Site Preparation									
4.3.1	Land Grading	Manage site clearing, excavation, and importation of fill material to minimize muddy runoff and preserve existing drainage system.	High	Low	●	○	●	○	○
4.3.2	Construction Exit	Keep sediment from being tracked onto public or other roadways. A rock pad of No. 2 stone is built where vehicles exit the site.	High	Low	●	○	○	○	○
4.3.3	Temporary Diversion (Berm or Ditch)	Prevent clean runoff from flowing through disturbed areas. Clean water from upslope areas is diverted around or through the site.	High	Low	●	○	◐	○	○
4.3.4	Topsoil Stockpiling	Preserve topsoil for later use when seeding & landscaping.	High	Low	●	○	●	○	○
4.3.5	Surface Roughening	Slow the velocity of water flowing down a slope and keep the seed and mulch in place. A dozer is operated up and down the slope to create small depressions with the tracks.	Moderate	Low	●	○	●	○	○
4.4 Soil Stabilization									
4.4.1	Temporary Seeding	Provide temporary vegetation and reduce erosion. Must be applied to areas where work has temporarily stopped after 14 days.	High	Low	●	○	●	○	○
4.4.2	Permanent Seeding	Provide permanent vegetation and reduce erosion. Must be applied within 14 days to areas that have reached final grade.	High	Low	●	○	●	○	○
4.4.3	Mulching	Reduce erosion, foster the growth of grass, and keep the soil moist by applying organic ground cover materials.	High	Low	●	○	●	○	○
4.4.4	Sodding	Quickly establish vegetation by using live, rooted mats of grass.	High	Low	●	○	●	○	○
4.4.5	Polyacrylamides	Reduce soil erosion by spraying the chemical binder on soil, or adding it to sediment basins to increase the settling of soil particles.	Moderate	High	◐	○	◐	○	○
4.4.6	Dust Control	Control fugitive dust emissions during dry weather on bare sites.	Moderate	High	◐	○	○	○	○
Page	**BMP Categories & Specific Practices**	**Purpose and Application**	**Relative Effectiveness**	**Relative Installation & Maintenance Costs**	**Sediment**	**Oil/ Grease**	**Nutrients**	**Toxics**	**Waste**
4.5 Slope Protection									

● *BMP is very effective in treating, removing, or immobilizing the target pollutant.*
◐ *BMP is somewhat effective in treating, removing, or immobilizing the target pollutant.*
○ *BMP is not effective in treating, removing, or immobilizing the target pollutant or not applicable.*

BMP Purpose, Effectiveness, and Relative Costs For Various Construction Site Runoff Pollutants

Page	BMP Categories & Specific Practices	Purpose and Application	Relative Effectiveness	Relative Installation & Maintenance Costs	Sediment	Oil/ Grease	Nutrients	Toxics	Waste
4.5.1	Silt Fences	Intercept sheet runoff and provide a place for water to pond, so sediment will fall out.	Moderate	Moderate	◐	○	◐	○	○
4.5.2	Brush, Rock, & Other Sediment Barriers	Intercept and slow down runoff and provide a place for water to pond, so sediment will fall out.	Moderate to high	Moderate	◐	○	◐	○	○
4.5.3	Erosion Control Blankets & Turf Reinforcement Mats	Prevent erosion & protect grass seed by applying blankets or mats to bare soil areas. Required for slopes greater than 2:1 and channel velocities greater than 5 feet per second.	High	High	●	○	●	○	○
4.5.4	Temporary Slope Drains	Transport water down the face of a slope without causing erosion. A pipe or concrete lined channel can be used.	Moderate	High	◐	○	○	○	○
4.5.5	Gabion Baskets and Mattresses	Stabilize steep slopes at the inlet or outlet of a pipe or on a stream bank. Should be used only if vegetation or erosion control blankets/ mats will not work.	High	High	◐	○	○	○	○
4.5.6	Cellular Confinement Systems	Stabilize steep slopes. Should be used only if vegetation or erosion control blanket/mats will not work.	High	High	●	○	◐	○	○
4.6 Drainage System Controls									
4.6.1	Curb Inlet Sediment Barrier	Create a small ponding area for soil to settle out at the front of the inlet using rock bags or commercial products.	Moderate	Moderate	◐	○	◐	◐	○
4.6.2	Drop Inlet Sediment Barrier	Create a small ponding area for soil to settle out around the perimeter of the drop inlet using rock, filter fabric, or other products.	Moderate	Moderate	◐	○	◐	◐	○
4.6.3	Culvert Inlet Sediment Barrier	Create a small ponding area for soil to settle out at the culvert entrance using rock or products.	Moderate	Moderate	◐	○	◐	◐	○
4.6.4	Culvert Outlet Energy Dissipator	Reduce the velocity of water exiting a pipe using a rock apron.	Moderate	High	●	○	◐	○	○
4.6.5	Rock Lined Ditches and Channels	Prevent channel erosion using rock installed on filter fabric.	High	High	●	○	◐	○	○
4.6.6	Grass Lined Ditches and Channels	Prevent channel erosion using vegetation protected by mulch, blankets, or turf mats.	High	High	●	○	◐	○	○
4.6.7	Check Dams for Ditches and Channels	Reduce the channel velocity, prevent channel erosion, and trap sediment.	Low	High	◐	○	◐	○	○
4.7 Sediment Traps and Basins									

● *BMP is very effective in treating, removing, or immobilizing the target pollutant.*
◐ *BMP is somewhat effective in treating, removing, or immobilizing the target pollutant.*
○ *BMP is not effective in treating, removing, or immobilizing the target pollutant or not applicable.*

BMP Purpose, Effectiveness, and Relative Costs For Various Construction Site Runoff Pollutants

Page	BMP Categories & Specific Practices	Purpose and Application	Relative Effectiveness	Relative Installation & Maintenance Costs	Sediment	Oil/ Grease	Nutrients	Toxics	Waste
4.7.1	Temporary Sediment (Silt) Traps	Trap sediment by collecting it in a small depression or bermed area and slowly discharging it.	Moderate	Moderate	◐	○	◐	○	○
4.7.2	Sediment (Detention) Basins	Trap sediment by collecting it in a basin and slowly discharging it. Required for disturbed drainage areas of more than 10 acres.	Moderate to high	High	◐	◐	◐	○	○
4.7.3	Dewatering Devices	Remove sediment from muddy water collected on-site from runoff or groundwater.	High	Moderate	◐	○	○	○	○
4.8 Stream & Wetland Protection									
4.8.1	Buffer Zones	Protect existing vegetation along the banks of a creek, wetland, lake, river, or sinkhole to filter runoff and trap pollutants.	High	Low	●	○	●	◐	○
4.8.2	Filter Strips	Create a vegetative buffer strip along the banks of a creek, wetland, lake, river, or sinkhole to filter runoff and trap pollutants.	High	Moderate	●	○	●	◐	○
4.8.3	Temporary Stream Crossing	Protect stream banks and bottoms from erosion by constructing a span of culverts for vehicles to use in crossing a stream.	Moderate	Moderate	●	○	○	○	○
4.8.4	Bioengineering: Live Staking	Stabilize a stream bank with vegetation by driving live stakes such as willows into the soil to grow.	Moderate	High	●	○	◐	○	○
4.8.5	Bioengineering: Wattles (Live Fascines)	Stabilize a stream bank with vegetation by binding live branches into long bundles and placing them into trenches along the slope to sprout and grow.	Moderate	High	●	○	◐	○	○
4.8.6	Bioengineering: Brushlayering	Stabilize a stream bank with vegetation by inserting live branches into the soil to sprout and grow.	Moderate	High	●	○	◐	○	○
4.9 Good Housekeeping & Other Controls									
4.9.1	Materials Delivery, Storage, and Use	Safely handle materials that might become potential pollutants.	High	Low	○	●	●	●	●
4.9.2	Spill Prevention and Control	Prevent and contain spills of oil, fuel, paint, fertilizers, or other liquids.	High	Low	○	●	●	●	◐

● *BMP is very effective in treating, removing, or immobilizing the target pollutant.*
◐ *BMP is somewhat effective in treating, removing, or immobilizing the target pollutant.*
○ *BMP is not effective in treating, removing, or immobilizing the target pollutant or not applicable.*

BMP Purpose, Effectiveness, and Relative Costs For Various Construction Site Runoff Pollutants

4.9.3	Vehicle and Equipment Maintenance	Minimize or eliminate runoff pollutants associated with operation of vehicles and equipment on the site.	High	Low	◐	●	○	●	◐
4.9.4	Debris and Trash Management	Provide waste storage containers on-site to minimize the amount of debris that is blown or washed off the site.	High	Moderate	○	○	○	○	●
4.9.5	Hazardous Waste Management	Provide containers for storing chemicals to prevent leaks and spillage.	High	Low	○	◐	○	●	●
4.9.6	Concrete Waste Management	Provide areas where trucks can dump concrete waste so that it does not wash into pipes or streams.	High	Low	◐	○	○	◐	●
4.9.7	Sanitary Facilities	Provide permanent or portable sanitary facilities.	High	Moderate	○	○	◐	○	●
4.9.8	Employee Training	Familiarize employees with overall program of runoff controls.	High	Moderate	●	●	●	●	●

● *BMP is very effective in treating, removing, or immobilizing the target pollutant.*
◐ *BMP is somewhat effective in treating, removing, or immobilizing the target pollutant.*
○ *BMP is not effective in treating, removing, or immobilizing the target pollutant or not applicable.*

4.2 BMP Map and Plan Symbols

SWPPPs contain information on site runoff management controls (i.e., BMPs). Much of the information is descriptive, but SWPPPs also include maps and plans of the site, showing pre-construction site conditions (e.g., topography, drainage, land cover), the BMPs that will be applied during construction (e.g., silt fences, sediment traps/basins, ditches), and the final project (e.g., drainage, roads, buildings).

The symbols that follow are used to denote specific activities and structural controls that are described in this section of the *BMP Planning and Technical Specifications Manual*. Each symbol corresponds to a Fact Sheet on the BMP containing information on the definition, purpose, design criteria, construction specifications, and inspection or maintenance requirements. The symbols are also depicted on each Fact Sheet—they should be used on construction site plans to indicate where specific runoff control BMPs will be sited or applied.

Symbols Used to Denote BMPs

Ref. No.	BMP Categories and Specific Practices	Symbol
4.3	***Site Preparation***	
4.3.1	Land Grading	
4.3.2	Construction Exit	
4.3.3	Temporary Diversion (Berm or Ditch)	
4.3.4	Topsoil Stockpiling	
4.3.5	Surface Roughening	
4.4	***Soil Stabilization***	
4.4.1	Temporary Seeding	
4.4.2	Permanent Seeding	
4.4.3	Mulching	
4.4.4	Sodding	
4.4.5	Polyacrylamides	
4.4.6	Dust Control	
4.5	***Slope Protection***	
4.5.1	Silt Fences	
4.5.2	Brush, Rock, and Other Sediment Barriers	
4.5.3	Erosion Control Blankets and Turf Reinforcement Mats	
4.5.4	Temporary Slope Drains	
4.5.5	Gabion Baskets and Mattresses	
4.5.6	Cellular Confinement Systems	
4.6	***Drainage System Controls***	

Ref. No.	BMP Categories and Specific Practices	Symbol
4.6.1	Curb Inlet Sediment Barrier	
4.6.2	Drop Inlet Sediment Barrier	
4.6.3	Culvert Inlet Sediment Barrier	
4.6.4	Culvert Outlet Energy Dissipator	
4.6.5	Rock Lined Ditches and Channels	
4.6.6	Grass Lined Ditches and Channels	
4.6.7	Check Dams for Ditches and Channels	
4.7	***Sediment Traps and Basins***	
4.7.1	Temporary Sediment (Silt) Traps	
4.7.2	Sediment (Detention) Basins	
4.7.3	Dewatering Devices	
4.8	***Stream and Wetland Protection***	
4.8.1	Buffer Zones	
4.8.2	Filter Strips	
4.8.3	Temporary Stream Crossing	
4.8.4	Bioengineering: Live Staking	
4.8.5	Bioengineering: Wattles (Live Fascines)	
4.8.6	Bioengineering: Brushlayering	
4.9	***Good Housekeeping / Other Stormwater Controls***	
4.9.1	Materials Delivery, Storage, and Use	
4.9.2	Spill Prevention and Control	
4.9.3	Vehicle and Equipment Maintenance	
4.9.4	Debris and Trash Management	
4.9.5	Hazardous Waste Management	
4.9.6	Concrete Waste Management	
4.9.7	Sanitary Facilities	
4.9.8	Employee Training	
4.9.9	Groundwater Protection	

Source: These BMP symbols are based on those used by the Kentucky MS4 Workgroup, Louisville-Jefferson County Metropolitan Sewer District, and Mapping Symbols and Nomenclature for Erosion and Sediment Control Plans for Land Disturbing Activities (ANSI/ASAE S422 MAR95), published by the American National Standards Institute and the American Society of Agricultural and Biological Engineers.

4.3 Site Preparation

Initial clearing and grading work on a site requires attention to a fairly common set of general goals:

- Minimize the extent and duration of site disturbance, and maintain existing vegetation as much as possible
- Keep the existing site drainage system - including nearby vegetation - intact as much as possible
- Limit the number of access points to the site to control off-site mud tracking
- Phase and sequence construction activities by dividing the project into logical work zones

Planning the clearing, grubbing, and site preparation work is necessary, especially for larger sites. Written plans—even very basic ones—help to ensure that everyone understands where the active work zones are, various activity phases, and the schedule.

- Locate temporary and permanent soil disposal areas, haul roads, and construction staging areas to minimize erosion, sediment transport, and disturbance to existing vegetation
- Install sediment barriers and controls before land clearing and grading wherever possible
- Get to final grade, seed and mulch as soon as you can

Construction site work includes clearing, grading, and preparing the site for built features like roads, utilities, buildings, parking lots, and the site drainage system. This section covers a broad range of site preparation tasks including land grading, installation of the construction exit, topsoil storage, identifying buffer zones around drainage features, and initial preparation of soil surfaces by roughening.

Contractors and equipment operators should understand erosion control plans developed by engineers and be prepared to adapt the controls as the job progresses. Key control points are areas of concentrated runoff and sheet runoff. Make sure the design, location, schedule, installation, and maintenance of BMPs is logged in the KPDES permit files if the site has a disturbed area of one acre or more.

For more information about designing construction projects that cost less and minimize water resource impacts, see the *Low Impact Development Design Strategies* guide posted at **www.epa.gov/owow/nps/lid/lidnatl.pdf**, or see the *Best Management Practices Manual for Erosion Prevention and Sediment Control* published by the Kentucky MS4 Work Group, posted at **www.bgky.org/publicworks/planningdesign/stormwater/bmpmanual/php**.

The normal sequence for basic site preparation work begins with the installation of controls before clearing and excavation work and ends with all bare areas covered with grass, gravel, or built surfaces, and stable ditches with functioning stormwater systems (see table that follows).

Typical Construction Phasing Schedule for Site Preparation Work

Construction Activity	Scheduling Considerations
Identify work zones and construction phases by analyzing proposed cut/fill work, location of proposed structures, site conditions, and site resources	Construction phase and work zone identification will ensure that land clearing and grading exposes a minimum amount of soil at any one time.
Identify and flag off areas to be protected, such as 25 to 50 ft buffer zones near creeks or sinkholes, drainage features, vegetated filter strips, mature trees, and so on.	All areas should be flagged and posted before land clearing and grading begins. Disturbed areas within 25 ft of streams, wetlands, and sinkholes must be stabilized within 24 hrs.
Install construction entrance/exit and designate vehicle parking areas	First land disturbing activity. Use geotextile liner under rock to maintain effectiveness; stabilize bare areas as soon as possible.
Install upgradient diversion swales or berms.	Seed and mulch as soon as construction of swales or berms is completed.
Size and install sediment barriers (e.g., silt fences), sediment traps, sediment basins, and outlet protection.	Install principal sediment basin(s) first, if possible; install other basins and traps as needed during clearing/grading or construction.
Install inlet protection dams, dikes, filters, screens, and such.	Applies to all curb, drop, pipe, or other inlets.
Construct drainage / runoff conveyance system; stabilize ditches and culvert outlets.	Seed and mulch as soon as possible. Use triple seeding (see seeding rates in Section 4.4.1) in ditches, and blankets/mats as necessary. Ensure that drainage entering streams or other waterbodies does not cause sedimentation.
Begin clearing, grubbing, and grading.	Strip and grade areas only as needed. Get to final grade and apply seed and mulch as soon as possible. Direct runoff toward appropriate controls; install new controls as needed.
Stabilize bare areas after final grade is reached.	Apply temporary or permanent seed, mulch, or other controls as soon as work is completed, but no later than 14 days after grading work in each area is finished.
Construct roads, buildings, parking lots and install utilities.	Install runoff controls as needed to deal with muddy runoff, rutting, and such.
Install landscaping and other final features.	Stabilize all bare areas and ditches. Remove all temporary controls.
Maintenance	Inspect and maintain controls weekly or every 14 days (if 14 day cycle then also after each rain of 0.5 inch or more).

SWPPP preparers and work crews should understand that controls change as the site is graded and construction proceeds. For example, fiber rolls (logs) can control sediment along curbs and roads in relatively flat residential developments, rather than silt fences, which function well in large areas of sheet runoff but are often moved or damaged on small lot applications.

Designating a logical progression for active project work zones and phasing work within those zones helps to minimize the area requiring erosion and sediment controls. Try to match cut and fill needs to minimize disturbed area and material handling.

4.3.1 Land Grading

The goal for land grading is to install necessary controls before clearing or cut/fill work, then get to final grade and seed/mulch as quickly as possible. Protect slopes and concentrated flow areas with extra controls as needed.

LG

Definition

Operations that remove vegetation—such as clearing and grubbing—and reshape the surface of the land through excavation or placement of fill material.

Purpose

Land grading serves to construct designed site drainage features, achieve site grades necessary for construction of roads, buildings, parking lots, and other site features.

Design Criteria

- All borrow and fill or disposal areas should be noted on the SWPPP.
- A phased clearing and grading schedule that minimizes the extent of the denuded areas and minimizes the length of time the areas are exposed should be developed and followed.
- Existing drainage features (e.g., swales, ditches, channels) and the vegetation nearby should be preserved wherever possible.
- Finished cut and fill slopes to be vegetated should not be steeper than 3H:1V unless erosion control blankets or turf reinforcement mats are used.
- Cuts or fills should not be so close to property lines as to endanger adjoining property—adequate protection against erosion, sedimentation, slippage, settlement, subsidence, and other damage must be implemented.
- Subsurface drainage should be provided to areas having high water tables to intercept seepage that might affect slope stability.
- Ditches and other drainage system features should be designed to safely convey increased runoff from cleared or developed areas without causing downstream channel aggradation, degradation, or increased off-site flooding.
- The site should be graded to direct flows to appropriate BMPs or other controls.
- Temporary structural controls (e.g., silt fencing, ditch checks, inlet dikes) installed during construction must be designed to accomplish maximum stabilization and control of erosion and sedimentation and must be installed, maintained, and removed according to the specifications set forth in this manual.

- All permanent structural controls, including drainage facilities such as channels, storm sewer inlets, and detention basins, must be designed according to the standards set forth in this manual.

Construction Specifications

- Drainage system controls (e.g., sediment traps/basins, ditches) and perimeter controls (silt fences, construction exit) should be installed before land grading.
- No fill may be placed where it can slide or wash onto adjoining property unless proper erosion and sediment control measures and proper stabilization is provided.
- No fill may be placed adjacent to creek channel banks where it can cause bank failure, reduce stream flow capacity, or wash into creeks unless proper erosion and sediment control measures and proper stabilization is provided.
- Brush cleared from the site can be used as a temporary downgradient sediment barrier if placed on the contour to intercept and detain muddy runoff.
- Stabilized construction entrances must be located and used at all points of ingress/egress on a construction site. The transfer of soil, mud and dust onto public rights-of-ways must be prevented.
- Whenever construction dewatering operations are required on a site, they must be conducted according to the specifications set forth in this manual and according to KPDES requirements if discharging to a ditch or waterbody.
- Crossings of waterways during construction must be minimized and covered under the appropriate USACE section 404 permit. Encroachment into stream buffers, riparian areas, and wetlands must be avoided.
- Topsoil must be stockpiled and preserved from erosion or dispersal both during and after site grading operations.
- Cut and fill slopes should be seeded and mulched (or covered with blankets/mats) immediately after construction (i.e., within 14 days).
- Where construction or land disturbance activity will or has temporarily ceased on any portion of a site, temporary site stabilization measures must be required as soon as practicable, but no later than 14 calendar days after the activity has ceased.
- Final stabilization of the site must be required within 14 calendar days of construction completion.

The following sensitive features should be noted on site maps and plans:

- *Local Regulatory Floodplain and Conveyance Zone, as defined by local ordinances (see local planning and zoning or public works office).*
- *Stream and river corridors (including blue line and intermittent), as mapped by United States Geological Survey on 7.5 minute topographic maps.*
- *Karst features with a well-defined surface opening, such as a cave, sinkhole, vadose shaft, or other karst feature.*
- *Lakes and impoundments and their dams and spillways.*
- *Jurisdictional wetlands as determined by the USACE or that meet USACE designation criteria.*
- *Slopes greater than 25% (4H:1V).*
- Erodible *and* severely erodible *soils, as determined by the Natural Resources Conservation Service.*
- *Sites with the potential to drain stormwater directly into a sensitive feature listed above (including any designated buffer area for that feature) or into a designated greenway.*

Inspection and Maintenance

- Inspect ditches and other areas where runoff exits the site for rutting or evidence of muddy flows. Install BMPs (e.g., silt traps, sediment barriers) as needed.
- Inspect perimeter controls where sheet runoff exits the site for silt fence undercutting, bypassing, or damage. Repair existing controls or install new ones as needed.
- Inspect sediment traps and basins and other drainage system controls weekly and after rainfall of one-half inch or more to verify available sediment storage capacity.
- Inspect construction exit to ensure that no mud tracking onto the paved road is occurring.
- Check flagged areas to ensure that no damage or other impacts are occurring in stream buffers or other protected areas.
- Inspect cleared and excavated areas continuously to check for the presence of underground pipelines, tanks, sinkholes, or other unforeseen features.

Install silt fencing, sediment traps, and stabilize ditches before clearing and grading. Make sure stakes are on the downhill side of the silt fence!

Flag off and preserve vegetated areas along streams, wetlands, lakes, and ponds wherever possible. Keeping these areas intact minimizes the expenses involved in CWA section 404 permitting and extensive erosion and sediment controls. Riparian zone vegetation provides an excellent buffer against sediment carried by sheet runoff.

4.3.2 Construction Exit

Definition

Stabilized construction exits are installed before clearing and grading work begins, and maintained until the site is stabilized. Inspections should note whether mud is being tracked onto paved roads. Truck shaker racks or tire spray wash units can also be used to control off-side sediment tracking.

A construction exit is a stabilized pad of 2-inch or larger rock at any point where vehicles or equipment leave a construction site and enter a public right-of-way, street, alley, sidewalk, or parking area.

Purpose

A stabilized construction exit is intended to reduce off-site sedimentation and improve public safety by eliminating the tracking or other movement of sediment onto public rights-of-way.

Design Criteria

Construction plans must limit traffic exiting the site to properly constructed and stabilized construction exits.

- The entrance must be constructed at a location that minimizes the impact to streams and storm drains and maximizes public safety.
- The aggregate size for construction of the pad must be 2–3 inch stone, at a minimum (KYTC No. 1 or No. 2, not 57s or DGA).
- The thickness of the pad must not be less than 6 inches. Use geotextile fabrics below the rock, if necessary, to improve stability of the foundation in locations subject to seepage or high water table.
- The width of the pad must not be less than the full width of all points of ingress or egress and, in any case, must not be less than 12 feet wide. Allow for necessary turning radii for trucks and equipment. The length of the pad must be as required, but not less than 50 feet.

Construction Specifications

- Construct rock construction exit before clearing, grubbing, and grading the site. Place the gravel to the specific grade and dimensions shown on the plans, and level it out. A geotextile underliner helps to keep rock up out of the mud and functioning properly to remove mud from vehicle and equipment tires.
- Construction entrances will be located as shown on the development plans, or as directed by approving regulatory agency. Any deviation from this location must receive regulatory agency approval.
- Provide drainage to direct muddy runoff from the construction exit toward a sediment trap or other controlled area. In no case should muddy runoff from the construction exit flow onto roads, parking lots, surface waters, or adjacent properties.

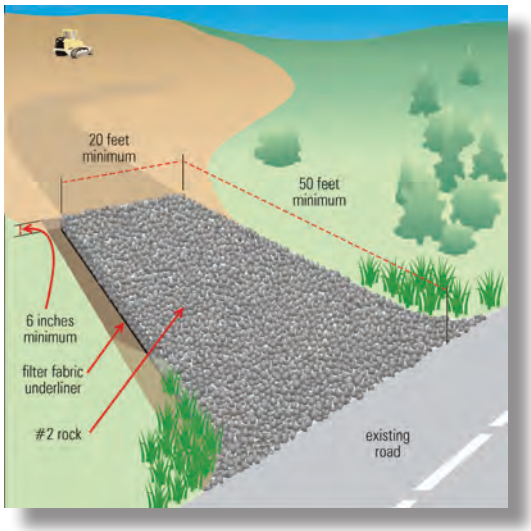
- When necessary, wheels must be cleaned with a shovel, scraper, or high-pressure water hose to remove sediment before entrance onto roads or other paved areas. When washing is required, it must be done on an area stabilized with KYTC No. 1 or No. 2 rock that drains into an approved sediment trap or sediment basin.

Inspection and Maintenance

Inspect all construction exits twice a day during dry weather and more often during wet weather. Encourage equipment operators and other personnel to immediately report any mud tracking onto paved off-site areas.

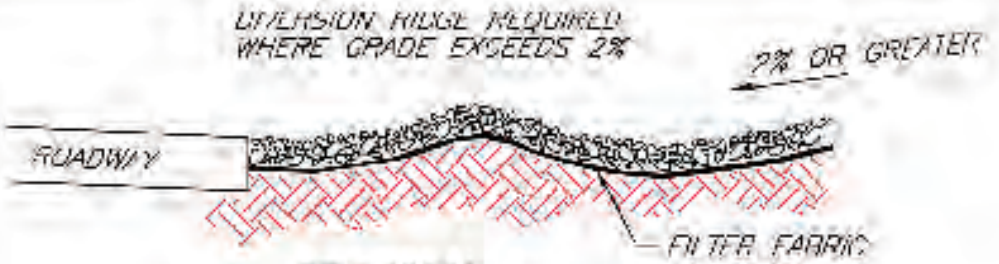
- All sediment spilled, dropped, washed or tracked onto public rights-of-way must be removed immediately.
- The entrance must be maintained in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. This could require periodic top dressing with additional stone as conditions demand, and repair or maintenance of any measures used to trap sediment.
- Replace gravel material when surface voids are filled with soil, or use a grubbing rake mounted to a front-end loader to stir the rock during dry conditions and shake down fine soil particles.
- Sediment from construction entrances and exits must be prevented from entering any storm drain, ditch, or watercourse through use of sediment traps, sand bags, commercial sediment dikes, inlet filters, or other approved methods. Maintain traps or other sediment trapping structures as needed.

A well-maintained construction exit keeps mud off the pavement and helps to reduce potential legal liability.



Dimensions are approximate; exits might need to be wider or longer to keep mud off paved public roads.

The construction exit will be one of the first things an inspector sees at the construction site and is often a good indication of how other controls are installed and maintained.



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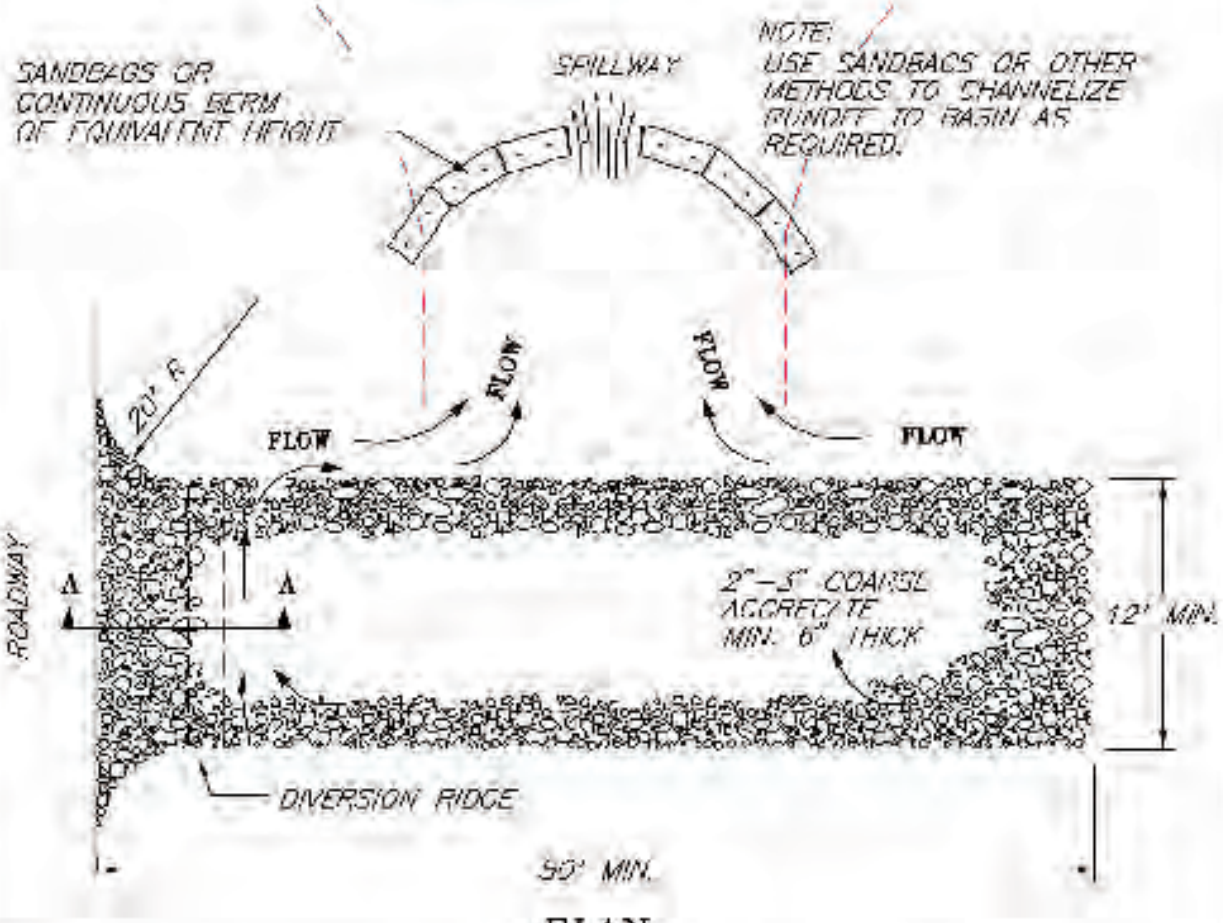


PLAN

NOTES:

1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

CONSTRUCTION ENTRANCE

4.3.3 Temporary Diversion (Berm or Ditch)

Use berms, ditches, fiber rolls, or other diversions to direct upslope water away from the disturbed area. This helps to reduce the amount of muddy runoff that controls must handle.

TD TD

Di

Definition

A temporary berm, ditch, or channel constructed above an area of exposed soil.

Purpose

Temporary diversion is intended to divert clean upland runoff or drainage water away from unprotected disturbed areas and toward a vegetated infiltration area, stabilized ditch, or other stabilized outlet.

Design Criteria

Locate diversion berms and ditches to intercept and carry runoff around or through bare soil areas as needed. Berms should be located to minimize damage by construction operations and traffic.

- Berms and ditches should be designed to carry the 10-year, 24-hour peak flow.
- Side slopes should be 2H:1V or flatter.
- Freeboard should be at least 0.5 feet.
- Berms and ditches should be stabilized with triple-seeded grass (see seeding rates in Section 4.4.1) and mulch or an erosion control blanket, turf reinforcement mat, or rock. For information on stabilizing ditches of varying slopes, see Sections 4.6.5–4.6.7.

Construction Specifications

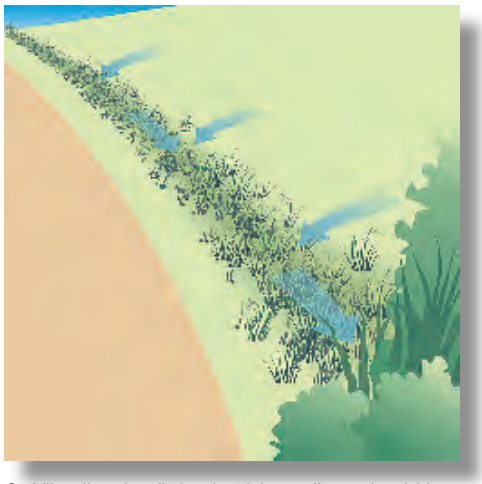
Temporary diversion berms or ditches must be installed as a first step in the land-disturbing activity and must be functional before downslope land disturbance.

- The berm must be adequately compacted to prevent failure.
- Temporary or permanent seeding and mulch must be applied to the berm or ditch immediately following its construction. Triple-seed areas below the flow line, and use erosion control blankets or turf reinforcement mats as needed.

Inspection and Maintenance

Inspect berms and ditches weekly and after every rainfall greater than one-half inch and after any repairs are made to the berm or flow channel. Check to make sure that berm or ditch is stable and outlet or infiltration areas are not eroding.

- If vegetation has not been established, reseed damaged and sparse areas immediately. Triple seed (see seeding rates in Section 4.4.1) areas below the flow line, and use erosion control blankets or turf reinforcement mats as necessary.
- Damages caused by construction traffic or other activity must be repaired before the end of each working day.

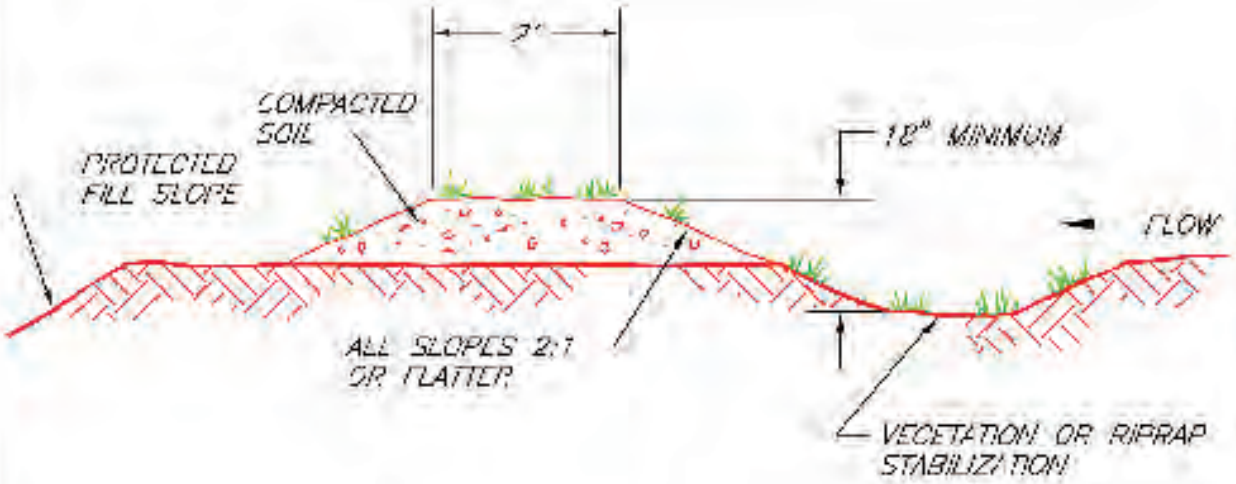


Stabilize diversion ditches by triple-seeding and mulching. Use nets or blankets if slopes are long (> 50 ft) and exceed 2 percent.

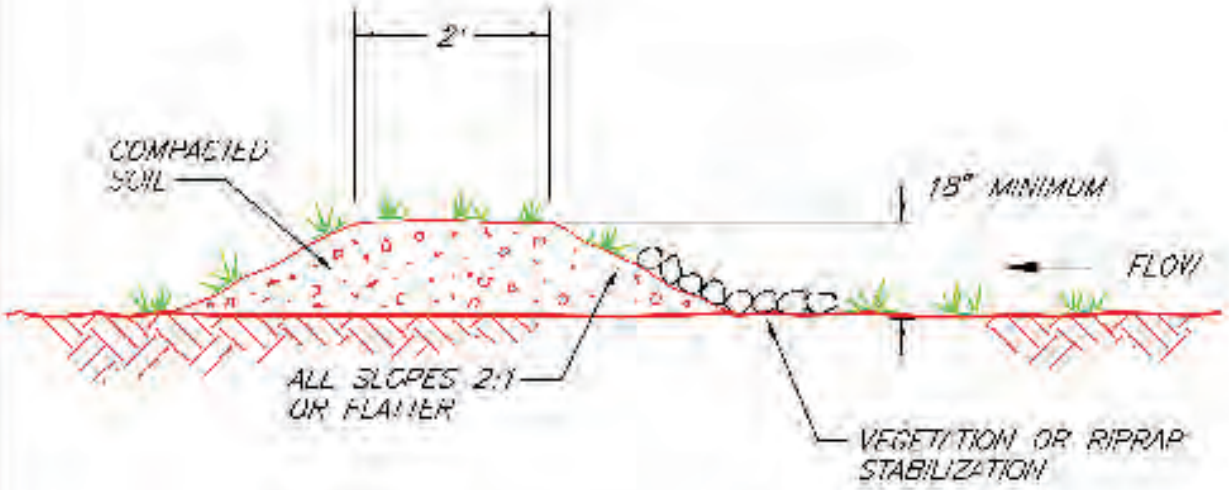
Diversion berms can be temporary or permanent. Make sure they are seeded and mulched immediately after construction. The upslope swale alongside steep berms might need an erosion control blanket to prevent scouring (for drainage system controls, see Section 4.6).

Stable diversion ditch protects slope during excavation and afterwards. Note spreader configuration of ditch discharge point, which helps dissipate flows.

Diversion berm directing runoff toward sediment trap: Controlling sheet runoff with berms and ditches ensures that flows are managed appropriately and provides the framework for a system of sediment traps and basins on larger sites.



TYPICAL FILL DIVERSION



TYPICAL TEMPORARY DIVERSION DIKE

NOTES:
1. THE CHANNEL BEHIND THE DIKE SHALL HAVE POSITIVE GRADE TO A STABILIZED OUTLET
2. THE DIKE SHALL BE ADEQUATELY COMPACTED TO PREVENT FAILURE.
3. THE DIKE SHALL BE STABILIZED WITH TEMPORARY OR PERMANENT SEEDING OR RIPRAP.

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

DIVERSION CHANNEL

4.3.4 Topsoil Stockpiling

Stockpiles of soil can deliver large amounts of muddy runoff to paved roads, adjacent lawns, and local creeks. Plans should specify that soil should be stored on flat areas, seeded, and surrounded with silt fencing to control offsite sediment impacts.

Definition

Stockpiling is the salvaging, storing, protecting, and use of topsoil to enhance final site stabilization and support selected vegetation.

Purpose

The purpose of topsoil stockpiling is to provide a suitable growth medium for vegetation. It should be used where the subsoil or areas of existing surface soil present the following problems:

- The structure, pH, or nutrient balance of the available soil cannot be amended by reasonable means to provide an adequate growth medium for the desired vegetation.
- The soil is too shallow to provide adequate rooting depth or will not supply necessary moisture and nutrients for growth of desired vegetation.
- The soil contains substances toxic to the desired vegetation.
- Stockpiling should also be used where high-quality turf or ornamental plants are desired and where slopes are 2H:1V or flatter.

Topsoil is the surface layer of the soil profile, generally characterized as darker than the subsoil because of enrichment with organic matter. It is the major zone of root development and biological activity—microorganisms that enhance plant growth thrive in this layer. Topsoil can usually be differentiated from subsoil by texture as well as color. Clay content usually increases in the subsoil. Where subsoils are often high in clay, the topsoil layer can be significantly coarser in texture. The depth of topsoil can be quite variable. On severely eroded sites, it might be gone entirely.

Advantages of topsoil over subsoil include its high organic-matter content and friable consistence (soil aggregates can be crushed with only moderate pressure) and its available water-holding capacity and nutrient content. The texture and friability of topsoil provide benefits to seedlings the growth of their roots. In addition to being a better growth medium, topsoils are often less erodible than subsoils, and the coarser texture of topsoil increases infiltration capacity and reduces runoff.

Although topsoil can provide an improved growth medium, there could be disadvantages, too. Stripping, stockpiling, hauling, and spreading topsoil or importing topsoil might not be cost effective. Handling can be difficult if large amounts of branches or rocks are present, or if the terrain is rough. Most topsoil contains weed seeds that compete with desirable species.

In site planning, compare the options of stockpiling with preparing a seedbed in the available subsoil.

The clay content of many subsoils retains moisture. When properly limed and fertilized, subsoils can provide a satisfactory growth medium that is generally free of weed seeds. Stockpiling is normally recommended where ornamental plants or high-maintenance turf will be grown. It might also be required to establish vegetation on shallow soils, soils containing potentially toxic materials, stony soils, and soils of critically low pH (high acidity).

Design Criteria

If topsoil is to be stockpiled, consider the following:

- Quality and amount of topsoil available and needed.
- Location for a stabilized stockpile that will not erode, block drainage, or interfere with work on the site. Topsoil stockpiles should be on flat ground if possible, and protected by a silt fence or other sediment barrier on the downgradient sides. Topsoil that will not be used for more than 14 days must be mulched or seeded.
- If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly, and it will be difficult to establish vegetation. To promote bonding, scarify or rip subsoil to a depth of 8–12 inches; do not compact during topsoil placement operations.
- Do not apply topsoil to slopes steeper than 2:1 to avoid slippage, or to a subsoil of highly contrasting texture. Sandy topsoil over clay subsoil is a particularly poor combination, especially on steep slopes. Water can creep along the junction between the soil layers and cause the topsoil layer to slip or slough.

Cubic Yards of Topsoil Required to Attain Various Soil Depths

Depth (Inches)	Per 1,000 Square Feet	Per Acre
1	3.1	134
2	6.2	268
3	9.3	403
4	12.4	537
5	15.5	672
6	18.6	806

Construction Specifications

Materials

Quality topsoil has the following characteristics:

The best texture is loam, sandy loam, and silt loam. Sandy clay loam, silty clay loam, clay loam, and loamy sand are fair. Do not use heavy clay and highly organic soils such as peat or muck as topsoil.

Organic matter content should be greater than 1 percent by weight.

Liming is required if pH is less than 6.0.

The depth of material meeting the above qualifications should be at least 2 inches. Soil factors such as rock fragments, slope, depth to water table, and layer thickness affect the ease of excavation and spreading of topsoil.

Generally, the upper part of the soil that is richest in organic matter is most desirable; however, material excavated from deeper layers could be worth storing if it meets the other criteria listed above.

Organic soils such as mucks and peats do not make good topsoil. They can be identified by their extremely light weight when dry.

Stripping

Strip topsoil from only those areas that will be disturbed by excavation, filling, road building, or compaction by equipment. **Avoid stripping topsoil to the extent that stormwater infiltration is significantly reduced.** A 4–6 inch stripping depth is common but depth varies depending on the site. Determine depth of stripping by taking soil cores at several locations within each area to be stripped. Topsoil depth generally varies along a gradient from hilltop to toe of slope. Put sediment basins, diversions, and other controls into place before stripping.

Stockpiling

Select stockpile location to avoid slopes, flood plains, natural channels, and traffic routes. Stockpiles should be placed away from water bodies to prevent sedimentation. On large sites, re-spreading is easier and more economical when topsoil is stockpiled in small piles near areas where they will be used.

Use silt fences or other barriers where necessary to retain sediment.

Protect topsoil stockpiles by temporarily seeding as soon as possible, and for no longer than 14 days if the stockpile is idle.

If stockpiles will not be used within 2 months, they must be stabilized with permanent vegetation to control erosion and weed growth.

Site Preparation

Before spreading topsoil, establish erosion and sedimentation control practices such as diversions, berms, and sediment basins.

Maintain grades on the areas to be topsoiled according to the approved plan. Adjust grades and elevations for receipt of topsoil.

Where the pH of the existing subsoil is 6.0 or less, or the soil is composed of heavy clays, incorporate agricultural limestone in amounts recommended by soil tests or specified for the seeding mixture to be used. Incorporate lime to a depth of at least 2 inches by disking.

Immediately before spreading the topsoil, loosen the subgrade by disking or scarifying to a depth of at least 4 inches to ensure bonding of the topsoil and subsoil. If no amendments have been incorporated, loosen the soil to a depth of at least 6 inches before spreading topsoil.

Spreading Topsoil

Uniformly distribute topsoil to a minimum compact depth of 2 inches on 3:1 slopes and 4 inches on flatter slopes. Do not spread topsoil while it is frozen or muddy or when the subgrade is wet or frozen.

Correct any irregularities in the surface that result from stockpiling or other operations to prevent the formation of depressions or water pockets.

Compact the topsoil enough to ensure good contact with the underlying soil, but avoid excessive compaction as it increases runoff and inhibits seed germination. Light packing with a roller is recommended where high-maintenance turf is to be established.

On slopes and areas that will not be mowed, the surface may be left rough after spreading topsoil. A disk may be used to promote bonding at the interface between the topsoil and subsoil.

After topsoil application, follow procedures for temporary or permanent seeding, taking care to avoid excessive mixing of topsoil into the subsoil.

This is a good location of topsoil pile on flat, grassy area and good use of a silt fence to protect nearby creek (foreground).

4.3.5 Surface Roughening

Specify surface roughening for bare areas that will be prepared for seeding and sodding. Roughening improves soil-to-seed contact and reduces erosion on slopes.

SR

Definition

Surface roughening is a technique for creating horizontal depressions, furrows, or other roughened surfaces on bare ground using tracked or other equipment.

Purpose

Surface roughening is intended to aid the establishment of vegetative cover from seed, reduce runoff velocity, increase infiltration, reduce erosion, and to provide for sediment trapping. All construction slopes require surface roughening to facilitate long-term stabilization with vegetation, particularly slopes that are steeper than 3H:1V.

Rough slope surfaces are preferred because they aid the establishment of vegetation, improve water infiltration, and decrease runoff velocity. Graded areas with smooth, hard surfaces can be initially attractive, but such surfaces increase the potential for erosion. A rough, loose soil surface is more favorable for rain infiltration and moisture retention than hard, smooth surfaces; this aids in seed germination.

Design Criteria

There are different methods for achieving a roughened soil surface on a slope, and the selection of an appropriate method depends upon the type of slope. Roughening methods include stair-step grading, furrowing, and tracking. Factors to consider in choosing a method are slope steepness, mowing requirements, and whether the slope is formed by cutting or filling.

Roughening techniques that call for indentations, furrows, ridges, stair-step grading (small benches), and so forth (see table) should specify that all these features be perpendicular to the direction of flow (i.e., across the slope rather than up and down). Surface roughening should be specified for all slopes at final grade and those not being actively worked as detailed below in the Construction Specifications section.

Soil Conditions vs. Erosion

If soil is:	Erosion will be:
Compacted and smooth	30 percent *more*
Tracks across slopes	20 percent *more*
Tracks up & down slopes	10 percent *less*
Rough and irregular	10 percent *less*
Rough & loose to 12" deep	20 percent *less*

Construction Specifications

Cut Slope Roughening

- Stair-step grade or groove all cut slopes that are steeper than 3H:1V.
- Use stair-step grading on any erodible material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.
- Make the vertical cut distance less than the horizontal distance, and slightly slope the horizontal position of the *step* in toward the vertical wall.
- Do not make individual vertical cuts more than 2 feet high in soft materials or more than 3 feet high in rocky materials.
- Groove the slope using machinery to create a series of ridges and depressions that run across the slope, on the contour.

Fill Slope Roughening

- Place fill slopes with a gradient steeper than 3H:1V in lifts not to exceed 8 inches, and make sure each lift is properly compacted.
- Ensure that the face of the slope consists of loose, uncompacted fill 4–6 inches deep.
- Use grooving or tracking to roughen the face of the slopes, if necessary. Grooves and track indentions must be perpendicular to the direction of downslope flow.
- Apply seed, fertilizer, and straw mulch then track or punch in the mulch with the bulldozer.
- Do not blade or scrape the final slope face.

Cuts, Fills, and Graded Areas

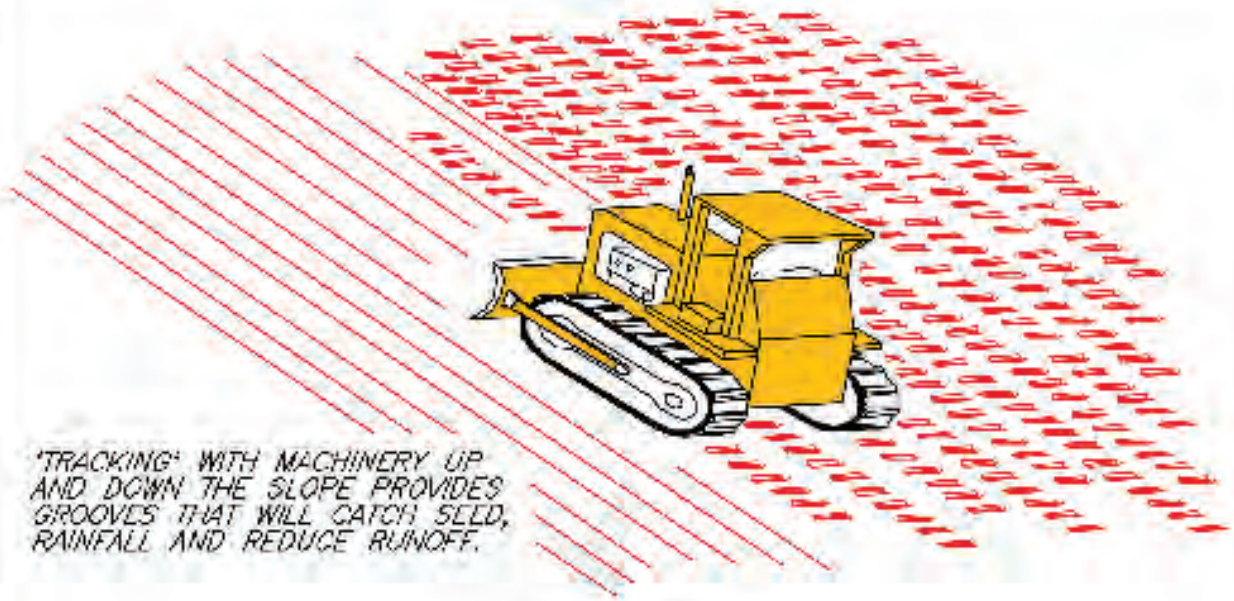
- Make mowed slopes no steeper than 3H:1V.
- Roughen these areas to shallow grooves by normal tilling, disking, harrowing, or use a cultipacker-seeder. Make the final pass of any such tillage on the contour (i.e., across the slope rather than up and down).
- Make grooves formed by such implements close together (less than 10 inches, and not less than 1 inch deep).
- Excessive roughness is undesirable where mowing is planned.

Roughening With Tracked Machinery

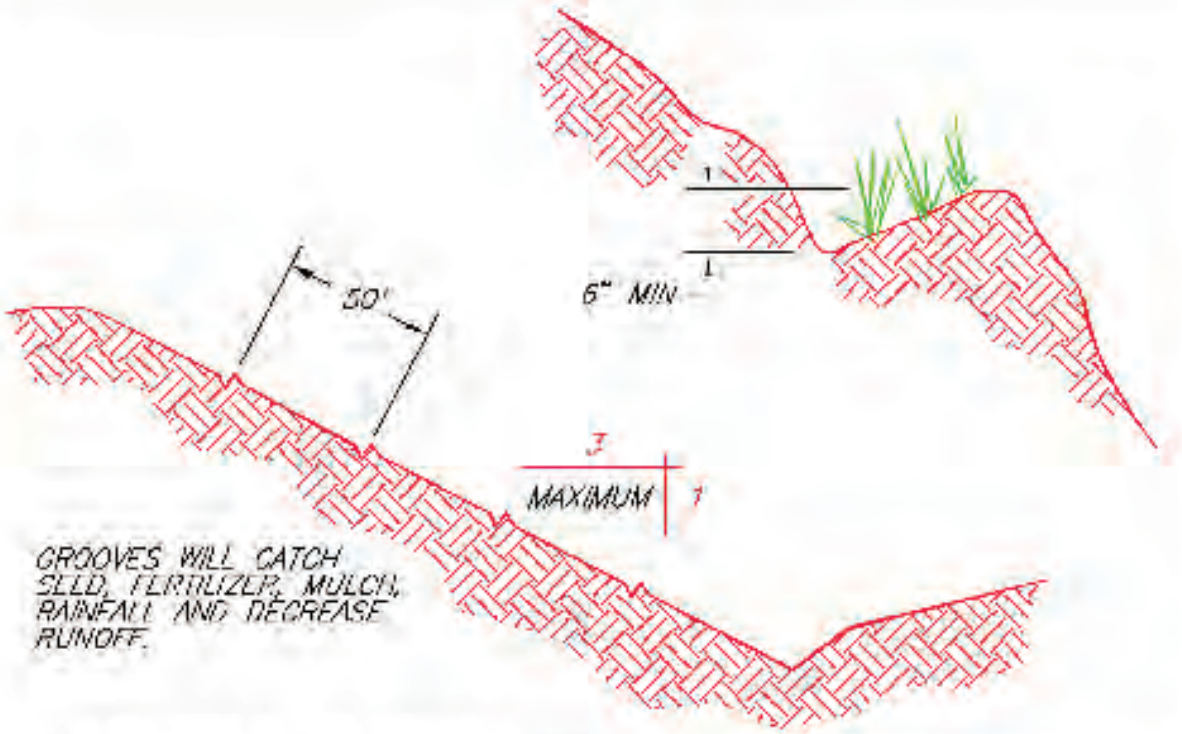
- Limit roughening with tracked machinery to soils with a sandy textural component to avoid undue compaction of the soil surface. Tracking soils with heavy clay content can cause compaction and *seal* the slope soils, increasing runoff and making seed germination difficult.
- Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. Do not back-blade during the final grading operation.
- Immediately seed and mulch roughened areas to obtain optimum seed germination and growth. Use erosion control blankets or turf reinforcement mats on long (> 50 feet) steep (> 2H:1V) slopes as necessary, or hydroseed.

Inspection and Maintenance

Periodically check the seeded slopes for rills and washes. Fill these areas slightly above the original grade, then reseed and mulch or cover with blanket or mat as soon as possible.



TRACKING



CONTOUR FURROWS

SURFACE ROUGHENING

4.4 Soil Stabilization

General Information

A variety of soil stabilization BMPs are available. All practices discussed in this section seek to vegetate or otherwise cover bare soil areas with grass, mulch, sod, or other material for the purpose of reducing raindrop erosion, muddy runoff, gullying, and dust problems. Note that for all sites with a disturbed area of one acre or more, **Kentucky requires that bare areas that have not been actively worked for 14 consecutive days be temporarily or permanently stabilized.** In practice, this means that seed, mulch, or other cover must be in place after 14 days if no clearing or grading has occurred in an area. Also, note that the use of erosion control blankets and turf reinforcement mats—which are specified for some bare areas, slopes, and ditches—are discussed in the Slope Protection section.

Hydraulically Applied Products

Note that hydraulically applied (i.e., spray-on) seed and mulch products have undergone rapid development and improvement during the past 10 years and now provide seed establishment and soil protection performance equivalent (or superior) to conventional seeding and mulching practices. The key benefits of hydraulically applied products are realized on large sites with steep (3H:1V to 1H:1V), long slopes or other areas where installation of erosion control blankets or turf reinforcement mats is difficult. A nearby source of water—or water tank—to mix the slurry is also necessary for large sites.

Typical hydraulic soil cover applications include a slurry-like mix of seed, fertilizer, and mulch. Also available for inclusion are other amendments such as tackifier and a variety of fibrous materials that dry to form a flexible *net* or crust that provides excellent protection for bare soil before seed germination.

Application equipment ranges from small, hand-pulled polyethylene units with electric sprayers and tanks that hold up to 15 pounds of seed, fertilizer, and mulch to large, towed or truck-mounted machines with tanks of 100–2,000 gallons. Mixing ratios will vary significantly by application, but in general a standard turf application for one acre will include 100–150 pounds of seed (or more, depending on seed variety and site conditions), 300–400 pounds of fertilizer, 140 pounds of binder, and 1,500–2,000 pounds of fiber mulch mixed with 4,000 or more gallons of water.

Soils on flatter areas are stabilized by temporary/permanent seeding and mulching. On slopes, tracking with a bulldozer or other equipment creates indentations perpendicular to runoff flow that effectively increase overall slope length and trap seed and sediment. Long, steep slopes typically require erosion control blankets or turf reinforcement mats (see Slope Protection section). Another key planning consideration for slopes is how to get upslope drainage down to the bottom, which is also covered in the Slope Protection section.

4.4.1 Temporary Seeding

Temporary seeding and/or mulching is necessary for bare areas that have not been worked for 14 or more consecutive days, according to state and local regulations.

Definition

Temporary seeding uses rapidly growing grass to stabilize disturbed areas that have not reached final grade. Areas that will be inactive for 14 days or more must be seeded and mulched.

Purpose

Temporary seeding serves to reduce problems associated with muddy runoff or dust from bare soil surfaces during construction and to maintain sheet flow, protect the soil surface, and promote infiltration into the soil; to protect the soil and prepare it for permanent seeding at a later date; and to reduce aesthetic and other concerns regarding water quality and visual impacts associated with construction areas.

Design Criteria

The area must be protected from excess run-on from upgradient areas as necessary with diversions or berms. Plant species must be selected on the basis of quick germination, growth, and time of year to be seeded. Fertilizer, lime, seedbed preparation, seed coverage, mulch, and irrigation must be used as necessary to promote quick plant growth.

Mulch should be specified for sites with slopes greater than five percent (20H:1V) and slope lengths greater than 100 feet.

Construction Specifications

Site Preparation

Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and anchoring.

Install the needed erosion control practices before seeding such as diversions ditches and berms.

Do not apply fertilizer, lime, or seed before heavy rain storms (e.g., predicted to be one-half inch or more in one hour or less).

Seedbed Preparation

Mix seed, mulch, and other material for application via hydraulic spray equipment or follow the procedure below.

Spread lime (in lieu of a soil test recommendation) on acid soil (pH 5.5 or lower) and subsoil at a rate of one ton per acre of agricultural ground limestone. For best results, test soil pH and fertility—this can

reduce the expense of unneeded lime and fertilizer and potential excess nutrient loss through runoff and leaching.

Fertilizer (in lieu of a soil test recommendation) must be applied at a rate of no more than 800 pounds per acre of 10-10-10 analysis or equivalent.

Work the lime and fertilizer into the soil with a disk harrow, springtooth harrow, or similar tools to a depth of two inches. On sloping areas, the final operation must be on the contour.

Seeding Rates for Temporary Site Protection

March 1 to October 31	Per 1,000 Square Feet	Per Acre
1. Oats	3 lbs.	120 lbs.
2. Perennial Ryegrass	1 lbs.	40 lbs.
3. Tall Fescue	1 lbs.	40 lbs.
4. Wheat	3 lbs.	120 lbs.
5. Annual Rye	3 lbs.	120 lbs.
November 1 to February 28	**Per 1,000 Square Feet**	**Per Acre**
1. Annual Rye	3 lbs.	120 lbs.
2. Wheat	3 lbs.	120 lbs.
3. Perennial Ryegrass	1 lb.	40 lbs.
4. Tall Fescue	3 lbs.	120 lbs.

Apply the seed uniformly with a cyclone seeder, drill, or hydroseeder (slurry can include seed and fertilizer) preferably on a firm, moist seedbed. Seed no deeper than one-fourth inch to one-half inch.

When feasible, except where a cyclone type seeder is used, the seedbed should be firmed following seeding operations with a cyclone, roller, or light drag. On sloping land, seeding operations should be on the contour wherever possible.

Triple the seeding rate for all ditches that will carry flowing water; cover seed with erosion control blanket or turf reinforcement mat if needed to prevent ditch erosion.

Inspection and Maintenance

Water the soil until the grass is firmly established. This is especially needed when seedings are made late in the planting season, in abnormally dry and hot seasons, or on sites with steep slopes or other adverse conditions.

Prepare spot repairs by working soil where seed establishment is poor, applying additional seed, and covering with mulch or erosion control blanket. Water area during dry conditions.

Designate haul roads and material storage areas on large sites, and seed or mulch the rest to minimize the amount of bare areas exposed to the weather. KPDES regulations require that portions of the site that have not been worked for 14 consecutive days be temporarily or permanently stabilized with seed and/or mulch.

4.4.2 Permanent Seeding

Establishing grass through broadcast or hydro-seeding reduces erosion and sediment loss by more than 90 percent. Use mulch on short flatter slopes and erosion control blankets or hydro-mulch on long steep slopes.

Definition

Permanent seeding is the establishment of permanent, perennial vegetative cover—usually grass—on disturbed areas. Permanent seeding must be applied to disturbed areas within 14 days of reaching final grade if no temporary cover is applied.

Purpose

Permanent seeding is intended to maintain sheet flow, promote infiltration, and reduce problems associated with muddy runoff or dust from bare soil surfaces during construction; to reduce sediment runoff to downstream areas and improve the visual aesthetics of the construction area; and to provide permanent site stabilization in preparation for completion of the project.

Design Criteria

The area must be protected from excess runoff as necessary with upgradient diversion berms or ditches. Plant species must be selected on the basis of quick germination, growth, and time of year to be seeded. Fertilizer, lime, seedbed preparation, seed coverage, mulch, and irrigation must be applied as necessary to promote quick plant growth.

Construction Specifications

Site Preparation

Soil should be capable of supporting permanent vegetation and have at least 25 percent silt and clay to provide an adequate amount of moisture holding capacity. An excessive amount of porous sand will not consistently provide sufficient moisture for good growth regardless of other soil factors.

- Plan to seed all areas as soon as final grade is reached, to take advantage of soil seedbed conditions and to minimize erosion potential.
- Where compacted soils occur, they should be broken up sufficiently to create a favorable rooting depth of 6–8 inches.
- Stockpile topsoil to apply to sites that are otherwise unsuited for establishing vegetation. Approximately 400 cubic yards of topsoil per acre are needed for application depths of 3 inches (~9.3 cubic yards per 1,000 square feet).
- Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application and anchoring, and maintenance. After the grading operation, spread topsoil where needed.

- Install the needed erosion control practices, such as diversion berms and ditches.

Seedbed Preparation

Spread lime (in lieu of a soil test recommendation) on acid soil and subsoil, at a rate of one ton per acre of agricultural ground limestone. For best results, test the soil—this can reduce the expense of unneeded lime and fertilizer and potential excess nutrient loss through runoff and leaching.

Fertilizer (in lieu of a soil test recommendation) should be applied at a rate of no more than 800 pounds per acre of 10-10-10 analysis. For best results, test the soil to determine fertilizer requirements. In limestone areas with streams and rivers impacted by high algae concentrations, use 10-0-10 fertilizer.

Work the lime and fertilizer into the soil with a disk harrow, springtooth harrow, or other suitable field equipment to a depth of 4 inches. On sloping land, the final operation must be on the contour.

Kentucky Transportation Cabinet Seed Mixes

Mixture Type	Seed Mixture
Mixture No. I	75% Kentucky 31 Tall Fescue 10% Red Top 5% White Dutch Clover 10% Ryegrass (perennial)
Mixture No. III	30% Kentucky 31 Tall Fescue 15% Red Top 15% Partridge Pea 20% Sericea Lespedeza 10% Sweet Clover – Yellow 10% Ryegrass

KYTC does not specify the seeding rate but requires that sufficient seed be applied to ensure a "dense, uniform vegetative cover."

Recommended Seeding Rates and Other Information for Various Species and Seed Mixtures

Seed species & mixtures	Seeding rate/acre	Per 1000 sq. ft	Soil pH	Other Information
Seed and seed mixtures for relatively flat or slightly sloping areas				
Perennial ryegrass	25 to 35 lbs	1 lb	5.6 to 7.0	Apply lime at 2 tons per acre if soil pH is below 5.5; use 400-800 lb fertilizer (10-10-10) on poor soils. Use wildflower mixes to save on mowing and watering costs.
+ tall fescue	15 to 30 lbs	1 lb	5.5 to 7.5	
Tall fescue	40 to 50 lbs	1.5 lb		
+ ladino or white clover	1 to 2 lbs	2 oz		
Steep slopes, banks, cuts, and other low maintenance areas (not mowed)				
Smooth bromegrass	25 to 35 lbs	1 lb	5.5 to 7.5	Track steep slopes with dozer up and down hill before seeding. Mulch slopes after seeding with 2 to 3 tons of straw or 6 tons of wood chips per acre. Use tackifier on mulch, disk it in, or punch in with sheep-foot roller. Disk or sheep-foot on the contour (across slope, on the level). For extremely steep slopes, use erosion control blankets after seeding. Use 20" spacing on blanket staples
+ red clover	10 to 20 lbs	0.5 lb		
Tall fescue	40 to 50 lbs	1 lb	5.5 to 7.5	
+ white or ladino clover	1 to 2 lbs	2 oz		
Orchardgrass	20 to 30 lbs	1 lb	5.6 to 7.0	
+ red clover	10 to 20 lbs	0.5 lb		
+ ladino clover	1 to 2 lbs	2 oz		
Crownvetch	10 to 12 lbs	0.25 lb	5.6 to 7.0	
+ tall fescue	20 to 30 lbs	1 lb		
Seed species & mixtures	**Seeding rate/acre**	**Per 1000 sq. ft**	**Soil pH**	**Other Information**
Lawns and other high traffic or high maintenance areas (mowed)				

Bluegrass	105 to 140 lbs	3 lb	5.5 to 7.0	Use wildflower mixes to save on mowing and watering costs. Do not establish grassed lawns near streams or wetlands—leave a 15 to 30 ft buffer of natural vegetation.
Perennial ryegrass (turf)	45 to 60 lbs	2 lb	5.6 to 7.0	
+ bluegrass	79 to 90 lbs	2.5 lb		
Tall fescue (turf type)	130 to 170 lbs	4 lb	5.6 to 7.5	
+ bluegrass	20 to 30 lbs	1 lb		
Channels and other areas of concentrated water flows				
Perennial ryegrass	100 to 150 lbs	3 lb	5.6 to 7.0	Seed ditches and channels thickly. Do not use fertilizer near ditch or channel bottom. Use erosion control blankets or turf reinforcement mats when channel bottom slopes exceed 3%. Silt check dams are needed when channel slopes exceed 5% or when channels begin downcutting (gullying) on the bottom. Do not use silt fencing or straw bales as silt check dams in channels with slopes greater than 3%; use rock or brush instead.
+ white or ladino clover	1 to 2 lbs	2 oz		
Kentucky bluegrass	20 lbs	0.5 lb	5.5 to 7.5	
+ smooth bromegrass	10 lbs	.25 lb		
+ switchgrass	3 lbs	2 oz		
+ timothy	4 lbs	.25 lb		
+ perennial ryegrass	10 lbs	.25 lb		
+ white or ladino clover	1 to 2 lbs	2 oz		
Tall fescue	100 to 150 lbs	3 lb	5.5 to 7.5	
+ ladino or white clover	1 to 2 lbs	2 oz		
Tall fescue	100 to 150 lbs	3 lb	5.5 to 7.5	
+ perennial ryegrass	15 to 20 lbs	0.5 lb		
+ Kentucky bluegrass	15 to 20 lbs	0.5 lb		

Inspection and Maintenance

Water the soil until the grass is firmly established. This is especially needed when seedings are made late in the planting season, in abnormally dry and hot season, or on sites with steep slopes or other adverse conditions.

Inspect all seeded areas for failures and make necessary repairs, replacements, reseedings, and remulching within the planting season.

If stand is inadequate, (less than 85 percent groundcover) seed over the site and fertilize, using half of the seeding rate originally applied, and apply mulch.

If stand is more than 60 percent damaged, reestablish the stand. Follow the original seedbed preparation methods, seeding and mulching recommendations, and apply lime and fertilizer as needed according to a soil test.

Hydraulically applied seed, mulch, tackifier, and soil amendments (e.g., lime, fertilizer) offer excellent results at a reasonable price on large sites, especially those with long, steep slopes. Follow manufacturer's recommendation regarding materials mixing and application rates.

Seed ditches immediately after construction. Use mulch, netting, or erosion control blankets to protect newly seeded areas.

4.4.3 Mulching

Mulch can be hand-scattered or blown straw or other material used on temporary or final grades. Use chemical tackifiers, netting, or blankets if wind is a concern. Mulch alone can reduce erosive forces by more than 90 percent; with seeding, the reductions approach 99 percent.

Definition

Mulching is the application of a protective layer of straw, cellulose, or other suitable material to the soil surface. Straw mulch and/or hydromulch are also used in conjunction with seeding and hydroseeding of critical areas for the establishment of temporary or permanent vegetation.

Purpose

Mulching serves to temporarily stabilize seeded or unseeded bare soil areas, to protect the soil surface from raindrop impact, to increase infiltration, to conserve moisture, to prevent soil compaction or crusting, and to decrease runoff. Mulching also fosters growth of vegetation by protecting the seeds from predators, reducing evaporation, and insulating the soil. Mulching with straw or fiber mulches is commonly used as a temporary measure to protect bare or disturbed soil areas that have not been seeded.

Design Criteria

Mulch can be applied to any site where soil has been disturbed and the protective vegetation has been removed. The most common use of a mulch is to provide temporary stabilization of soil, usually until permanent stabilizing vegetation is established. Where mulches are used to complement vegetation establishment, they should be designed to last as long as it takes to establish effective vegetative erosion control.

Where mulches are used as surface cover only (i.e. bark, wood chips, or straw mulch cover) the serviceable duration of the application and maintenance requirements, including augmentation or replication should be specified.

On steep slopes, greater than 2.5H:1V, or where the mulch is susceptible to movement by wind or water, the mulch material should be hydraulically applied or the straw mulch should be appropriately anchored. Hydraulic fiber mulches or tackifying agents are used effectively to bind the straw together and prevent displacement by wind or rain. Straw can also be covered by degradable netting or secured by crimping (see below).

NOTE: For steep slopes—especially long ones—specify erosion control blankets (see Section 3) or hydraulically applied mulches with sufficient tackifier to protect seedbed. Nets can be used with straw mulch if properly staked down.

Summary of Mulch Design and Application Considerations

Mulch product	Application rate	Benefits	Limitations
Straw or hay	1½ to 2½ tons per acre	Readily available and inexpensive; very effective in controlling erosion; can be applied on large sites via blower	Can carry unwanted seeds; might need tackifier or anchoring, especially on steep slopes
Wood chips, bark, sawdust	5 to 8 tons per acre	Very low cost in some locations; chips effective on slopes up to 35%	High nitrogen demand when decomposing; can float away or blow away during rain storms
Rock	200 to 500 tons or more per acre	Could be inexpensive and readily available in some localities; might be suitable for smaller sites	Inhibits plant growth; adds no nutrients to the soil; can be costly to apply on slopes and large sites; adds "hardened" look to slopes
Hydraulic mulches and soil binders	1½ to 2 tons per acre	Easily and rapidly applied with sprayer equipment; can include seed, fertilizer, flexible/fibrous mulches, and soil binders	Could be too expensive for small or very remote sites; must dry for at least 24 hours before rainfall

Construction Specifications

Straw

Straw is an excellent mulch material. Because of its length and bulk, it is highly effective in reducing the impact of raindrops and in moderating the microclimate of the soil surface. Straw mulch can be applied by hand on small sites and blown on by machine on large sites. Straw blowers have a range of about 50 feet. Some commercial models advertise a range up to 85 feet and a capacity of 15 tons per hour.

- Mulch should not be applied more than 2 inches deep on seeded sites, unless it is incorporated into the soil by tracking, disking (crimping), or other *punching in* techniques. If the straw is applied at rates higher than 3 tons per acre, the mulch could be too dense for the sunlight and seedlings to penetrate.
- Before mulching, install any needed erosion and sediment control practices such as diversions, grade stabilization structures, berms, dikes, grass-lined channels and sediment basins.
- Obtain clean wheat, barley, oat, or rice straw to prevent the spread of noxious weeds. Avoid moldy, compacted straw because it tends to clump and is not distributed evenly.
- The straw must be evenly distributed by hand or machine to the desired depth (about 2 inches) and should cover the exposed area to a uniform depth. One bale (approximately 80 lbs) of straw covers about 1000 square feet adequately. The soil surface should be barely visible through the straw mulch. On steep or high-wind sites, straw must be anchored to keep it from blowing away.
- For seeded sites, apply 1.5–2 tons per acre, 1–2 inches deep, covering 80 percent of the soil surface. For unseeded sites, use 1.5–2.5 tons per acre, apply 2–4 inches deep, covering 90 percent of the soil surface.
- Mulch must be anchored immediately to minimize loss by wind or water. Straw mulch is commonly anchored by crimping, tracking, disking, or punching into the soil; covering with a netting material; spraying with asphaltic or organic tackifier; or tacking with cellulose fiber mulch at a rate of 750 pounds per acre.
- On small sites where straw has been distributed by hand, it can be anchored by hand punching it into the soil every 1–2 feet with a dull, round-nosed shovel. A sharp shovel will merely cut the straw and not anchor it. A mulch anchoring tool is a tractor-drawn implement designed to punch and anchor mulch into the top 2–8 inches of soil. This practice affords maximum erosion control but is limited to flatter slopes where equipment can operate safely. A set of disk harrows can be used for this purpose if the disks are straightened (not angled) so they cut the straw into the soil. Tracking is the process of cutting straw into the soil using a bulldozer or other equipment

that runs on cleated tracks. Tracking is used primarily on slopes 3:1 or flatter where this type of equipment can safely operate. This is an effective way to crimp straw on fill slopes. Tracking equipment must operate up and down the slope so the cleat tracks are perpendicular to flow.

- Netting material made of biodegradable paper, plastic or cotton netting can be used to cover straw mulch. Netting should be specified judiciously since birds, snakes and other wildlife can get trapped in the nettings.
- Polymer tackifiers are generally applied at rates of 40–60 pounds per acre, however manufacturers recommendations vary. Organic tackifiers are generally applied at rates of 80–120 pounds per acre, however manufacturer's recommendations vary. Applications of liquid mulch binders should be heavier at edges, in valleys, and at crests of banks and other areas where the mulch could be moved by wind or water. All other areas must have a uniform application of the tackifier.

Wood Chips or Bark

Apply at a rate of 5–8 tons per acre.

The mulch should be evenly distributed across the surface to a depth of about 2 inches.

If decomposition, soil building and revegetation are desired, increase the application rate of nitrogen fertilizer by 20 pounds of nitrogen per acre, to compensate for the temporary diversion (loss) of available nitrogen to the soil microbes.

Hydraulic Mulches

Hydraulic mulches can be made of recycled newsprint, magazines, wood or other wood/paper waste sources. This type of mulch is to be mixed in a hydraulic application machine (hydroseeder) and applied as a liquid slurry that contains the recommended rates of seed and fertilizer for the site. It can be specified with or without a tackifier.

Apply at rate of 1.5 to 2 tons per acre—mixed with seed and fertilizer at recommended rates—to achieve uniform, effective coverage.

Paper mulch used to tack and bind straw mulch can be specified at a lower rate (i.e., about 750 pounds per acre).

Hydraulic mulches from wood and paper fiber are combination mulches generally composed of 70 percent wood fiber and 30 percent paper fiber, manufactured from lumber mill waste, virgin wood chips, recycled newsprint, office paper and other waste paper. The mulch is mixed in a hydraulic application machine (hydroseeder) and applied as a slurry in combination with the recommended seed and fertilizer. The mulch can be specified with or without a tackifier.

Wood, paper or combination fiber mulches are typically applied with a hydraulic applicator (hydroseeder) at a minimum rate of 1.5 tons per acre. A typical construction specification and application for this type of mulch is as follows:

- Moisture content (total weight basis) not to exceed 12 percent +/- 3 percent.
- Organic matter content (oven dry weight basis) is 98 percent minimum.
- Inorganic matter (ash) content (oven dried basis) 2 percent maximum.
- pH at 3 percent consistency in water should be 4.9 or greater.
- Fiber must be dyed to aid in visual metering during application. The dye must be biodegradable and must not inhibit plant growth.
- Water holding capacity (oven dried basis) minimum 1.0 gallons per pound of fiber.
- The mulch must be mixed with seed and fertilizer as specified and applied at a rate

recommended by the manufacturer to achieve uniform, effective coverage and provide adequate distribution of seed.

Rock

Rock is recommended for long slopes of 2H:1V or flatter that will not support thickly seeded grass. Install non-woven geotextile on graded slope, place rock of mixed sizes on geotextile, starting at bottom and working uphill. Generally rock is not suitable for residential or other areas where aesthetics are a design consideration.

Inspection and Maintenance

Inspect weekly and repair or replace any bare areas promptly. If properly applied and anchored, little additional maintenance is required during the first few months. After high winds or significant rainstorms, mulched areas should be checked for adequate cover and re-mulched if necessary. Mulch needs to last until vegetation develops to provide permanent erosion resistant cover. Straw mulch can last from 6 months to 3 years.

Visually inspect mulched areas to ensure uniform, sufficient coverage. Application must cover all bare areas, with less than 5 percent soil showing through mulch cover.

Good use of straw mulch and grass seed in relatively flat and fairly wide swale. For more concentrated flows, triple seed the ditch and use erosion control blankets.

Use netting to secure loose straw on steep or long slopes. Above: Good coverage with straw mulch. Mulch alone can reduce erosion by more than 90 percent. Apply temporary or permanent mulch as soon as final grade is established.

4.4.4 Sodding

Sod reduces erosion potential to near zero. Make sure the surface is properly prepared with appropriate soil amendments; use fresh sod and keep well watered during the first 2 weeks after application.

SO

Definition

Sod consists of rectangular strips of live turf grass held together by matted roots laced through an organic, growing medium.

Purpose

The purpose of sodding is to immediately establish a permanent turf grass cover over bare soil and improve visual aesthetics, during almost any time of year; to prevent erosion and damage from sediment and runoff by stabilizing the soil surface, and to promote the infiltration of precipitation and reduction of stormwater runoff; to reduce the production of dust and mud associated with bare soil surfaces; to stabilize swales, ditches, and channels where concentrated flows will occur; and to protect areas around drop inlets from muddy inflows.

Design Criteria

- Sod should be machine-cut and contain one-half inch to 1 inch of soil, not including roots or shoots or thatch.
- Specify that sod will be installed within 36 hours of digging and removal from the field.
- Avoid planting when subject to frost heave or hot weather if irrigation is not available.
- Sod should not be used on slopes steeper than 2H:1V. If it is to be mowed, installation should be on slopes no greater than 3H:1V.

Construction Specifications

Cutting and Handling Sod

The sod should consist of strips of live, vigorously growing grasses. The sod should be free of noxious and secondary noxious weeds and should be obtained from good, solid, thick-growing stands. The sod should be cut and transferred to the job in the largest continuous pieces that will hold together and that are practical to handle.

- The sod must be cut with smooth, clean edges and square ends to facilitate laying and fitting. The sod must be cut to a uniform thickness of not less than three-fourths of an inch measured from the crown of the plants to the bottom of the sod strips for all grasses except bluegrass. Bluegrass sod must be cut to a uniform thickness of not less than 1.5 inches.
- The sod must be mowed to a height of not less than 2 inches and no more than 4 inches before cutting.

- The sod must be kept moist and covered during hauling and preparation for placement on the sod bed.

Site Preparation

Soils in areas to be sodded must be capable of supporting permanent vegetation and must consist of at least 25 percent silt and clay to provide an adequate amount of moisture-holding capacity. An excessive amount of porous sand will not consistently provide sufficient moisture for the sod regardless of other soil factors.

- Compacted soils must be broken up sufficiently to create a favorable rooting depth of 6–8 inches.
- Stockpile topsoil to apply to sites that are otherwise unsuited for establishing vegetation.
- Grade as needed and feasible to permit the use of conventional equipment for the sod bed preparation. After the grading operation, spread topsoil where needed.

Sod Bed Preparation

Apply lime (in lieu of a soil test) on acid soil and subsoil at a rate of one ton per acre. The lime should be agricultural ground limestone or equivalent. For best results, conduct a soil test. This can reduce expense of unneeded lime and fertilizer and potential excess nutrient loss through runoff and leaching.

- Apply fertilizer (in lieu of a soil test) at 1,000 pounds per acre of 10-10-10 analysis. For best results, conduct a soil test.
- Work lime and fertilizer into the soil with a disk harrow, springtooth harrow, or other suitable field equipment to a depth of 4 inches.
- Before sodding, the soil surface must be cleared of all trash, debris, and stones larger than 1.5 inches in diameter, and of all roots, brush, wire, and other objects that would interfere with the placing of the sod.
- After the lime and fertilizer have been applied and just before laying the sod, the soil in the area to be sodded must be loosened to a depth of one inch. The soil must be thoroughly dampened immediately after the sod is laid if it is not already in a moist condition.

Placing Sod

No sod should be placed when the temperature is below 32° F. No frozen sod must be placed nor should any sod be placed on frozen soil.

- Sod should be carefully placed and pressed together so it will be continuous without any voids between the pieces. Stagger the joints between the ends of strips in a brick-like pattern. Ensure that the edge of the sod at the outer edges of all gutters is sufficiently deep so that the surface water will flow over onto the top of the sod.
- For channel sodding, carefully place the sod on rows or strips at right angles to the centerline of the channel (i.e., at right angles to the direction of flow). On steep, graded channels, stake each strip of sod with at least two stakes not more than 18 inches apart. The stakes should be wooden and approximately 1/2" x 3/4" x 12". Drive the stakes flush with the top of the sod and with the flat side against the slope.
- On slopes 3:1, or steeper, and where drainage into a sod gutter or channel is one-half acre or larger, roll or tamp the sod and then peg chicken wire, jute, or other netting over the sod for protection in the critical areas. Stake the netting and sod with at least two stakes not more than 18 inches apart. The stakes should be wooden and approximately 1/2" x 3/4" x 12". Drive the

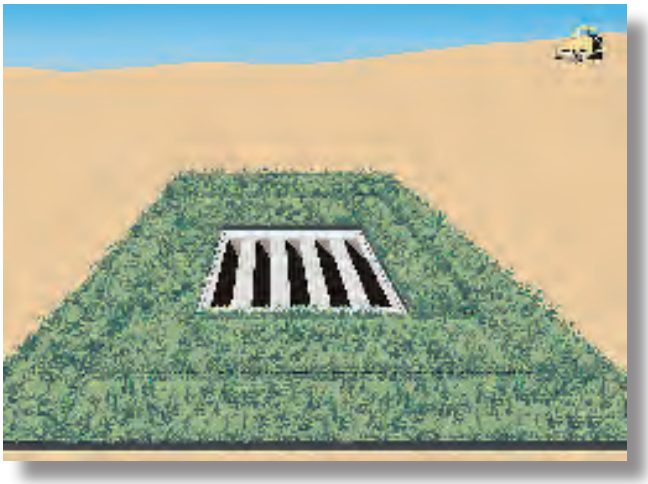
stakes with the flat side against the slope and on an angle toward the slope. Staple the netting on the side of each stake within 2 inches of the top of the stake, then drive the stake flush with the top of the sod.

- The sod should be tamped or rolled after placing and then watered. Watering must consist of a thorough soaking of the sod and of the sod bed to a depth of at least 4 inches. Maintain the sod in a moist condition by watering for a period of 30 days.

Inspection and Maintenance

Inspect sod twice a week after installation to check on moisture conditions and grass viability. Irrigate sod immediately after installation and every few days afterwards if no significant rainfall occurs during the first 2 weeks. Soak the area thoroughly to a depth of 3 inches during irrigation.

- Where sodding does not establish properly, remove the old sod and resod the area as soon as possible. Identify the cause of the failure and correct it as soon as possible.
- Once established, initiate a regular maintenance program for fertilization (if needed) and mowing.



Use sod in ditches and around drop inlets for superior protection against scouring flows. Sod slows down concentrated flows and promotes filtration and settling of sediment-laden runoff.

Rolled sod should be moist, flexible, green, and fresh. For best results, install as soon as possible after final grade is established.

4.4.5 Polyacrylamides

Long, bare slopes need to be stabilized. Polyacrylamide offers excellent temporary protection for slopes that will not be seeded or mulched immediately. Do not use near creeks, rivers, or wetlands. Follow manufacturer's instructions.

PAM

Definition

The land application or stormwater application of products containing anionic polyacrylamide (PAM), a chemical agent that binds soil particles together, which reduces erosion in the field and promotes coagulation and rapid settling in sedimentation basins.

Purpose

Land application of PAM is performed to reduce soil surface erosion due to wind or water forces. Stormwater applications of PAM promote settling of fine soil particles in sediment basins. Polyacrylamides are applied directly—via liquid spray or hand or mechanical spreader for the dry product—to bare soil areas where the timely establishment of vegetation might not be feasible or where vegetative cover is absent or inadequate. Such areas can include construction sites where land-disturbing activities prevent the establishment or maintenance of a vegetative cover. For stormwater treatment, PAM can be applied to stormwater as it enters sediment basins. This will cause soil particles to bind together and settle within the pond.

This temporary practice is not intended for application to surface waters or ditches that lead directly to surface waters. It is intended for application within construction stormwater drainage systems that feed into pre-constructed sedimentation (detention or retention) ponds or basins.

Design Criteria

Only the anionic form of PAM should be used. Cationic PAM is toxic and should NOT be used. PAM and PAM mixtures should be environmentally benign, harmless to fish, wildlife, and plants. PAM and PAM mixtures should be noncombustible.

PAM is typically applied at construction sites with temporary seeding or mulching on areas where the timely establishment of temporary erosion control is so critical that seedings and mulching need additional reinforcement. It can be used alone on sites where no disturbances will occur until site work is continued and channel erosion is not a significant potential problem. Permanent grassing applications can be better established using PAM as a tackifier and soil conditioner.

Anionic PAM is available in emulsions, powders, and gel bars or logs. Other BMPs must be used in conjunction or combination with anionic PAM, such as mulch, sediment basins, and eventually seed or other cover. The use of seed and mulch for additional erosion protection beyond the life of the anionic PAM is recommended. Repeat application if disturbance occurs to the target area. The following recommendations relating to design can enhance PAM use and help prevent problems:

- Use 25-foot minimum setbacks when applying anionic PAM near natural water bodies, such as creeks, ponds, lakes, wetlands, and rivers.
- Consider that performance of PAM decreases with time and exposure to ultraviolet light.
- In concentrated flow channels, the effectiveness of PAM decreases.
- Mulch to protect seed if seed is applied with anionic PAM.
- Never add water to PAM; add PAM slowly to water. If water is added to PAM, clumping can form, which can clog dispensers. This signifies incomplete dissolving of the PAM and increases the risk of under-application.
- Using PAM logs or block formulations is effective in removing colloidal clay, nutrients, and metals in sediment basins. Passive addition of PAM to incoming basin flows must be managed carefully by monitoring logs, blocks, or other application methods. Basin or pond systems featuring baffles or grids that slow stormwater movement through the detention area provides extended treatment or settling times and better performance. Level spreader applications provide a similar level of contact and treatment time.

Construction Specifications

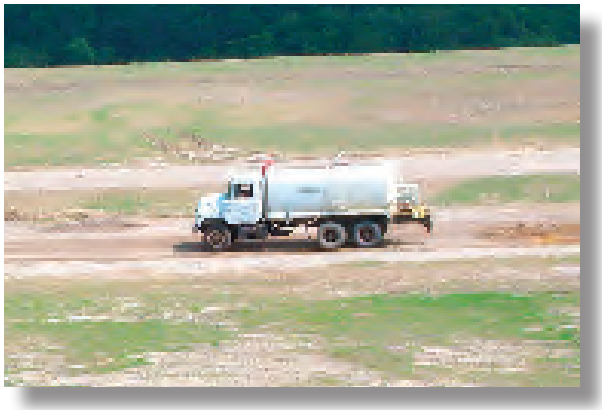
Application rates should be uniform and conform to manufacturer's guidelines for application. Anionic PAM, in pure form, should have less than or equal to 0.05 percent acrylamide monomer by weight, as established by the Food and Drug Administration and EPA. To maintain less than or equal to 0.05 percent of acrylamide monomer, the maximum application rate of PAM, in pure form, should not exceed 200 pounds per acre per year. Do not over-apply PAM. Excessive application of PAM can lower the infiltration rate or suspend solids in water rather than promoting settling.

- Users of anionic PAM should obtain and follow all Material Safety Data Sheet requirements and manufacturer's recommendations. Additives to PAM such as fertilizers, solubility promoters, or inhibitors, should be nontoxic. The manufacturer or supplier should provide written application methods of PAM and PAM mixtures. The application method should ensure uniform coverage to the target and avoid drift to non-target areas including waters of the state. The manufacturer or supplier should also provide written instructions to ensure proper safety, storage, and mixing of the product.
- Gel bars or logs of anionic PAM mixtures can be used in ditch systems. This application should meet the same testing requirement as anionic PAM emulsions and powders. Effectiveness is reduced in steeply sloping ditches.
- To prevent exceeding the acrylamide monomer limit in the event of a spill, the anionic PAM in pure form should not exceed 200 pounds/batch at 0.05 percent acrylamide monomer or 400 pounds per batch at 0.025 percent acrylamide monomer.

Inspection and Maintenance

Inspect the area before anticipated storm events (or series of storm events such as intermittent showers over one or more days), within 24 hours after the end of a rainfall event of one-half inch or more, and at least once every 14 calendar days. Maintenance needs that are identified in inspections or by other means must be accomplished before the next storm event if possible, but in no case more than 7 days after the need is identified. Maintenance consists of reapplying anionic PAM to disturbed areas including high-use traffic areas that interfere with the performance of this practice.

4.4.6 Dust Control



Apply water, polyacrylamide, or other stabilizers to bare areas if windblown dust will be a problem. Heavy dust blowing toward downwind homes can result in complaints to regulatory authorities.

Definition

Dust control is the reduction of windborne sediment and dust movement during land clearing, grading, excavation, fill placement, demolition, and other construction activities.

Purpose

The purpose of dust control is to prevent the airborne movement of sediments to off-site areas or on-site areas without sediment control where they could subsequently be washed into surface waters. Dust control should be planned in association with earthmoving or site grading activities and areas with frequent construction traffic.

Design Criteria

Construction activities must be phased to minimize the total exposed soil area and the length of time bare areas are exposed, thereby reducing erosion due to air and water movement.

- Existing trees, shrubs, and ground cover must be retained as long as possible during construction. Initial land clearing should be conducted only in those areas to be regraded or where construction is to occur. Areas to be cleared only for new vegetation or landscaping must be stabilized with seed and/or mulch immediately following clearing.
- Vegetative cover is the most effective means of dust and erosion control, when appropriate. See sections on Temporary Seed, Permanent Seed, Mulch, and Sod in this manual.
- When areas have been regraded or brought to final grade, stabilize them using temporary or permanent seed and mulch or other measures.
- Use mulch with mulch binders as an interim dust control measure in areas where vegetation might not be appropriate.
- Anionic polyacrylamide (PAM) is an effective dust control agent for undisturbed areas (see Section 4.4.5). Calcium chloride has proven effective in controlling dust on roadways, but repeat applications are necessary and the product could restrict establishment of vegetation on treated areas. A permit might be needed for using calcium chloride.
- Salt solutions such as magnesium chloride, calcium chloride, and natural brines are popular and effective dust control products for roads. Organic, nonpetroleum-based chemicals such as calcium lignosulfonate and sodium lignosulfonate are also effective. All these chemicals work best on unpaved roadways with fines in the 10 percent to 30 percent range. Petroleum-based products are not recommended because of their adverse effects on plants and water resources.

Construction Specifications

Construction roads should be watered as needed to minimize dust. Repeat applications will be necessary during dry weather.

- Roughening the soil to create ridges perpendicular to the prevailing wind direction can reduce surface wind velocities and sediment loss significantly. However, if winds shift to become parallel to the ridges, blown sediment will increase.
- Silt fences or board fencing that is perpendicular to the prevailing wind direction can also be used to lower surface wind velocities and reduce airborne sediment problems. Fences do not have to be trenched in, but may need to be 50–100 feet apart to appreciably reduce wind velocities.
- See sections on Temporary Seed, Permanent Seed, Sod, Mulch, and Construction Entrance.

Dust Control BMPs for Various Site Conditions

Site condition	Grass/ seeding	Mulching	Watering	Chemical application	Gravel or asphalt surfacing	Silt or sand fencing	Rock pad or wash-down
Disturbed areas—no traffic	●	●	●	●	●	●	
Disturbed areas—with traffic			●	●	●		
Soil stockpiles	●	●	●	●		●	
Demolition			●				●
Clearing/ Excavation	●	●	●	●		●	
Unsurfaced roads			●	●	●		
Site exit to paved road					●		●

Inspection and Maintenance

Observe the site daily for evidence of windblown dust and take reasonable steps to reduce dust whenever possible.

- When construction on a site is inactive for a period, stabilize the site with mulch or temporary vegetation, and inspect it at least weekly for evidence of dust emissions or previously windblown sediments.
- Implement dust control measures or upgrade them if the site inspection shows evidence of wind erosion.
- Heavy rains will wash away chemical dust control products. This will require reapplication after the site dries out.

4.5 Slope Protection

General Information

Relatively flat areas—those with slopes of 2 percent or less—can be stabilized to a large extent through controlled clearing and grading, mulch, and temporary or permanent seed. Slopes greater than that, however, require more attention to sheet runoff volume and the management of areas where flows converge and are transported to downstream receiving waters. Sediment barriers, rolled erosion control products, and greater attention to downslope drainage are usually needed on slopes, especially those that are steep and long.

This section addresses erosion protection and sediment control approaches specifically for slopes. In general slopes that are long (50 feet or more), steep (5 percent plus), and composed of highly erodible (silty) soils require more protection that shorter, flatter slopes of less erodible soil. Slope protection approaches discussed below include erosion control blankets and turf reinforcement mats, which can also be used for ditch protection, surface roughening, slope drains, gabion structures, and cellular mats.

Approximate Slope Conversions

Approximate slope conversions (horizontal:vertical)		
Percent	*Slope Ratio*	*Degrees*
100%	1:1	45º
50%	2:1	27º
33%	3:1	18º
25%	4:1	14º
10%	10:1	6º

Slope Protection Basics

Protecting slopes from erosion requires several actions that must be taken together. No single approach will be successful, especially if the slope is steep or has highly erodible soils (see table). Use one or more of the following actions to reduce erosion on slopes:

Divert upland runoff—Install a berm or channel above the slope to divert upland rain runoff around the bare soil area or a stable ditch to move upland flows through the site without picking up additional sediment.

Control slope runoff—If slopes are broken up into benches or steps, runoff can be collected and diverted along berms or in channels to pipe or channel slope drains.

Till seedbed or condition the soil—Dozer tracks up and down slopes help hold soil in place. See the table below for information on how the condition of the soil surface (e.g., compacted, tracked) can increase or decrease erosion.

Seed and mulch—This is the best and cheapest protection by far. See temporary and permanent seeding Fact Sheets for details on seed types, application rates, and mulch, blanket, and mat products.

Silt fence or brush barrier—These should be installed at the toe of the slope, and every 75 to 125 feet apart on long slopes.

Retaining wall—Extremely steep slopes can be leveled out and shortened into two or more steps or benches by installing retaining walls of rock, brick, block, wood, logs, or other material. If rock layers are present along the slope, use these to establish firm benches in a stair-step pattern.

Blankets or armoring—Long slopes (greater than 100 feet) exceeding 3H:1V with highly erodible soils need to be protected with erosion control blankets or turf reinforcement mats. Rock mulch and lined downdrain channels might be needed on steep slopes to control gullying.

Soil Conditions vs. Erosion

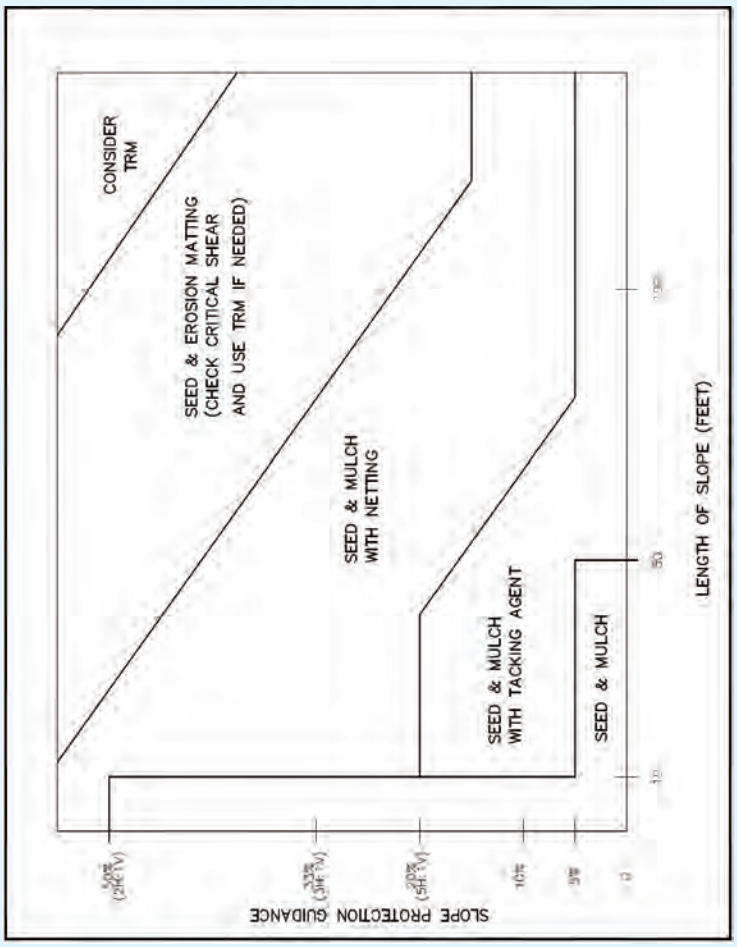
Soil Conditions vs. Erosion	
If soil is:	***Erosion will be:***
Compacted and smooth	30 percent more
Tracks across slopes	20 percent more
Tracks up & down slopes	10 percent less
Rough and irregular	10 percent less
Rough & loose to 12" deep	20 percent less

Slope Angle and Soil Type vs. Erodibility

Slope angle	Erodibility	Soil type
50%	Very high	Silt
40%		Silty sand
30%		Clayey sand
20%		Organic soil
15%		Clays
10%		Silty gravel
5%		Sand
< 5%		Gravel
	Very Low	

The value of seed on a slope: the left (seeded) section shows almost no erosion; right side rills are quickly becoming gullies. Seed and mulch slopes as soon as final grade is established for best results. ***Bare areas must be seeded or mulched within 14 days if no work is planned during the next week.***

Slope Protection Guidance Chart - Based on Slope Angle and Length



The slope protection chart can be used to determine what type of slope protection measures should be used, given the slope angle (vertical axis) and length (horizontal axis). When addressing highly erodible (silty) soils, tend toward a more conservative approach.

4.5.1 Silt Fence

Silt fencing is commonly used to pond, settle, and filter sediment from sheet runoff. Install at proper spacing on slopes; set back from slope toe to allow for maintenance. Make sure fencing is trenched in properly and stakes are on the downhill side. Inspect frequently to detect and address bypasses, undercutting, and overtopping.

SF

Definition

A silt fence is a temporary sediment barrier consisting of filter fabric entrenched into the soil and attached to supporting posts. Silt fences are downhill from bare soil areas and are installed with a trencher or by a slicing machine to prevent against common silt fence failures.

Purpose

Silt fences are common sediment control devices. Silt fencing should be installed where sediment-laden water can pond, thus allowing the sediment to fall out of suspension and separate from the runoff. Runoff will also *bleed through* the silt fence fabric, providing physical filtering for larger sediment particles. Reasons for the high failure rate of improperly designed (located) and installed silt fence include

- Improper placement (i.e., not on the contour, ends not turned up)
- Allowing excessive drainage area to the silt fence structure
- Shallow trenches with little or no soil compaction
- Inadequate attachment to posts
- Failure to maintain the silt fence after installation
- Installing silt fence along property boundaries, producing *concentrated* runoff

Design Criteria

Silt fencing must be installed only where water can pond. Specify silt fencing downgradient from bare soil areas, installed on the contour if possible, with the ends turned up to prevent bypassing. Provide adequate setbacks from slope toe for routine maintenance and access. Silt fencing can be used where

- Non-concentrated sheet flow will occur
- Protection of adjacent property or nearby surface waters is required
- The size of the drainage area is no more than 1/4 acre per 100 linear feet of silt fence
- The maximum flow path length above the barrier is 100 feet for slopes less than 2 percent, and 50 feet for slopes up to 10 percent

- The maximum slope gradient above the barrier is 2H:1V
- Silt fencing can be used in flat, short swales (i.e., slope is less than 2 percent; length is less than 200 feet) that drain less than 2 acres, if silt fencing is spaced every 50 feet.
- Reinforced silt fence must be required when the contributing slope is longer than 100 feet and greater than 3 percent and the design life of the silt fence is greater than 6 months.

Silt Fence Spacing on Long Slopes

Land Slope	Max. Slope Distance
3% – 5%	100 ft.
5% – 10%	75 ft.
10% – 20%	50 ft.
20% – 50%	25 ft.

Silt fencing should not be used

- Around the perimeter of large construction sites, unless J-hooks are used. Long continuous runs of silt fence will divert and concentrate sediment-laden runoff and almost certainly result in failure. A good general rule is to drain no more than 1/3 acre of disturbed area into each discrete J-hook;
- In ditches, channels, or streams. Silt fences cannot handle the volumes generated by concentrated channel flows. When installed across a concentrated flow path, undercutting or *end cutting* of the fence often occurs, or the fence is pushed over by the force of the flow.

Construction Specifications

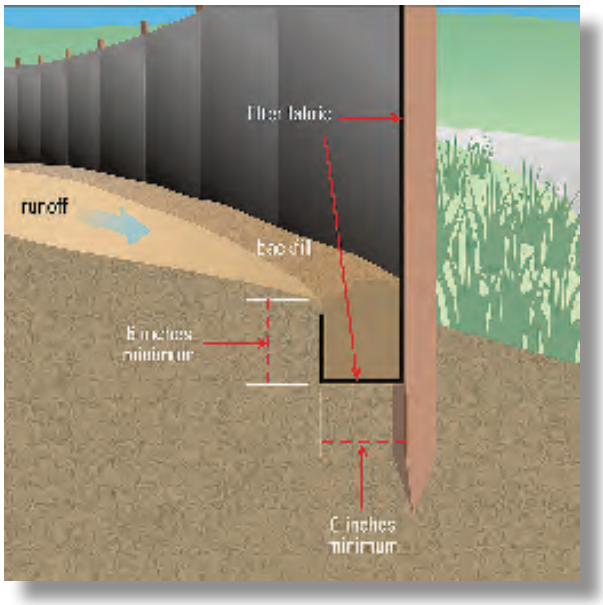
Silt fences have a useful life of one season. Their principal mode of action is to slow and pond the water and allow soil particles to settle with some minor filtration through the fabric. Silt fences are not designed to withstand high heads of water, and therefore should be located where only shallow pools (i.e., 1.5 feet or less) can form. Their use is limited to situations in which sheet or overland flows are expected.

- Dig a trench on the contour at least 6 inches wide and 6 inches deep below the area to be treated, taking care to install J-hooks where flows will travel along the silt fence. Turn fence ends uphill to trap potential bypasses as needed.
- If posts are already attached to fabric, position the fencing so the posts are installed on the downhill side of the fabric. Drive posts to a depth of 1 foot below the bottom of the trench, against downslope trench wall for extra support. Posts for all silt fencing are spaced 6 feet apart.
- Push fabric into the trench, and spread fabric along trench bottom and sides; backfill the trench and compact the soil. A preferred installation technique in deep, easily-worked soils with minimal rock content involves static slicing of the fence into the ground with a chisel-plow implement such as the *Tommy Silt Fence Machine* or equivalent. The filter fabric is wire-tied directly to the posts with three diagonal ties.
- The height of a silt fence must be 18 inches minimum and 30 inches maximum. Sediment storage height and ponding height must not exceed 18 inches.
- Silt fences placed at the toe of a slope must be set at least 6 feet back from the toe to increase ponding volume and provide room for maintenance.

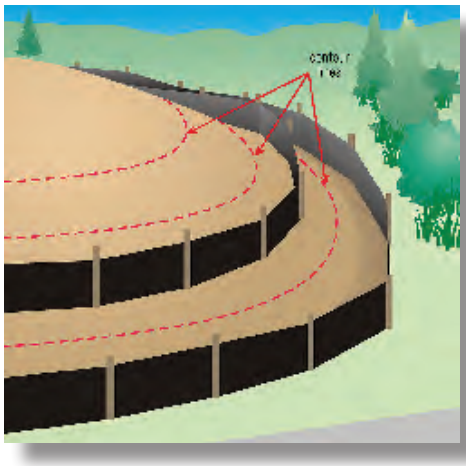
Inspection and Maintenance

All sediment barriers should be placed downgradient from bare areas to be treated. The ends of the barrier should be turned uphill or otherwise configured to prevent end-around bypasses.

- Inspect fence for proper installation and compaction by pulling up on the fence while kicking the toe of the fabric. If the fence comes out of the ground, do not accept the installation.
- If there are long, linear runs of silt fence without J-hooks, do not accept the installation.
- Silt fences and filter barriers must be inspected weekly or every 14 days and after each storm of greater than one-half inch. Any required repairs must be made immediately.
- Sediment should be removed when it reaches 1/3 height of the fence or 18 inches maximum.
- The removed sediment must be spread and vegetated or otherwise stabilized so that it does not result in muddy runoff to nearby ditches or surface waters.
- Silt fences must be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized (e.g., vegetated) and any sediment stored behind the silt fence has been removed. Silt fences and other temporary controls must be removed before project close-out.



Make sure silt fence fabric is trenched in and is upslope of stakes. Leave room between the fencing and the upgradient slope for removing accumulated sediment.



Install silt fencing on the contour, with the ends turned uphill to trap muddy runoff and prevent bypasses. Remove silt fences when grass is established.

Do not use silt fencing in areas of concentrated flows. For best results, triple-seed ditches and line with erosion control blankets.

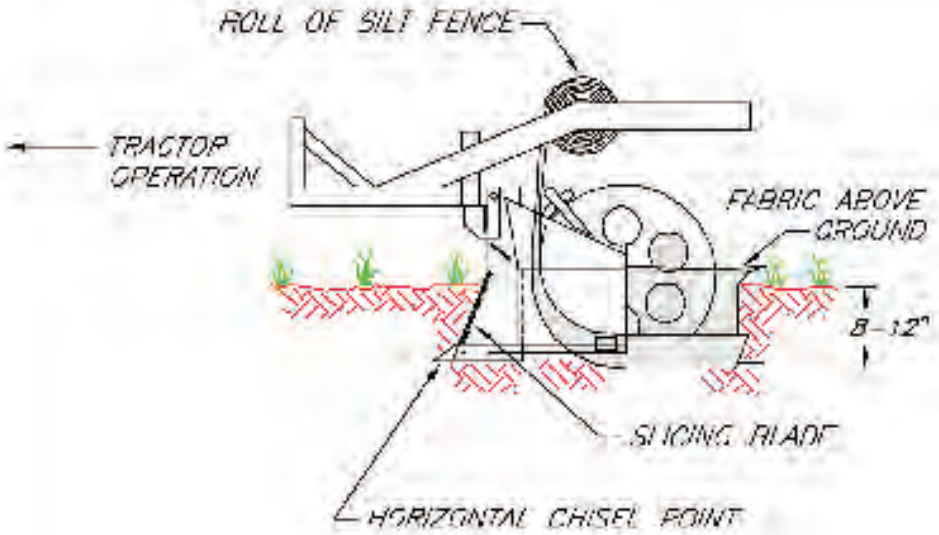
Use several short lengths of silt fence and J-hooks to intercept converging runoff in critical areas, such as property corners. This can help relieve stress and prevent failure at the corners.

Silt fence installed backwards—note that stakes are on the uphill, rather than downhill, side of the fabric. Ponding flows against this fence will push the fabric away from the stakes, causing failure and releasing sediment to the small stream on the right.

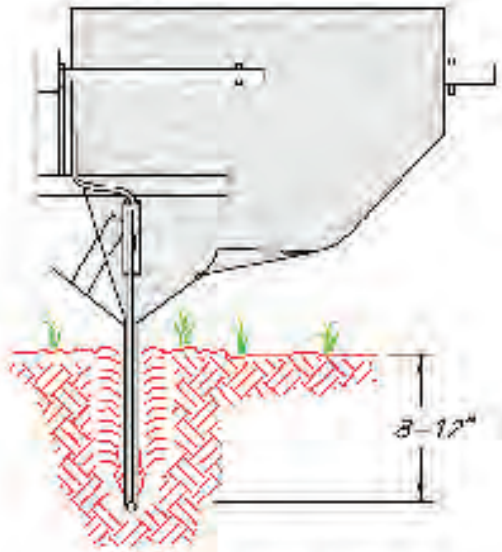
Use multiple silt fences at proper spacing (see table) to protect long, unvegetated slopes. Fences provide only temporary protection and can be removed when the area is seeded and mulched.

Silt fence is functioning well, but needs maintenance. Set fences back from the toe of the slope, to allow room for sediment to accumulate and maintenance.

Good installation of "super" (i.e., wire reinforced) silt fence. Note that wire is installed between the fabric and stakes, and provides a web of support as the ponded flow pushes against the fabric. Also, note the grass strip between the bare area and the fence, which helps to slow and filter flows before ponding along the fence line.



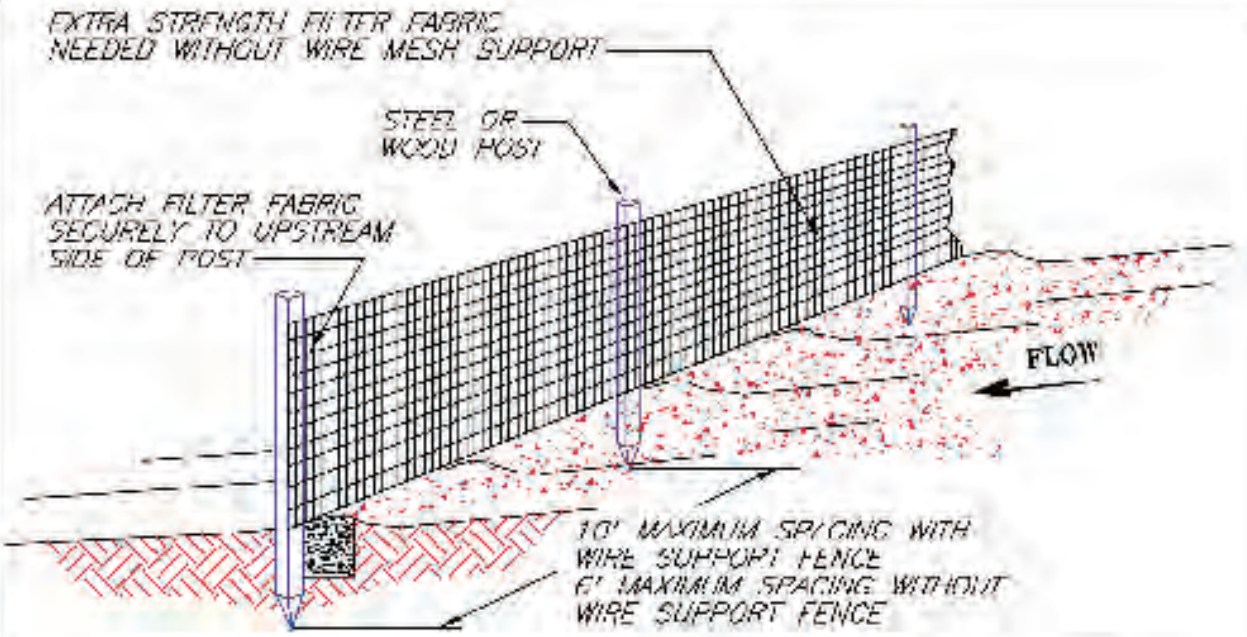
STATIC SLICING METHOD
SIDE VIEW

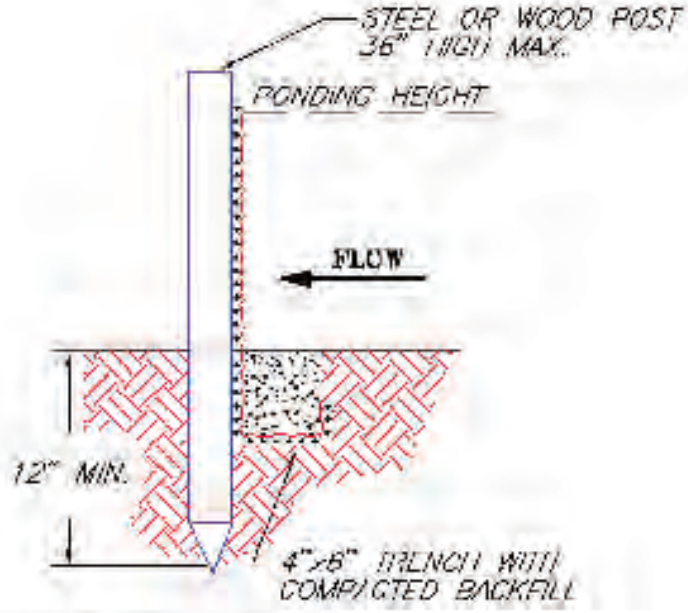


STATIC SLICING METHOD
BACK VIEW

SILT FENCE INSTALLATION: SLICING METHOD

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0





TRENCH DETAIL

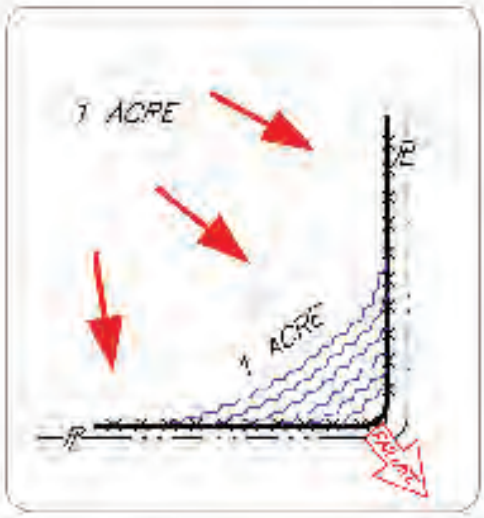
NOTES:

1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY. 9" MAXIMUM RECOMMENDED STORAGE HEIGHT.
3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.

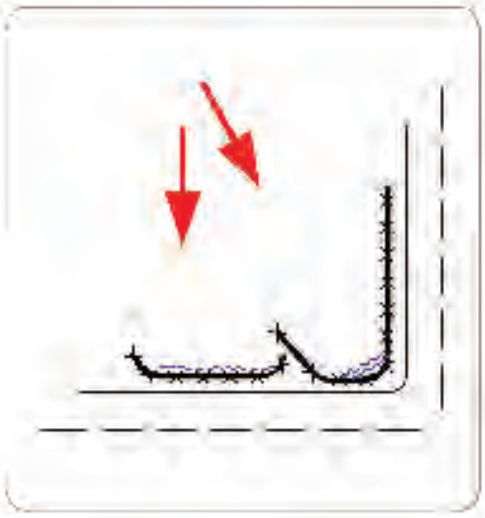
SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

NOT TO SCALE

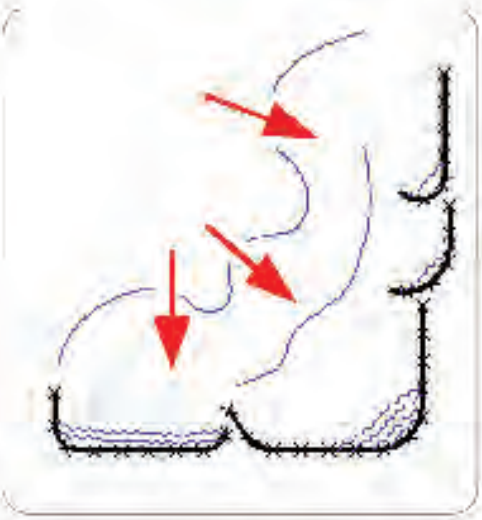
SILT FENCE INSTALLATION: TRENCH METHOD

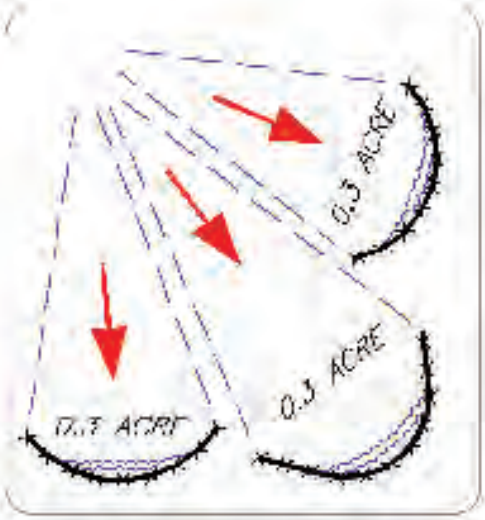


Incorrect – Do Not layout "perimeter control" silt fences along property lines. All sediment laden runoff will concentrate and overwhelm the system.



Correct – install J-hooks

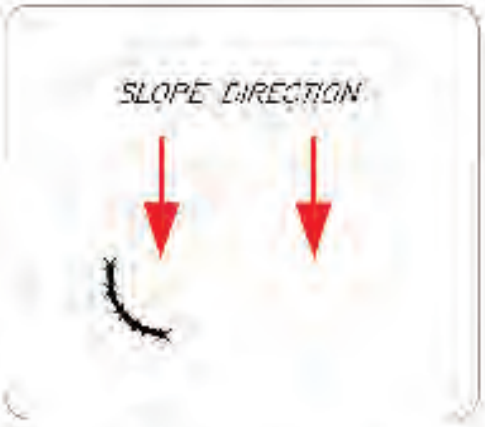




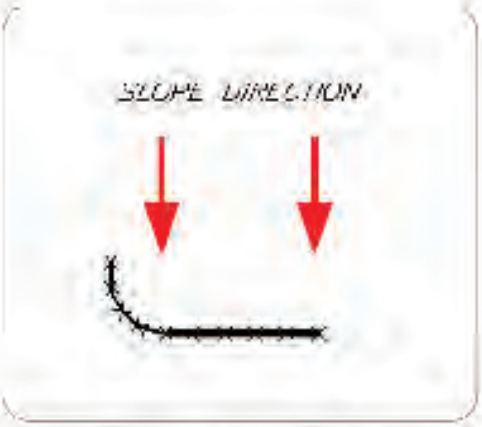
Discreet segments of silt fence, installed with J-hooks will be much more effective.

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

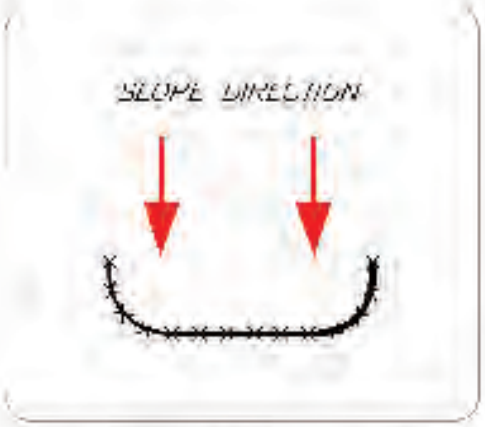
SILT FENCE PLACEMENT FOR PERIMETER CONTROL



STEP 1 – CONSTRUCT LEG



STEP 2 CONSTRUCT DAM

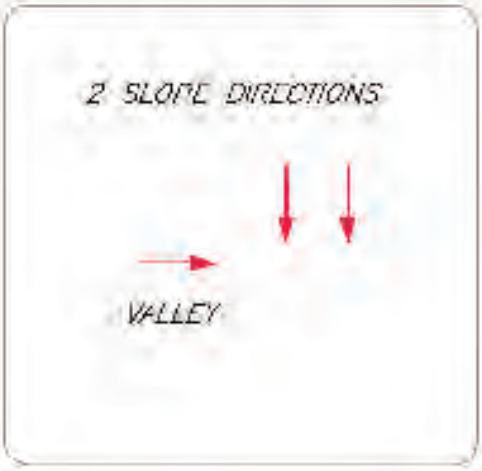


STEP 3 CONSTRUCT LEG 2

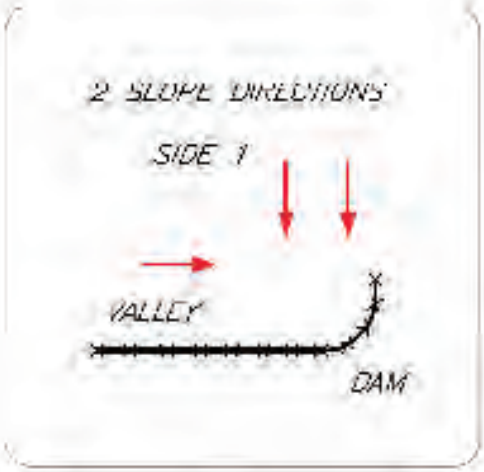
INSTALLATION WITH J-HOOKS INCREASE SILT FENCE EFFICIENCY

SILT FENCE: TYPICAL PLACEMENT ON SLOPE

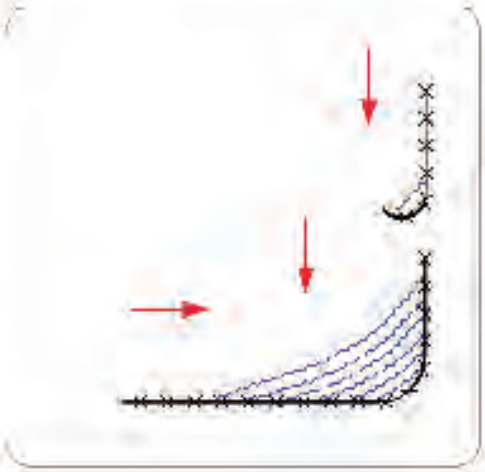
SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0



STEP 1 – CONSTRUCT A DAM



STEP 2 – CONSTRUCT SIDE 2



STEP 3 – CONSTRUCT J-HOOKS AS NEEDED

INSTALLATION WITH J-HOOKS WILL INCREASE SILT FENCE EFFICIENCY AND REDUCE EROSION-CAUSING FAILURES.

SILT FENCE: TYPICAL PLACEMENT TWO SLOPES

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

4.5.2 Brush, Rock, and Other Sediment Barriers

If rock will be used at the site eventually, it could be beneficial to have it delivered early for use as a sediment barrier in the vicinity of its final use. Large rock is especially useful as berming for temporary sediment traps. Other sediment barriers include brush cleared from the site, fiber (log) rolls, and other commercial products.

Definition

Brush, rock, and other commercial barriers can be used as a temporary sediment barrier instead of a silt fence.

Purpose

The purpose of any sediment barrier is to provide a place where sediment-laden water can pond, thus allowing the sediment to fall out of suspension and separate from the runoff.

Design Criteria

Sediment barriers should be installed where non-concentrated sheet flow will occur. They should not be used in ditches, channels, or streams unless they can withstand predicted flows. Sediment barriers are usually placed a few feet beyond the toe of a slope, or across long slopes at specific intervals. When placing sediment barriers, consider materials on hand that might be used (e.g., brush cleared from the site, shot rock) during initial clearing and grading work. Silt fences or commercial sediment barrier products should be sited far enough away from the toe of the slope to allow for maintenance (i.e., access by a small loader, truck). There are several other factors to consider in placing silt fences, rock sediment filters, or other commercial sediment barriers:

- Place filters on downhill edge of bare soil areas.
- Make sure the filter catches all the muddy runoff.
- Turn the ends of the barrier uphill to prevent bypasses
- The goal is to pond runoff, to filter and settle it out.
- Install multiple sediment filters on long slopes.
- Spacing on long slopes is every 50 to 100 feet.
- Put filters across slopes, on the contour (level).

Placement criteria are similar to those specified for silt fences (see the preceding section).

Construction Specifications

Brush cleared from the site can make an excellent sediment filter if it is properly placed and built up well. Brush barriers are installed on the contour and are 2–5 feet high and 4–10 feet wide at the base. They should be trenched in and walked down with a loader or dozer to compress the material.

A rock berm can also provide an effective and low-maintenance sediment barrier. Rock berms placed in concentrated flow areas function as sediment traps (for more information on that type of application, see Section 4.7.1). Longer rock berms constructed as sheet runoff sediment barriers should be 18" to 30" in height and consist of stone 2–6 inches in diameter.

Fiber rolls and other commercial products made from coconut fiber, plastic, wood shavings, compost, or other material can also be used as sediment barriers on slopes. Follow manufacturers' installation instructions and ensure that sediment filter spacing on slopes is correct--spacing decreases significantly on slopes >10:1.

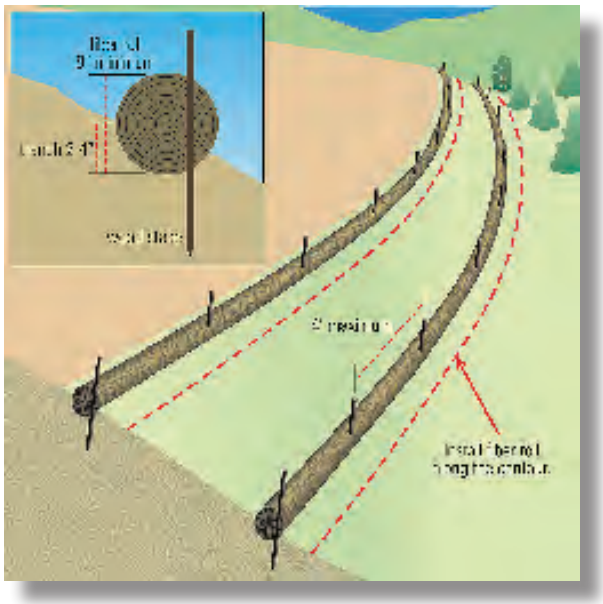
For information on locating and installing rock or commercial barriers, see construction specifications for silt fences in the preceding section.

Inspection and Maintenance

Sediment barriers should be inspected weekly and after each rainfall of greater than one-half inch. Look for signs of bypassing along the sides, undercutting below the barrier, overtopping, or blowout. Make required repairs immediately. For recurring blowouts, consider pulling some upland muddy flow away and trapping it before it can reach the blowout area. Use a J-hook or other strategically placed barrier.

Remove sediment when it reaches 1/3 height of the fence or 9 inches maximum. Spread the removed sediment and vegetate or otherwise stabilize it.

Remove sediment barriers when they have served their useful purpose but not before the upslope area has been permanently stabilized (i.e., vegetated or otherwise covered) and any sediment stored behind the barrier has been removed.



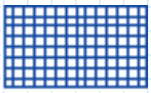
Fiber rolls provide excellent protection for residential lots. They can be stepped over and driven over, and are preferable to silt fencing in tight areas.

Brush cleared from the site used as a temporary downslope sediment barrier. Make sure barrier intercepts and ponds up muddy runoff. Remove when grass is established.

Super (wire reinforced) silt fence in the foreground, supplemented by rock sediment barrier (background). Use rock or other sediment barriers when appropriate.

4.5.3 Erosion Control Blankets and Turf Reinforcement Mats

Erosion control blankets provide excellent protection for seedbeds, especially on slopes and in areas of high winds. Blankets can be used to stabilize ditches with flatter slopes. For steeper ditches, use turf reinforcement mats.



Definition

Temporary erosion control blankets (ECBs) and permanent turf reinforcement mats (TRMs), known generally as rolled erosion control products, are single or multiple layer sheets composed of natural or synthetic material that is woven, sewn, bonded, or otherwise manufactured for placement on bare soil slopes or flow channels. ECBs have been described as temporary, degradable products composed of processed natural or polymer fibers mechanically, structurally, or chemically bound together to form a continuous matrix to provide erosion control and facilitate vegetation establishment.

Purpose

ECBs are used to temporarily stabilize and protect disturbed soil from raindrop impact and surface erosion, to increase infiltration, decrease compaction and soil crusting, and to conserve soil moisture. ECBs will increase the germination rates for grasses and legumes and promote vegetation establishment. ECBs also protect seeds from predators, reduce desiccation and evaporation by insulating the soil and seed environment.

Some types of ECBs and turf reinforcement mats are specifically designed to stabilize channelized flow areas. These blankets and mats can aid the establishment of vegetation in waterways and increase the maximum permissible velocity of the given channel by reinforcing the soil and vegetation to resist the forces of erosion during runoff events. Stems, roots and rhizomes of the vegetation become intertwined with the mat, reinforcing the vegetation and anchoring the mat.

Design Criteria

All final slopes 2H:1V or steeper should be protected with an ECB or TRM. ECBs are constructed of various degradable organic / synthetic fibers that are woven, glued or structurally bound with nettings or meshes. The most widely used ECBs are made from straw, wood excelsior, coconut, polypropylene or a combination thereof stitched or glued together or into or between biaxially oriented process nettings or woven natural fiber nettings. They are useful on sites requiring greater, more durable or longer-lasting erosion protection. Applications include gradual to steep slopes, low to moderate flow channels and low-impact shore linings. Because these degradable materials are designed to provide temporary erosion protection, they generally are limited to areas where natural, unreinforced vegetation alone will provide long-term soil stabilization.

The functional longevity of ECBs can be varied to accommodate the site-specific requirements. Some ECBs are designed to last less than 3 months for use in high-maintenance areas that will be mowed soon after turf establishment, while others are made to provide longer-lasting protection in applications requiring erosion control/mulch for up to 3 years.

Permanent TRMs consist of various UV-stabilized, synthetics fibers and filaments processed into permanent, high-strength, 3-D matrices. Common examples include cuspated polyethylene meshes heat-bonded together, extruded monofilaments of nylon or PVC heat-bonded at their intersections, and crimped polyolefin fibers and other materials mechanically stitched between high-strength nettings. TRMs are designed for permanent and critical hydraulic applications such as drainage channels, where design discharges exert velocities and shear stresses that exceed the limits of mature, natural vegetation. Though some TRMs also contain degradable components to supplement their permanent structures, all TRMs by definition have a permanent three dimensional structure with high-tensile strength that functions as a matrix for entangling plant roots, stems and soils.

Together, the TRM and vegetation form a continuous composite—a unified, living mat. This synergism increases root systems' lateral strength, reducing plant dislodgement under high-velocity, high-shear stress flows. The TRM's permanent structure also functions to consolidate and protect the soils in which the plants are anchored, preventing soil from being stripped out of the vegetative cover and the resulting weakening of the root support. TRMs are often used in situations where the *green* alternative is preferred to hard armor.

Select the ECB or TRM according to slope steepness and length and expected sheer stress if application is to a flow channel or ditch. If the area will be mowed eventually, consider the specified breakdown time for ECB plastic netting. TRM areas should not be mowed until vegetation is well established, and then as little (or as high) as possible. The table at the end of this section provides guidance on the application of various blankets and mats. An ECB or TRM should be used in all drainage channels with slopes of 2 percent or more, and in the following conditions:

- Slopes and disturbed soils where mulch anchoring is difficult and other methods such as crimping or tackifying are not feasible nor adequate
- Steep, long slopes, generally steeper than 3H:1V and longer than 50 feet
- Slopes where erosion hazards are high
- Critical slopes adjacent to sensitive areas such as streams and wetlands
- Disturbed soil areas where planting is likely to be slow in providing adequate protective cover

Take care to choose the type of blanket or matting that is appropriate for the specific needs of a project. There are many soil stabilization products available today, and it is very difficult to cover all the advantages, disadvantages and specifications of all the manufactured blankets and mats. Therefore, as with many erosion control type products, there is no substitute for a thorough understanding of manufacturer's instructions and recommendations and a site visit by a designer or plan reviewer to verify a product's appropriateness. See table in this section for details.

Construction Specifications

ECBs and TRMs are designed to cover germinating seed and provide a protective matrix that helps anchor seed to the underlying soil. (Note: a few ECBs have seed embedded in the mat.) This requires complete, uniform contact with the soil, solid stapling, and attention to topslope anchoring, overlaps, and other installation details, as noted below.

Site Preparation

Proper site preparation is essential to ensure complete contact of the protection matting with the soil.

- Grade and shape area of installation

- Remove all rocks, roots, clods, vegetative, or other obstructions so that the installed blankets or mats will have direct contact with the soil
- Prepare seedbed by loosening 2–3 inches of topsoil above final grade
- Incorporate amendments, such as lime and fertilizer, into soil according to soil test and the seeding plan, then seed the area

Seeding

Seed the area before installing blanket for erosion control and revegetation. (Seeding after mat installation is sometimes specified for turf reinforcement application—check the manufacturer's instructions). When seeding before blanket installation, reseed all check slots and other areas disturbed during installation.

Where soil filling is specified for certain TRMs, seed the matting and the entire disturbed area after installation and before filling the mat with soil. Follow the manufacturer's instructions to ensure proper installation.

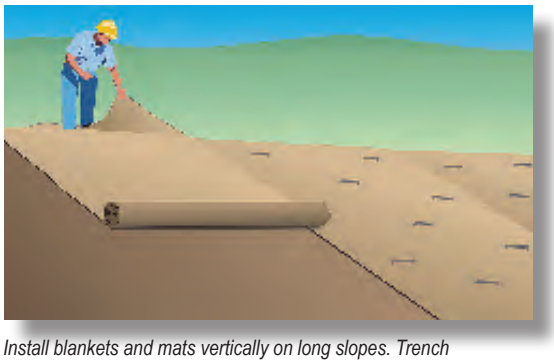
Anchoring

U-shaped wire staples, metal geotextile stake pins, or triangular wooden stakes can be used to anchor ECBs and TRMs to the ground surface. Wire staples should be a minimum of 11 gauge. Metal stake pins should be 3/16 inch diameter steel with a 1.5 inch steel washer at the head of the pin. Wire staples and metal stakes should be driven flush to the soil surface. All anchors should be 6–8 inches long and have sufficient ground penetration to resist pullout. Longer anchors might be required for loose soils. Use biodegradable composite or wooden stakes where dislodged metal staples or stakes might cause extreme hazards, such as near airport runways or areas where future mowing might cause risk.

Installation on Slopes

Begin at the top of the slope and anchor the blanket in a 6 inch deep by 6 inch wide trench. Backfill trench and tamp earth firmly.

- Unroll blanket downslope in the direction of the water flow.
- The edges of adjacent parallel rolls must be overlapped at least 3 inches and be stapled through the overlapped area at least every 3 feet on slopes less than 4H:1V and every 2 feet on steeper slopes.
- When blankets must be spliced, place uphill blanket end over downhill blanket (shingle style) with 6-inch overlap. Staple through overlapped area, approximately 12 inches apart.
- Lay blankets and mats loosely and maintain direct contact with the soil—do not stretch. Ensure good, consistent, direct soil contact.
- ECBs and TRMs must be stapled sufficiently to anchor the blanket and maintain contact with the soil. Staples must be placed down the center and staggered with the staples placed along the edges. Steep slopes (1H:1V to 2H:1V) require at least two staples per square yard. Moderate slopes (2H:1V to 3H:1H) require 1-2 staples per square yard (1 staple 3 every feet on center). Flatter slopes require one staple per square yard.



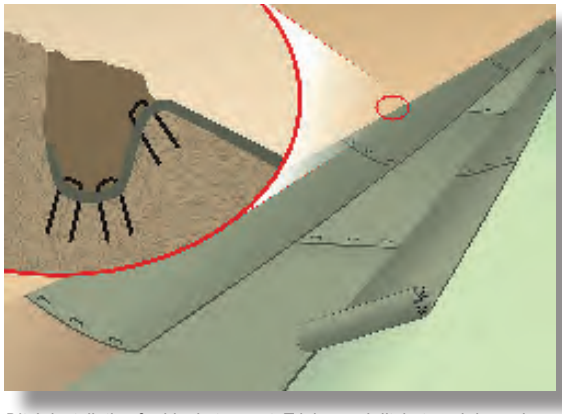
Install blankets and mats vertically on long slopes. Trench and staple top section, overlap sides 3 to 6 inches. Follow manufacturer's directions regarding stapling and slope limitations. For areas that will be mowed, specify blankets without plastic netting or material designed to decompose within 6 months.

Installation in ditches and channels

Dig initial check slot trench 12 inches deep and 6 inches wide across the channel (i.e., perpendicular to the flow direction) at the lower end of the project area. Seed area first, if specified for the type of TRM or ECB used.

- Excavate intermittent check slots, 6 inches deep and 6 inches wide across the channel at 25–30 foot intervals along the channel.

- Cut longitudinal channel anchor slots 4 inches deep and 4 inches wide along each side of the installation to bury edges of matting. These anchor slots will mark the upper elevation of the ECB or TRM along the channel side slopes, and should be above the 10 year, 24-hour peak flow line. Whenever possible extend the ECB or TRM 1 foot or more above the crest of channel side slopes.



Ditch installation for blanket or mat. Triple-seed ditch, trench in upslope blanket sides, and staple down securely. Lay ditch sections horizontally, lapping upslope sections over downslope sections. Use plenty of staples below the water line.

- Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at 1-foot intervals. Note: Matting will initially be upside down in anchor trench.
- In the same manner, position adjacent rolls in the anchor trench, overlapping the preceding roll a minimum of 6–8 inches.
- Secure these initial ends of mats with anchors at 1-foot intervals, backfill and compact soil.
- Unroll the center strip of matting upstream. Stop at the next check slot or terminal anchor trench.
- Unroll adjacent mats upstream in similar fashion, maintaining a 3-inch overlap.
- Fold and secure all rolls of matting snugly into all transverse check slots. Lay the mat in the bottom of the slot then fold back against itself. Anchor through both layers of mat at 1-foot intervals, then backfill and compact the soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench.
- Alternate method for noncritical installations: place two rows of anchors on 6-inch centers at 25–30 feet intervals in lieu of excavated check slots. Shingle-lap the spliced ends by a minimum of 1 foot with the upstream mat on top (to prevent uplifting by water) or begin new rolls in a check slot. Anchor the overlapped area by placing two rows of anchors, 1 foot apart on 1-foot intervals.
- Place the edges of outside mats in previously excavated longitudinal slots, anchor them using the prescribed staple pattern, then backfill and compact the soil.
- Anchor, fill, and compact the upstream end of the mat in a 12-inch by 6-inch terminal trench.
- Secure the mat to the ground using U-shaped wire staples, geotextile pins, or wooden stakes. (Note: some TRMs require seeding after installation--check manufacturer's requirements).
- Spread and lightly rake one-half to three-quarter inch of fine topsoil into the mat apertures to completely fill the mat thickness. Use the backside of a rake or other flat implement. Spread topsoil using lightweight loader, backhoe, or other power equipment. Avoid making sharp turns with the equipment.
- Do not drive tracked or heavy equipment over the mat. Avoid any traffic over the matting if loose or wet soil conditions exist.
- Use shovels, rakes or brooms for fine grading and touch up. Smooth out soil filling, just exposing the top netting of matrix.

Erosion Control Technology Council Standard Specification for Temporary Rolled Erosion Control Products

For use where natural vegetation alone will provide permanent erosion protection

ULTRA SHORT TERM: Typical 3-Month Functional Longevity

			*Slope Applications**		*Channel Applications**	
Type	***Product Description***	***Material Composition***	Maximum Gradient	C Factor [2, 5]	Permissible Shear Stress [3, 4, 6]	***Minimum Tensile Strength[1]***
1.A	Mulch Control Nets	A photodegradable synthetic mesh or woven biodegradable natural fiber netting.	5:1 (H:V)	< 0.10 @ 5:1	= 0.25 lbs/ft^2	5 lbs/ft
1.B	Netless Rolled ECBs	Natural and/or polymer fibers mechanically interlocked and/or chemically adhered together to form a RECP.	4:1 (H:V)	< 0.10 @ 4:1	= 0.5 lbs/ft^2	5 lbs/ft
1.C	Single-net ECBs & Open Weave Textiles	Processed degradable natural and/or polymer fibers mechanically bound together by a single rapidly degrading, synthetic or natural fiber netting or an open weave textile of processed rapidly degrading natural or polymer yarns or twines woven into a continuous matrix.	3:1 (H:V)	< 0.15 @ 3:1	= 1.5 lbs/ft^2	50 lbs/ft
1.D	Double-net ECBs	Processed degradable natural and/or polymer fibers mechanically bound together between two rapidly degrading, synthetic or natural fiber nettings.	2:1 (H:V)	< 0.20 @ 2:1	= 1.75 lbs/ft^2	75 lbs/ft

SHORT-TERM: Typical 12-Month Functional Longevity

			*Slope Applications**		*Channel Applications**	
Type	***Product Description***	***Material Composition***	Maximum Gradient	C Factor [2, 5]	Permissible Shear Stress [3, 4, 6]	***Minimum Tensile Strength[1]***
2.A	Mulch Control Nets	A photodegradable synthetic mesh or woven biodegradable natural fiber netting.	5:1 (H:V)	< 0.10 @ 5:1	= 0.25 lbs/ft^2	5 lbs/ft
2.B	Netless Rolled ECBs	Natural and/or polymer fibers mechanically interlocked and/or chemically adhered together to form a RECP.	4:1 (H:V)	< 0.10 @ 4:1	= 0.5 lbs/ft^2	5 lbs/ft
2.C	Single-net ECBs & Open Weave Textiles	An erosion control blanket composed of processed degradable natural or polymer fibers mechanically bound together by a single degradable synthetic or natural fiber netting to form a continuous matrix or an open weave textile composed of processed degradable natural or polymer yarns or twines woven into a continuous matrix.	3:1 (H:V)	< 0.15 @ 3:1	= 1.5 lbs/ft^2	50 lbs/ft
2.D	Double-net ECBs	Processed degradable natural and/or polymer fibers mechanically bound together between two degradable, synthetic or natural fiber nettings.	2:1 (H:V)	< 0.20 @ 2:1	= 1.75 lbs/ft^2	75 lbs/ft

Erosion Control Technology Council Standard Specification for Temporary Rolled Erosion Control Products (continued)

For use where natural vegetation alone will provide permanent erosion protection

EXTENDED TERM: Typical 24-Month Functional Longevity

Type	*Product Description*	*Material Composition*	*Slope Applications**		*Channel Applications**	*Minimum Tensile Strength*[1]
			Maximum Gradient	C Factor [2, 5]	Permissible Shear Stress [3, 4, 6]	
3.A	Mulch Control Nets	A slow degrading synthetic mesh or woven natural fiber netting.	5:1 (H:V)	< 0.10 @ 5:1	= 0.25 lbs/ft^2	25 lbs/ft
3.B	ECBs & Open Weave Textiles	An ECB composed of processed slow degrading natural or polymer fibers mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix or an open weave textile composed of processed slow degrading natural or polymer yarns or twines woven into a continuous matrix.	1.5:1 (H:V)	< 0.25 @ 1.5.:1	= 2.00 lbs/ft^2	100 lbs/ft

LONG TERM: Typical 36-Month Functional Longevity

Type	*Product Description*	*Material Composition*	*Slope Applications**		*Channel Applications**	*Minimum Tensile Strength*[1]
			Maximum Gradient	C Factor [2, 5]	Permissible Shear Stress [3, 4, 6]	
4	ECBs & Open Weave Textiles	An ECB composed of processed slow degrading natural or polymer fibers mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix or an open weave textile composed of processed slow degrading natural or polymer yarns or twines woven into a continuous matrix.	1:1 (H:V)	< 0.25 @ 1:1	= 2.25 lbs/ft^2	125 lbs/ft

NOTES:

* "C" factor and shear stress for Types 1.A., 2.A. and 3.A mulch control nettings must be obtained with netting used in conjunction with pre-applied mulch material.

1 Minimum Average Roll Values when tested in the machine direction using ECTC Modified ASTM D 5035.

2 Factor calculated as ratio of soil loss from RECP protected slope (tested at specified or greater gradient, H:V) to ratio of soil loss from unprotected (control) plot in large-scale testing. Performance test values should be supported by periodic bench scale testing under similar test conditions using ECTC Test Method # 2.

3 Minimum shear stress RECP (unvegetated) can sustain without physical damage or excess erosion (0.5 in soil loss) during a 30-minute flow event in large-scale testing. Performance test values should be supported by periodic bench-scale testing under similar test conditions and failure criteria using ECTC Test Method #3.

4 The permissible shear stress levels established for each performance category are based on historical experience with products characterized by Manning's roughness coefficients in the range of 0.01–0.05.

5 Acceptable large-scale test methods may include ASTM D6459 or other independent testing deemed acceptable by the engineer.

6 Acceptable large-scale testing protocol may include ASTM D6460 or other independent testing deemed acceptable by the engineer.

Erosion Control Technology Council Standard Specification for Permanent Rolled Erosion Control Products

For applications in ditches and channels, and on slopes not exceeding 0.5H:1V where vegetation alone will not sustain expected flow conditions and/or provide sufficient long-term erosion protection

Type[1]	Product Description	Material Composition	Minimum Tensile Strength [2, 3]	Minimum Thickness (ASTM D 6525)	UV Stability (ASTM D 4355 @ 500 Hours)	Channel Applications Permissible Shear Stress [4, 5]
5.A	TRM	Long term, non-degradable rolled erosion control product composed of UV stabilized, nondegradable, synthetic fibers, filaments, nettings and/or wire mesh processed into three dimensional reinforcement matrices designed for permanent and critical hydraulic applications where design discharges exert velocities and shear stresses that exceed the limits of mature, natural vegetation. TRMs provide sufficient thickness, strength and void space to permit soil filling and/or retention and the development of vegetation within the matrix.	125 lbs/ft	0.25 inches	80%	= 6.0 lbs/ft^2
5.B	TRM		150 lbs/ft	0.25 inches	80%	= 8.0 lbs/ft^2
5.C	TRM		175 lbs/ft	0.25 inches	80%	= 10.0 lbs/ft^2

NOTES:

1 For TRMs containing degradable components, all property values must be obtained on the non-degradable portion of the matting alone.

2 Minimum Average Roll Values, machine direction only for tensile strength determination using ASTM D6818 (Supersedes Mod. ASTM D5035 for RECPs)

3 Field conditions with high-loading and/or high survivability requirements may warrant the use of a TRM with a tensile strength of 3,000 lb/ft or greater.

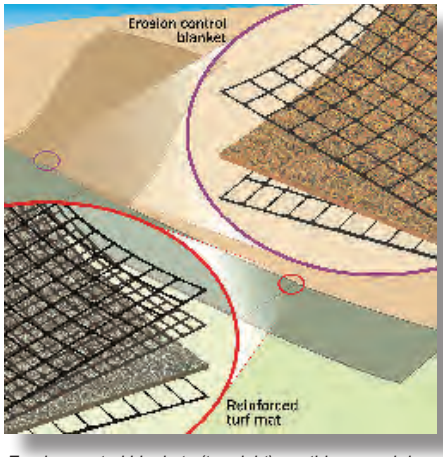
4 Shear stress that fully vegetated TRM can sustain without physical damage or excess erosion (0.5 in) soil loss) during a 30-minute flow in large-scale testing.

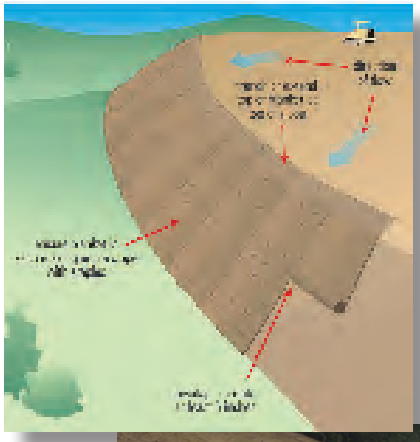
5 Acceptable large-scale testing protocol may include ASTM D6460 or other independent testing deemed acceptable by the engineer.

Inspection and Maintenance

All blankets and mats should be inspected periodically following installation.

- Inspect installation after significant rainstorms to check for erosion and undermining. Any failure should be repaired immediately.
- If washout or breakage occurs, reinstall the material after repairing the damage to the slope or drainageway.





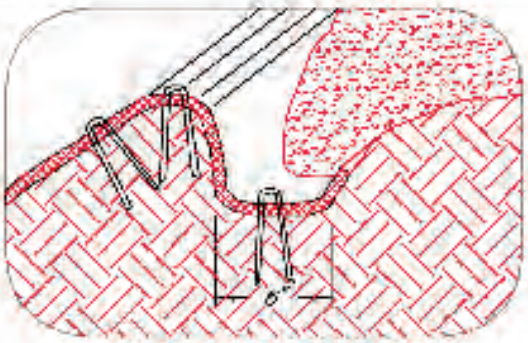
Blankets are highly recommended for long, steep slopes (i.e., longer than 75 feet and steeper than 3H:1V). Trench in top of blankets, overlap sides, and use plenty of staples. Blankets can become saturated and heavy after a rain and begin to slip down the slope if not staked securely.

Erosion control blankets (top right) are thinner and degrade quicker than turf reinforcement mats (lower left). Blankets are used on shorter, flatter slopes and low-flow ditches. Mats can be used on steep slopes and high-velocity ditches.

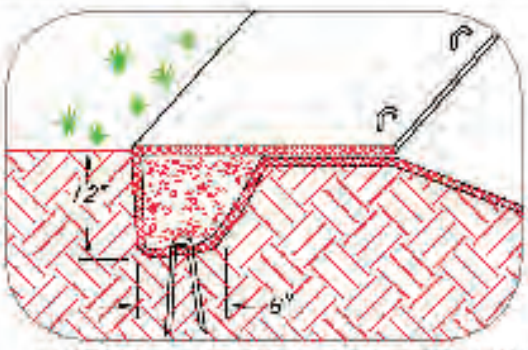
Very good installation of turf mat in long, steep, high-flow ditch below long slope.

Good use of straw and excelsior blankets on streambank stabilization project. Note that the bottom of stream is not disturbed to preserve habitat. This site is ready for live stakes, tree plantings, or other vegetation (see Section 4.7, Stream and Wetland Protection).

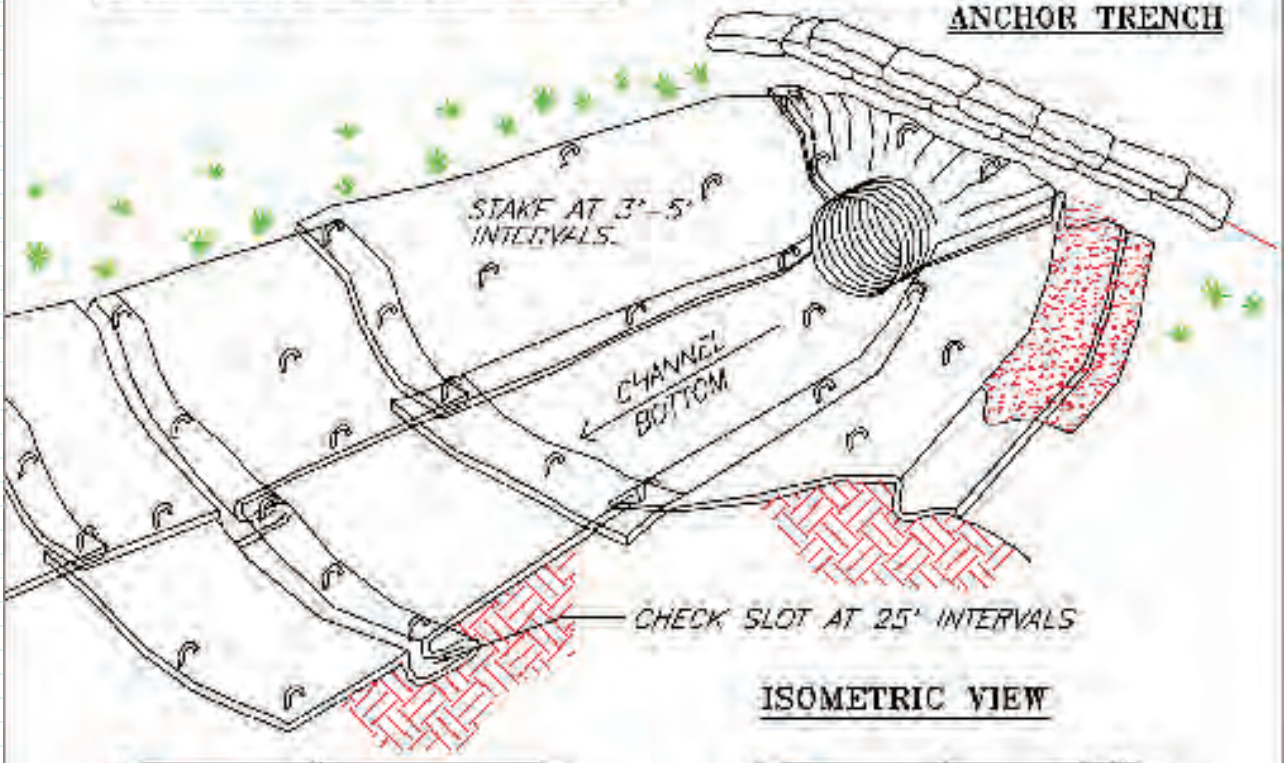
Seeding on long, steep slope protected by straw erosion control blanket. Make sure blankets are stapled down securely for these applications to prevent blankets from sliding downhill when weighted down with rain and fugitive sediment.



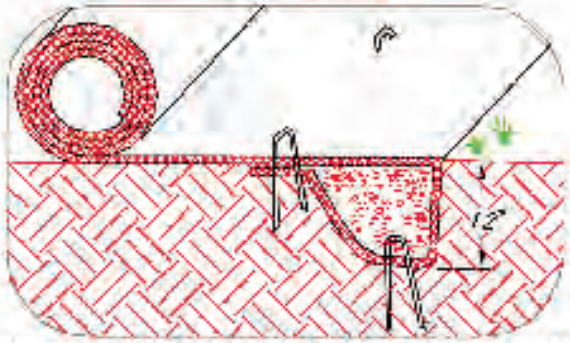
LONGITUDINAL ANCHOR TRENCH



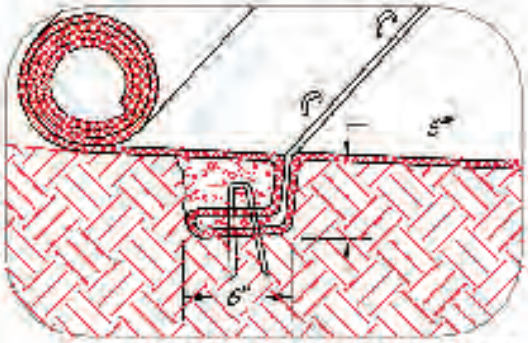
TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH



ISOMETRIC VIEW



INITIAL CHANNEL ANCHOR TRENCH



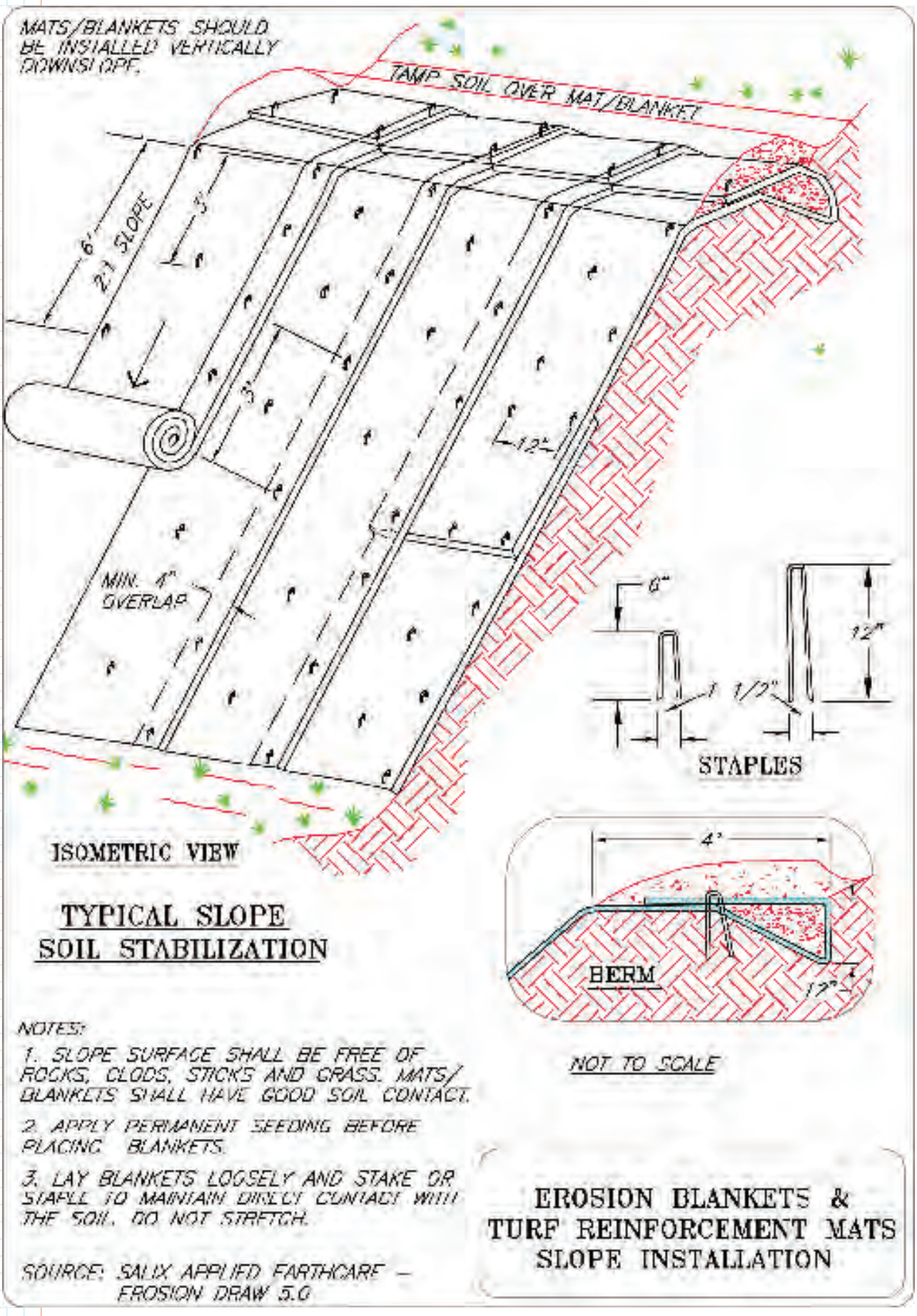
INTERMITTENT CHECK SLOT

NOTES:

1. CHECK SLOTS TO BE CONSTRUCTED PER MANUFACTURERS SPECIFICATIONS.
2. STAKING OR STAPLING LAYOUT PER MANUFACTURERS SPECIFICATIONS.

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

EROSION BLANKETS & TURF REINFORCEMENT MATS CHANNEL INSTALLATION



TYPICAL SLOPE SOIL STABILIZATION

NOT TO SCALE

NOTES:

1. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS. MATS/ BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
3. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

EROSION BLANKETS & TURF REINFORCEMENT MATS SLOPE INSTALLATION

4.5.4 Temporary Slope Drains

Securely installed plastic pipe functions very well as a temporary slope drain. Inspect after rainfall to make sure flows are routed into drain pipe, and outlet areas are stable and not eroding.

TSD TSD

Definition

A temporary slope drain is a pipe or lined (TRM, rock, or concrete) ditch or channel extending from the top to the bottom of a cut or fill slope during the construction period.

Purpose

Temporary slope drains serve to convey concentrated runoff down the face of a cut or fill slope without causing erosion. They are generally used in conjunction with diversions to convey runoff down a slope until permanent water management measures can be installed.

Design Criteria

Use the design criteria below for both pipe and channel slope drains. For channels, see the section on Channels and Ditches for information on lining temporary and permanent slope drains constructed as open conveyances.

***General*—**It is very important that these temporary structures be sized, installed, and maintained properly, because their failure will usually result in severe erosion of the slope. The entrance section to the drain should be well entrenched, staked down, and stable so that surface water can enter freely. The drain should extend downslope beyond the toe of the slope to a stable area or appropriately stabilized outlet.

***Pipe capacity*—**The pipe should be able to handle peak flow from the 10-year, 24-hour storm. Use 10-inch diameter or larger pipe to convey runoff from areas up to one-third acre; 12-inch or larger pipe for up to half-acre drainage areas, and 18-inch pipe for areas up to one acre. Multiple pipes or channels are often required for large areas, spaced as needed.

***Conduit*—**Construct the slope drain pipes from heavy-duty, flexible materials such as non-perforated, corrugated plastic pipe, or open top overside drains with tapered inlets, or corrugated metal pipe (CMP). Install reinforced, hold-down grommets or stakes to anchor the conduit at intervals not to exceed 10 feet with the outlet end securely fastened in place. CMP or corrugated plastic pipe must have one anchor assembly for every 20 feet of slope drain. The conduit must extend beyond the toe of the slope.

***Entrance*—**Construct the entrance to the slope drain of a standard flared-inlet section of pipe with a minimum 6-inch metal toe plate. Make all fittings watertight. A standard T-section fitting can also be used at the inlet. An open top flared inlet for overside drain can also be used.

***Temporary diversion*—**Generally, use an earthen diversion with a dike ridge or berm to direct surface runoff into the temporary slope drain. Make the height of the ridge over the drain conduit a minimum of 1.5 feet and at least 6 inches higher than the adjoining ridge on either side. The lowest point of the

diversion ridge should be a minimum of 1 foot above the top of the drain so that design flow can freely enter the pipe.

***Outlet protection*—**Protect the outlet of the slope drain from erosion with an energy dissipator. (i.e., rock apron or other armoring).

Construction Specifications

A common failure of slope drains is caused by water saturating the soil and seeping along the pipe. Proper backfilling around and under the pipe haunches with stable soil material and hand-compacting in 6 inch lifts to achieve firm contact between the pipe and the soil at all points will reduce this type of failure.

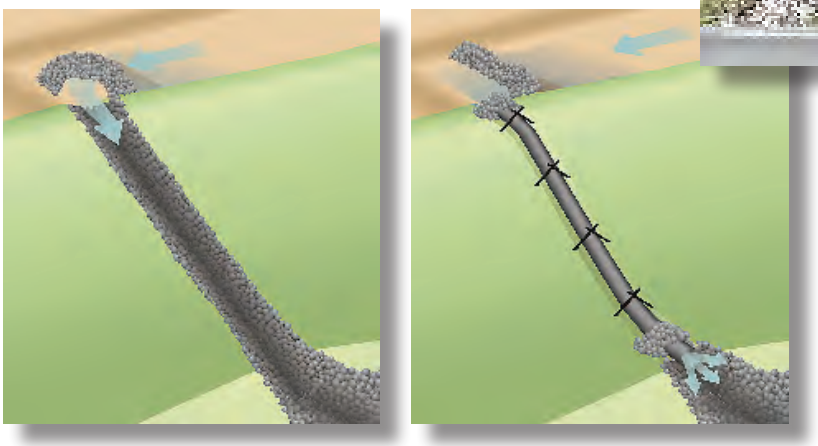
- Place slope drains on undisturbed soil or well-compacted fill at locations and elevations shown on the plans.
- Slightly slope the section of pipe under the dike toward its outlet.
- Compact the soil under and around the entrance section in lifts not to exceed 6 inches.
- Ensure that fill over the drain at the top of the slope has a minimum depth of 1.5 feet and a minimum top width of 4 feet. The sides should have a 3H:1V slope.
- Ensure that all slope drain connections are watertight.
- Ensure that all fill material is well compacted. Securely fasten the exposed section of the drain with grommets or stakes spaced no more than 10 feet apart.
- Extend the drain beyond the toe of the slope and adequately protect the outlet from erosion.
- Make the settled, compacted dike ridge no less than 1 foot higher than the top of the pipe inlet.

Immediately stabilize all disturbed areas following construction.

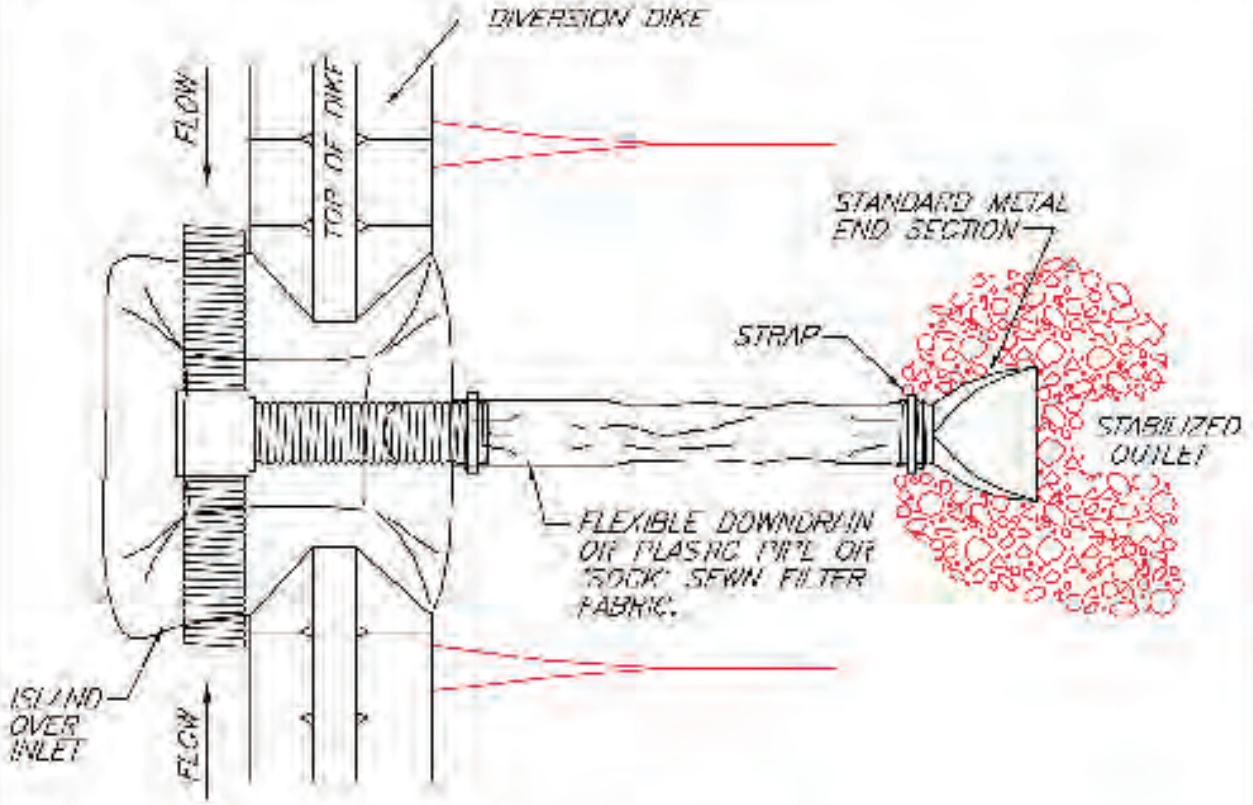
Inspection and Maintenance

Inspect slope drains and supporting diversions weekly and after every significant rainfall and promptly make necessary repairs. When the protected area has been permanently stabilized, temporary measures can be removed, materials disposed of properly, and all disturbed areas stabilized appropriately.

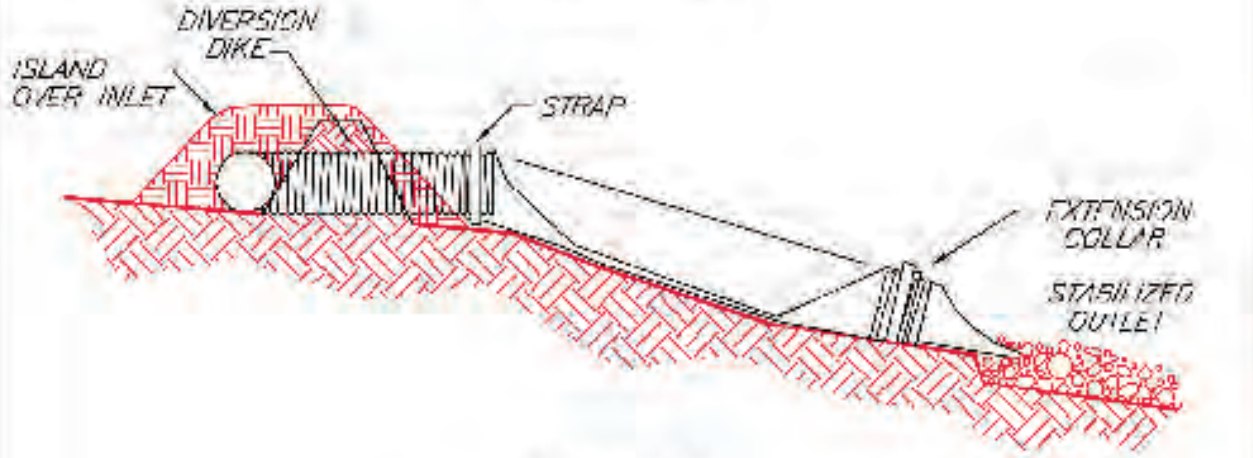
This is a very good installation of a rock-lined slope drain. Inspect weekly until site is stabilized. Use geotextile under rock to prevent undercutting.



Rock-lined slope drains (left) should have a non-woven geotextile underliner, to prevent erosion and undermining. Use rock or sandbag berms to route runoff into slope drains (right). Stake down plastic pipe securely. Control outlet erosion with a flow dissipator (see Section 4.5).



PLAN VIEW



SECTION

SLOPE DRAIN

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

4.5.5 Gabion Baskets and Mattresses

Galvanized wire can be fabricated into box-like gabion baskets (left) or flatter mattresses. Mixing mulch and soil into gabion structures—or applying it to the surface after construction—can help establish vegetation that provides a softer look. Note that US Army Corps of Engineers Section 404 permits and KDOW floodplain permits are required when gabion structures are laced within the banks of streams, rivers, wetlands, lakes, or other regulated water bodies.

Ga

Definition

Gabions are rectangular galvanized wire baskets filled with stones used as pervious, semi-flexible building blocks for slope and channel stabilization. Mulch, soil, and live rooting branches can be placed between the rock-filled baskets to support vegetation.

Purpose

Gabions protect slopes and streambanks from the erosive forces of moving water. Rock-filled gabion baskets or mattresses can be used as retaining walls for slopes, to armor the bed or banks of channels, or to divert flow away from eroding channel sections. Rock-filled or vegetated rock gabions are used on streambank sections subject to excessive erosion because of increased flows or disturbance during construction. Gabions can be specified where flow velocities exceed 6 feet per second and where vegetative streambank protection alone is not sufficient. Gabions can be used to construct deflectors or groins intended to divert flow away from eroding streambank sections. Gabions are also used to construct retaining walls and grade control structures. Gabion walls are appropriate where

- An excessively steep stream bank must be stabilized and vegetative or extreme mechanical means of stabilization (i.e., pulling back bank) are not feasible because of site conditions.
- The vertical integrity of a soil bank needs a higher tensile strength to reduce sloughing of the streambank.
- There is moderate to excessive subsurface water movements that could be creating erosion and damaging other types of nonpermeable structures.
- The slope must be modified while heavy machinery is unavailable to the site.
- Fill must be disposed of along an eroding streambank (fill can be placed behind gabion to modify slope).
- A retaining or toe wall is needed to stabilize the slope.
- Rock riprap is an appropriate practice, but the available or desired rock size (smaller) is not sufficient alone to resist the expected shear stress exerted on the revetment. Gabions allow the use of a smaller size rock than would be possible without the wire baskets because the rock is bound by the wire mesh, creating a more monolithic structure.

Design Criteria

There are several types of gabion structures and applications useful on construction sites, as summarized below. Gabion structures are not recommended for steeply sloping channels where rock or high volumes of gravel sediment move at high velocity in the channel bed because of the possibility of damage to the wire mesh and failure of the basket or mattress structure.

The use of gabion structures in urban areas may be restricted, because of the possibility that they will harbor rodents and other pests. Some counties and cities in Kentucky have banned gabion structures except in extreme conditions, where no other material is appropriate.

Gabion wall—Basically a gravity wall that relies on its own weight and frictional resistance to resist sliding and overturning from lateral earth pressure.

Vegetated rock gabion—A rock-filled gabion earth-retaining structure that has live branches placed between each consecutive layer of rock-filled baskets. The live branches will take root inside the gabion and into the soil behind the structure. The vegetation will consolidate the structures and bind it to the slope.

Gabion deflector—Deflector or groins project into the streams and divert flows away from eroding streambank sections.

Gabion aprons—Rock-filled gabions or gabion mattress used as outlet protection, energy dissipators, or spillways. These semiflexible gabions are designed to settle without fracturing and adhere to the ground if scour occurs.

Grade control—Drop structures or weirs. Gabion baskets and mattresses can be combined to construct check dams or weirs.

Channel lining—Gabion mattresses can be used to line channels. The lining thickness depends on many factors such as the type of rock, design flow velocity, sediment and bedload, and channel gradient.

Gabion mattresses—Also referred to as Reno mattresses or revet mattresses, gabion mattresses are not as thick as gabions, usually one-half, three-quarters, or 1 foot thick. Gabion mattresses are used to line channels, armor streambanks and slopes, and used with gabions for grade-control structures (spillways or aprons).

Gabions and gabion mattresses are often preferable to rock riprap alone. For any given hydraulic condition, the gabion or gabion mattress revetment thickness is one-third of an equivalent riprap design. Gabions and gabion mattresses are flexible and free draining, thus allowing some soil settling. They can be used in unstable streambeds and streambanks. Gabions can provide an important component to a bioengineering solution for streambank or slope erosion because they allow the growth and establishment of natural vegetation.

Gabion containers are generally fabricated from a double-twist, hexagonal mesh of heavily zinc-coated wire. Some gabions use welded wire. As an option, the wire can be coated with PVC. Wire diameter is 0.086 inches for the double-twisted gabion mattress and 0.106–0.120 inches for the double-twisted gabion. The welded wire gabion uses wire diameters of 0.120 inches or greater. The rectangular gabions are divided into cells with diaphragms of equal capacity. The compartments add strength and assure that the full material remains evenly distributed. Gabions and gabion mattresses come in various sizes.

Choose the dimensions of the gabions or combination of gabions to meet the design requirement site conditions. The mesh opening for gabions is typically or nominally 3.25 x 4.5 inches. Some gabion mattresses have mesh openings of approximately 2.5 x 3.25 inches. Both styles perform hydraulically equivalent.

Typical Gabion Basket Sizes

Letter Code	Length (ft)	Width (ft)	Depth (ft)	Number of Cells	Capacity (cubic yards)
A	6	3	3	1	2
B	9	3	3	2	3
C	12	3	3	3	4
D	6	3	1.5	1	1
E	9	3	1.5	2	1.5
F	12	3	1.5	3	2
G	6	3	1	1	0.666
H	9	3	1	2	1
I	12	3	1	3	1.333
T	9	6	.75	3	2.0
U	12	6	.75	4	1.33
Q	9	6	.5	3	1.33
S	9	6	.5	2	1.0

Construction Specifications

Install gabions in accordance with manufacturer's standards and specifications.

- Gabions must be fabricated so that the sides, ends, lid and diaphragms can be assembled at the construction site into rectangular baskets of the sizes specified and shown on the construction drawings.
- Gabions must be of single-unit construction; the base, lid, ends and sides must be either woven into a single unit or one edge of these members connected to the base section of the gabion so that the strength and flexibility at the connecting point is at least equal to that of the mesh.
- Where the length of the gabion exceeds 1.5 times its horizontal width, the gabion must be divided by diaphragms of the same mesh and gauge as the body of the gabion, into cells whose length does not exceed the horizontal width.
- Gabions and mattresses are unfolded and assembled at the job site. Corners are first joined together and then the diaphragms are attached to the side panels.
- Each gabion must be assembled by tying all untied edges with lacing wire or approved fasteners. The lacing wire must be tightly looped around every other mesh opening along the seams so that single and double loops are alternated.
- The gabion or gabion mattress must be securely keyed into the streambank or streambed to assure that flows do not erode the soils beneath or around it.
- Starting at the lowest point of the slope, excavate the loose material 2–3 feet below the ground elevation until a stable foundation is reached.
- Excavate the back of the stable foundation slightly deeper than the front so the foundation tilts back into the slope.
- A line of empty gabion units must be placed in the bottom of its excavation and the baskets are to be joined together along adjacent edges, both horizontally and vertically. The base of the empty gabions placed on top of a filled line of gabions must be tightly wired to the latter at front and back.

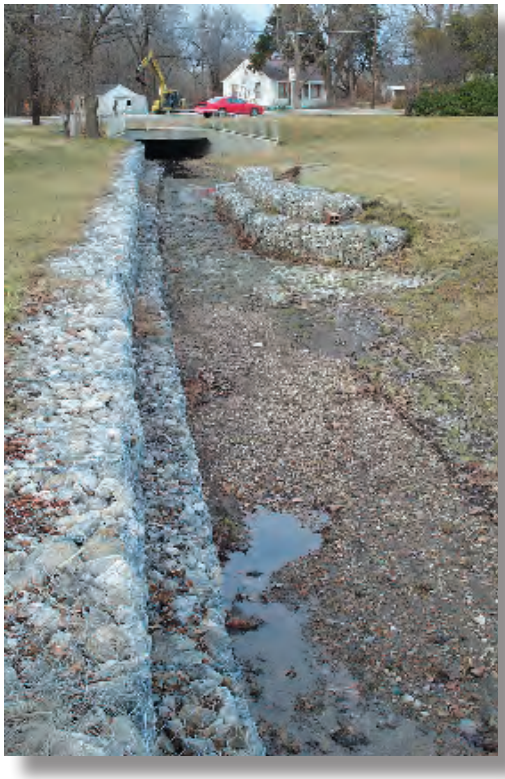
- To achieve better alignment and finish in gabion walls, stretching of the gabions is recommended.
- For gabions greater than 18 inches, connecting wires (wires tied to opposite faces of each gabion cell) must be installed during filling operations.
- Hand-packing the gabion baskets or mattresses is preferred, but mechanical filling is acceptable if care is taken to avoid bending, distorting, or damaging the wire structures. Gabions must be filled to a depth of 12 inches and then two connecting wires must be tightly tied to opposite faces of each gabion cell at a height of 12 inches above the base. Gabions must then be filled with a further depth of 12 inches and two connecting wires must be similarly tied at this level. Then gabions must be filled to the top.
- Fill gabions with appropriately sized river rock or quarry stone or other approved infill material. Use of hard material with high specific gravity is recommended. The tops of the gabions are then closed along edges and diaphragms using lacing wire or approved fasteners. Keep voids and bulges in the gabions to a minimum to ensure proper alignment and a neat, compact, square appearance.
- The stone size to fill gabions must be 3–5 inches for gabion mattresses and 4–8 inches for gabion baskets.

Inspection and Maintenance

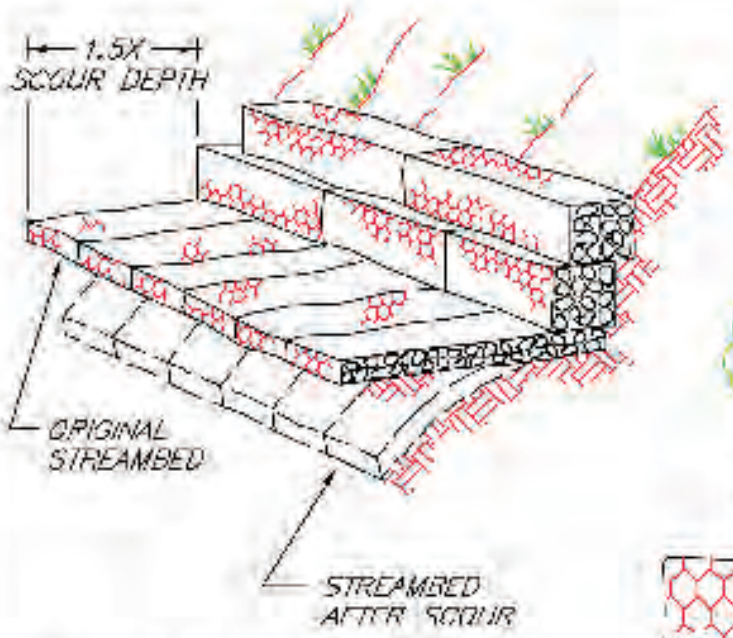
Inspection of construction methods during the gabion assembly, placement, and fill process will help ensure that the structure performs as intended. All structures should be maintained in an *as built* condition. Structural damage caused by storm events should be repaired as soon as possible to prevent further damage to the structure or erosion of the streambank.

During inspection, look for undercutting, bypassing, or other flow-related erosion problems. Check to ensure that basket wiring is adequate, and components are not separating (i.e., sidewalls becoming detached). Repair baskets that appear to be splitting; use rock or other armoring to repair eroded areas.

Gabion mattresses can replace turf mats in high-flow, high-velocity channels. Mixing mulch and soil into the rock can help support vegetation for a "greener" look.



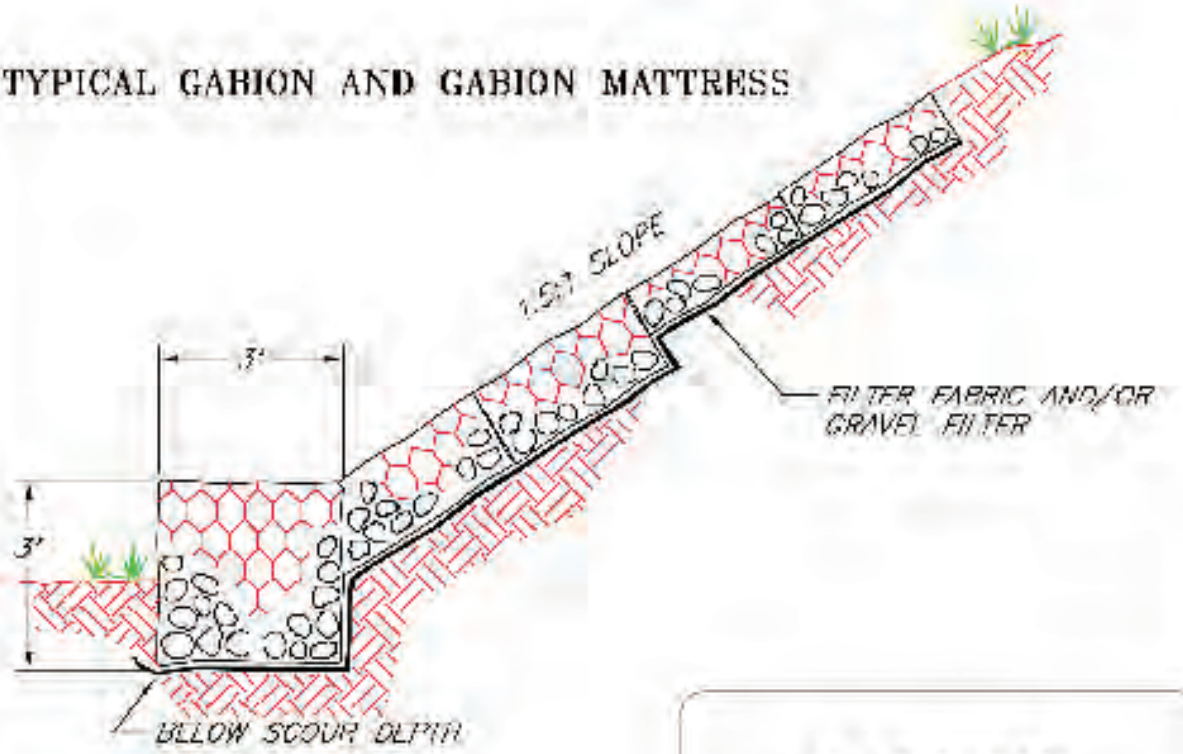
Gabions can protect banks in areas of high velocity flows. Some designers prefer TRMs in these situations, if space is available to slope banks back appropriately.



TYPICAL GABION APRON

TYPICAL VEGETATED ROCK GABION

TYPICAL GABION AND GABION MATTRESS



GABIONS

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

4.5.6 Cellular Confinement Systems

Concrete and plastic cellular blankets, like this open-celled concrete block product, provide heavy armoring while supporting vegetation that softens the final look.

Definition

A cellular confinement system (CCS) is a three-dimensional, honeycombed, sheet, mat, or interlocking structure filled with soil and planted with vegetation used to stabilize the surface of earthen cut and fill slopes.

Purpose

CCSs are permanent erosion control practices intended to stabilize infill materials for slope and channel protection, load support, and earth retention applications. The expandable panels create a cellular system that confines topsoil infill, protects and reinforces the plant's root zone, and permits infiltration and natural subsurface drainage. The honeycomb shaped cells encapsulate and prevent erosion of the infill material. The cellular confinement systems are used for

- ***Revetments*—**Filling the cells with topsoil or rock and vegetation can provide an alternative to hard armor revetment systems
- ***Erosion control on steep slopes*—**Cells can be filled with soil and vegetated or filled with granular materials. Slopes as steep as 1H:1V can be treated with cellular confinement systems. Application on steep slopes may require tendons for system stability and security against sliding.
- ***Flexible channel lining systems***—either vegetated or rock filled.
- ***Road stabilization***—cells confine and reinforce select fill materials, thereby increasing load-bearing capacities. Creates a porous pavement system with aggregate or topsoil/vegetation infill.
- ***Temporary low-water stream crossings***.

Construction Specifications

Site Preparation

The surface of the slope should be leveled, with stones and debris removed. Gullies should be filled and well compacted. Major obstacles such as boulders can be left in place. Simply cut out panels around them.

Following excavation and fill placement operations, shape and compact the subgrade surfaces to the designed elevations and grades.

Excavate the area so that when cellular confinement systems are installed, the top of the section is flush with or slightly lower than the adjacent terrain or final grade.

Remove unstable subgrade soils when required and install geotextile underliner if specified.

Installation

Follow manufacturer's instructions regarding application type, slope limits, installation procedure, appropriate fill material, and so on.

- Anchor the cellular confinement system sections at the top of the slope across a 2–4 foot ledge. Expand and stretch the cellular confinement system down the slopes.
- The type of anchors and frequency of anchoring will depend on site conditions. Typically, every other cell across the top section is anchored with J-pins or other suitable anchor devices. This anchoring pattern is repeated every 6 feet down the slope.
- The cells should be anchored securely to prevent deformation of the panel while backfilling. Depending on the slope angle and fill soils involved, intermediate anchorage will be necessary on some interior cells to limit sideways deformation, ensure stability and avoid overloading the upper sections.
- Additional panels are abutted together and joined with staples, hog rings or other suitable fasteners.

Infill Placement

Place the fill material in the expanded cells with suitable equipment such as a backhoe, front-end loader or conveyer.

- Limit drop height to 3 feet to reduce crushing force on cell material.
- On steep slopes, infill from the crest to the toe to prevent displacement and deformation of the cellular confinement system.
- Overfilling and compacting of infill depend on the type and consistency of material and the depth of the cells.

Inspection and Maintenance

Inspect slope periodically and after significant rainstorms to check for erosion. Any failure should be repaired immediately.

If vegetation has not been established, fertilize and reseed damaged and sparse areas immediately.

Cellular concrete mat used to stabilize banks in a highly erodible silty loam soil. Double- or triple-seed these applications immediately after installation. Mulch might be needed to support seeded areas until grass is established.

Plastic cellular blanket installed on a steep, long slope. Work closely with manufacturers on these applications to ensure proper design, installation, and initial maintenance.

Cellular blankets provide an aesthetic alternative to poured concrete walls and other armored installations

4.6 Drainage System Controls

General Information

Construction site ditches, curb inlets, drop inlets, inlets to culverts, and other areas where muddy runoff flows toward the stormwater conveyance system need to be protected. Ditches are protected with a variety of liners: sod, grass-seeded turf reinforcement mats, riprap, gabions, pavement, or other material as appropriate. The long-term management of ditches and channels as stable, vegetated, *natural* drainage systems with native vegetation buffers is highly recommended because of the inherent stability offered by grasses, shrubs, trees, and other vegetation; greater visual and other aesthetic benefits provided by native plant buffers; and higher habitat and property values.

Ditches and Channels

During the construction phase, ditches and channels with gently sloping bottoms (less than 3 percent) can be stabilized with thick grass seedings and erosion control blankets. Moderately sloping channels (3–6 percent slopes) will likely require seed and TRMs and perhaps riprap if soils have high silt content. Steeply sloping channels (greater than 10 percent) need heavier armoring with concrete, riprap, gabions, geogrid, grade control structures, or other measures.

Silty soils are the most erodible, and clay is the least erodible. Steeper ditches and channels and those with highly erodible soils need more protection. Ditch or channel bank slopes should not exceed 2:1. If tractor mowers or other equipment will cross channels in the future, bank slopes should be 3:1 or flatter. Ditches and channels must be constructed and stabilized as soon as possible or before the channel receives incoming flows.

Culvert Inlets and Outlets

The basic approach for inlet protection is to create or install a structure that ponds or filters the flow, which facilitates sediment removal through settling or physical filtration. Outlet protection involves erosion prevention in the receiving ditch, channel, pond, or other area so that high-flow scour forces can be dissipated before localized erosion occurs.

A wide variety of ditch protection and ponding or filtration products have been developed for construction site applications. These products can provide excellent performance if used correctly, but often they are installed improperly, not maintained, or otherwise misused. Following the manufacturer's instructions is essential when using commercial products.

The following sections describe both rock and commercial ditch, inlet, and outlet protection approaches and devices. Rock of various sizes (see table below) is often used to stabilize ditches, construct inlet ponding dams, and armor pipe outlets to dissipate erosive flows. Commercial products are also gaining in popularity, and some (e.g., gravel-filled bags, commercial sediment dams, filter bags) can often be reused, if care is taken to protect them from vehicles and equipment during construction.

Good construction of drainage ditch, with riprap liner for steeply sloping section (background) and erosion control blanket over triple-seeding in flatter area. Ditches should be stabilized or seeded and mulched immediately after construction.

General Stabilization Approaches for Ditches and Channels

Channel Slope	Soil Type along Banks		
	Sandy	*Silty*	*Clays*
Steep > 10%	Pavement, gabions, or riprap with non-woven filter fabric	Pavement, gabions, or riprap with non-woven filter fabric	Riprap with non-woven filter fabric or gabions
Moderate ~ 10%	Riprap with non-woven filter fabric or gabions	Riprap or cellular geogrid or TRMs & seeding	Riprap or cellular geogrid or TRMs & seeding
Slight ~ 5%	Riprap or TRMs & seeding	Seeding & TRMs	Seeding & TRMs
Mostly Flat < 3%	Seeding & ECBs	Seeding & mulching	Seeding & mulching

Rock Sizing and Weight Information

KYTC coarse aggregate sizing	
Aggregate Size (KYTC Size No.)	*Mean Spherical Diameter (d50) (inches)*
1	3.5
2	2.5
23	2.5
3	2.0
357	2.0
4	1.5
467	1.5
5	1.0
57	1.0
610	1.0
67	0.75
68	0.75
710	0.75
78	0.50
8	0.375

This is a good example of a rock-lined ditch for conveying high velocity flows. Ditch was lined with rock after construction; surrounding areas should be seeded and mulched as quickly as possible to eliminate opportunities for sediment runoff. Use geotextile under rock to prevent undercutting.

4.6.1 Curb Inlet Sediment Barrier

Rock bags of netting material provide excellent curb inlet support, and are easy to fabricate, handle, and reuse. Avoid fabric-covered plastic piping and other products that do not adequately pond, detain, and settle incoming storm flows.

Definition

Curb inlet sediment barriers are temporary dikes or barriers constructed from concrete block, gravel, gravel-filled fiber bags, filter fabric, or other material.

Purpose

Curb inlet sediment barriers are intended to reduce the sediment discharged into storm drains by ponding the runoff and allowing the sediment to settle out. The structures allow for overflow from high runoff events, and the gravel allows the area to dewater rapidly. Some proprietary curb inlet protection devices feature a frame that supports a geotextile that promotes physical filtration of sediment in muddy runoff. Most devices—proprietary or constructed on-site—will function appropriately if assembled and placed properly.

All inlet dams and filters are intended to provide temporary treatment (i.e., until the upslope catchment area is vegetated or otherwise stabilized). A feature in using inlet protection devices is to minimize the length of time they are needed by getting the upstream area to final grade and seeding and mulching as soon as possible.

Design Criteria

There is no formal design, though SWPPP notes should specify that dikes or filters intercept all muddy flows toward the inlet without bypasses. The sediment barriers can be used at curb inlets on gently sloping, paved streets where

- Water can pond and allow sediment to separate out of suspension
- Runoff is relatively low, less than 0.5 cubic feet per second

Once the small catchment areas behind the fiber bags or block and gravel fill with sediment, future sediment-laden runoff will enter the storm drain without being treated. Therefore, sediment must be removed from these structures after each storm. Additional storage can be obtained by constructing a series of sandbag barriers along the gutter so that each barrier traps small amounts of sediment.

Construction Specifications

General

Place the barriers on gently sloping streets where water can pond. Note that devices placed in the roadway or that cause ponding on roads open to traffic could present a safety hazard; if this will be a problem, use filters with frames that lay against the curb, drop inlet filter bags, or other low-profile devices.

The barriers must allow for overflow from a severe storm event. Slope runoff must be allowed to flow over blocks and gravel and not be bypassed over the curb. A spillway must be constructed with dike structures to allow overflow.

If using fiber bags filled with gravel, the bag should be of woven-type geotextile fabric because burlap bags deteriorate rapidly. The bags must be filled with three-quarter inch drain rock or one-quarter inch pea gravel. Fill fiber bags just over halfway so they can be packed tightly together without large gaps.

The fiber bags must be placed in a curved row from the top of curb at least 3 feet into the street. The row should be curved at the ends, pointing uphill, and be tied into the curbing to prevent bypasses. Several layers of bags should be overlapped and packed tightly. Leave a one-sandbag gap in the top row to act as a spillway.

Block and Gravel Type Barriers

Place two concrete blocks on their sides perpendicular to the curb at either end of the inlet opening. These will serve as spacer blocks.

Place concrete blocks on their sides across the front of the inlet and abutting the spacer blocks. The openings in the blocks should face outward, not upward.

Cut a 2 by 4 inch stud the length of the curb inlet plus the width of the two spacer blocks. Place the stud through the outer hole of each spacer block to help keep the front blocks in place.

Place wire mesh over the outside vertical face (open ends) of the concrete blocks to prevent stone from being washed through the blocks. Use chicken wire, hardware cloth with half inch openings, or filter fabric.

Place three-quarter to one and a third inch gravel against the wire to the top of the barrier.

Inspection and Maintenance

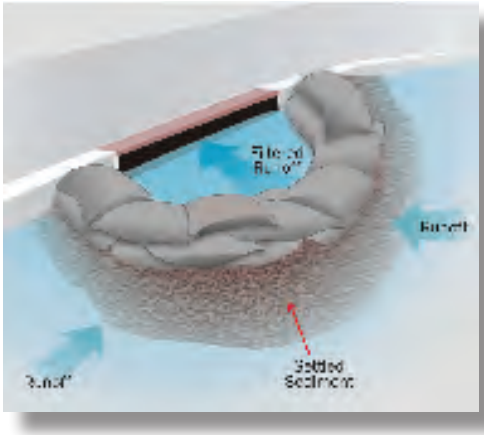
Inspect and clean barrier weekly and after each rainfall greater than one-half inch, and remove sediment from behind the sandbag structure.

Immediately remove any sediment and gravel from the traveled way of roads.

Place the removed sediment where it cannot enter a storm drain, stream, or be transported off site.

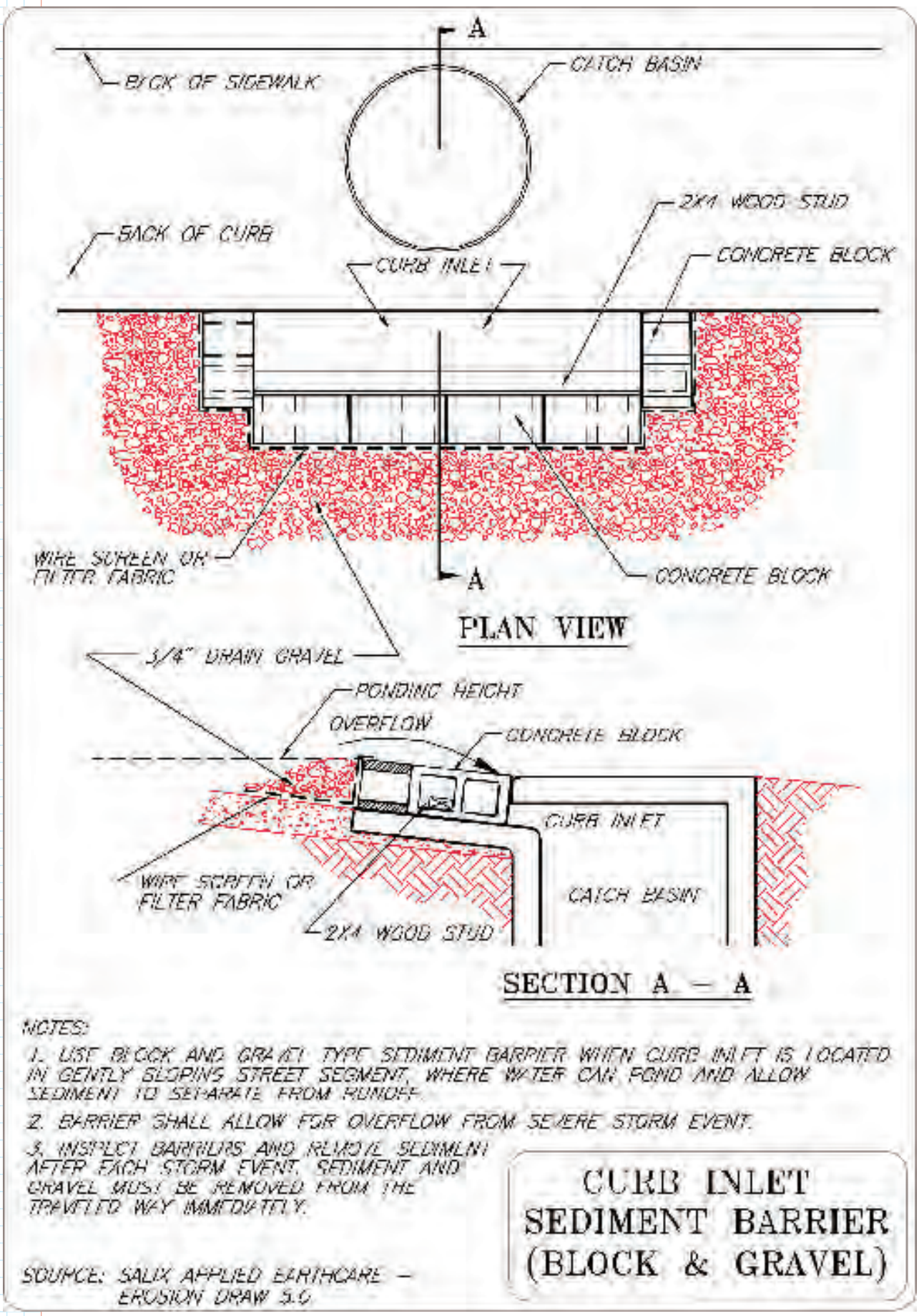
If the gravel becomes clogged with sediment, carefully remove it from the inlet and either clean or replace it.

Protect inlets with commercial dike products or site-fabricated ponding berms made of rock, wire, or other material. If structures and ponding within roadway areas are a problem, use inlet filter bags or other low-profile products. For best results, require that sediment be retained on landscaped areas and not discharged into roadways or parking lots.



Use half-filled stone bags to create a versatile and effective ponding berm in front of inlets. Make sure there are no bypasses.

This shows poor maintenance on inlet protection device. Do not allow concrete truck washouts or other discharges into the storm sewer system—this is a direct violation of the KPDES stormwater permit!

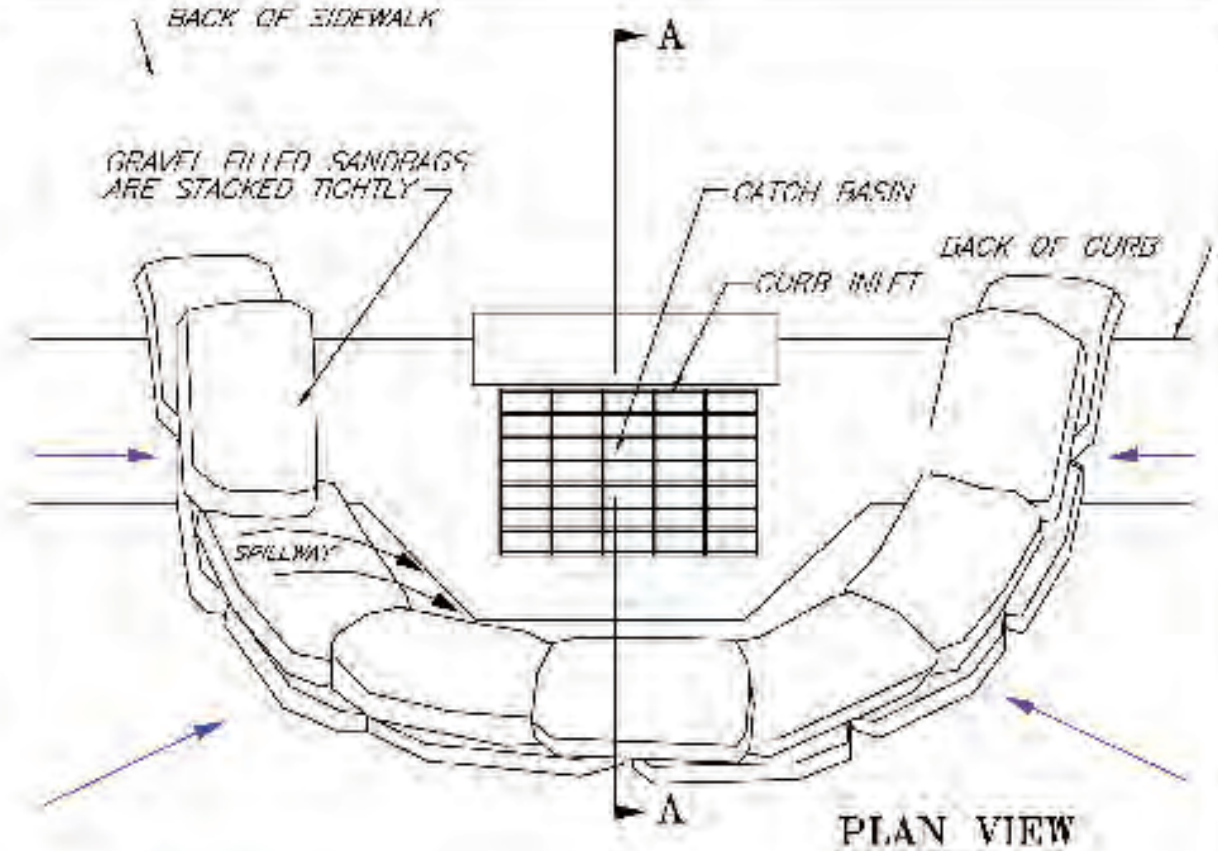


NOTES:

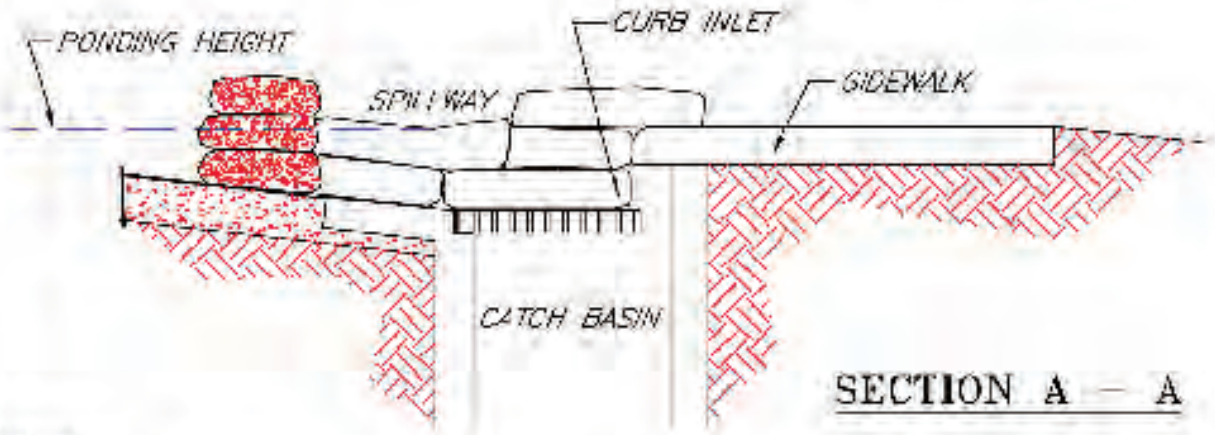
1. USE BLOCK AND GRAVEL TYPE SEDIMENT BARRIER WHEN CURB INLET IS LOCATED IN GENTLY SLOPING STREET SEGMENT, WHERE WATER CAN POND AND ALLOW SEDIMENT TO SEPARATE FROM RUNOFF.
2. BARRIER SHALL ALLOW FOR OVERFLOW FROM SEVERE STORM EVENT.
3. INSPECT BARRIERS AND REMOVE SEDIMENT AFTER EACH STORM EVENT. SEDIMENT AND GRAVEL MUST BE REMOVED FROM THE TRAVELED WAY IMMEDIATELY.

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

CURB INLET SEDIMENT BARRIER (BLOCK & GRAVEL)



PLAN VIEW



SECTION A — A

NOTES:

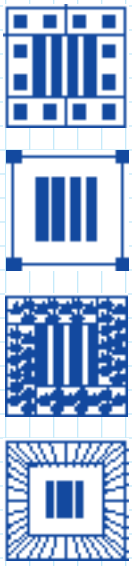
1. PLACE CURB TYPE SEDIMENT BARRIERS ON GENTLY SLOPING STREET SEGMENTS WHERE WATER CAN POND AND ALLOW SEDIMENT TO SEPARATE FROM RUNOFF.
2. SANDBAGS, OF EITHER BURLAP OR WOVEN GEOTEXTILE FABRIC, ARE FILLED HALFWAY WITH GRAVEL, LAYERED AND PACKED TIGHTLY. NETTING BAGS CAN BE USED WITH BALLAST ROCK.
3. LEAVE ONE SANDBAG GAP IN THE TOP RUN TO PROVIDE A SPILLWAY FOR OVERFLOW.
4. INSPECT BARRIERS AND REMOVE SEDIMENT AFTER EACH STORM. SEDIMENT MUST BE REMOVED FROM ROADS IMMEDIATELY.

SOURCE: SALIX APPLIED EARTHCARE — EROSION DRAW 5.0

CURB INLET SEDIMENT BARRIER (SANDBAGS)

4.6.2 Drop Inlet Sediment Barrier

Plastic frames covered with silt fence fabric make good drop inlet protection devices. Stake frames down securely and trench in bottom of fabric to eliminate bypasses. Remove accumulated sediment before it reaches halfway to the top of the fabric. Use inlet barriers during the construction period until upland areas are stabilized (i.e., bare areas are covered with vegetation, gravel, or structures).



Definition

A drop inlet sediment barrier is a temporary barrier placed around or inside a drop inlet that promotes ponding, settling of sediment, or physical filtration of sediment from muddy inflows. The sediment barrier can be constructed of silt fence, geotextile, gravel and stone, or block and gravel. Straw bales should not be used because of their high failure rates caused by improper placement, rotting, and structural weakness.

Purpose

Drop inlet sediment barriers are intended to prevent sediment from entering the storm drains during construction operations. This practice allows early use of the storm drain system. Sediment-laden runoff is ponded or filtered before entering the storm drain, thus allowing some sediment to fall out of suspension or be removed through physical filtration.

Design Criteria

The contributing drainage area should be one acre maximum. The ponding area must be relatively flat (less than 1 percent slope) with a sediment storage of 35 cubic yards per disturbed acre.

All incoming storm flows must be intercepted and ponded or filtered by the structure, and pass over the structure and into the storm drain without bypasses. Temporary diking around the structure might be necessary to prevent bypass flow. Material can be excavated from inside the sediment storage area for this purpose.

Drop inlet bag and frame filters are available from commercial vendors. These devices work very well if installed and maintained properly. Specify frames or filters that fit tightly around inlets and eliminate bypass opportunities. Filters can be reused if they are not damaged and washed out after prior use.

Construction Specifications

Silt Fence Sediment Barrier

Support posts for a silt fence must be steel fence posts or 2 by 4 inch wood, length 3-foot minimum, spacing 3-foot maximum, with a top frame X-brace or other support recommended.

Excavate a trench 4 inches wide and at least 8 inches deep and bury the bottom of the silt fence in the trench.

Backfill the trench with gravel or soil. Compact the backfill well.

The height of the silt fence must be a 1.5-foot maximum, measured from the top of the inlet.

Gravel Doughnut

Keep the stone slope toward the inlet at 3:1 or flatter or use concrete blocks to help prevent the stone from being washed into the drop inlet. A minimum 1-foot-wide level area set 4 inches below the drop inlet crest will add further protection against the entrance of material.

Stone on the slope toward the inlet should be 3 inches or larger for stability, and 1 inch or smaller on the slope away from the inlet to control flow rate. Mix various size stone for best results.

Wire mesh with 2-inch openings can be placed over the drain grating, but it must be inspected frequently to avoid blockage by trash. If concrete blocks are used, the openings should be covered with wire screen or filter fabric.

Inspection and Maintenance

Inspect the barrier weekly and after each rainfall greater than one-half inch, and promptly make repairs as needed.

Remove sediment after each significant rainfall (one inch in 24 hours) to provide adequate storage volume for the next rain.

Deposit the removed sediment in an area that will not contribute sediment off-site and can be permanently stabilized.

For gravel filters: If the gravel becomes clogged with sediment carefully remove it from the inlet and either clean or replace it. Close monitoring of drop-down inlet filter bags is required to ensure that they do not become overfilled.

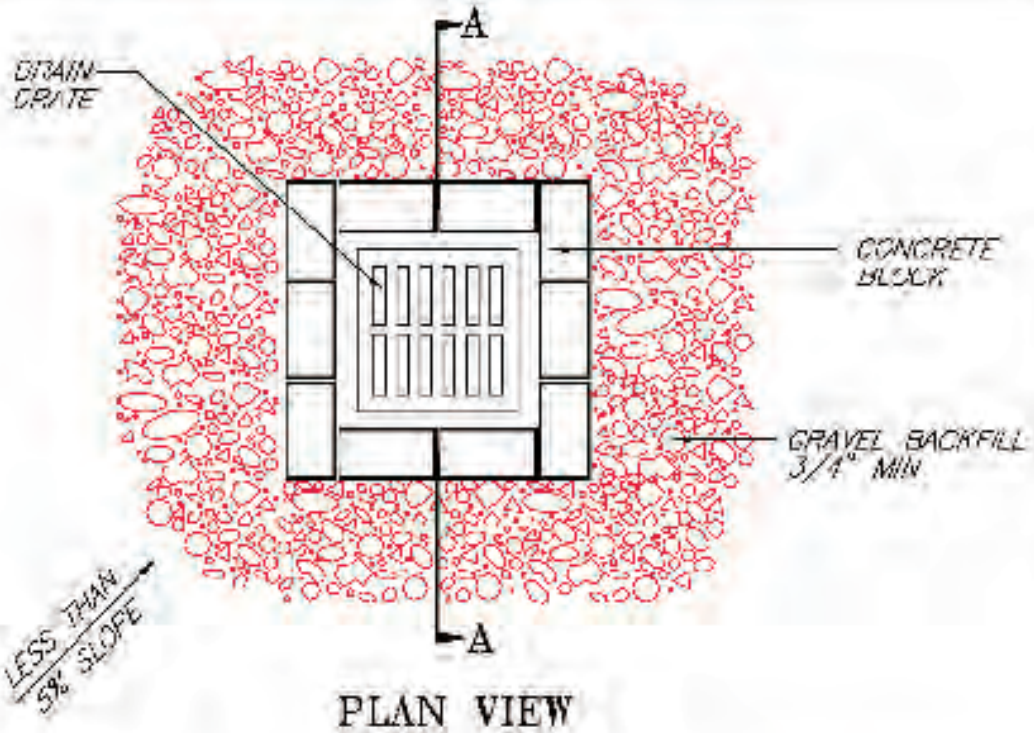
Tap filter fabric with a wooden stake when dry to remove caked-on fines, taking care not to tear the fabric.

Inlet protection berm constructed of half-filled stone bags. Use #57 rock, overlap bags to eliminate large openings and rapid flow-through. Construction-grade bags of netting material--similar to onion bags--can also be used.

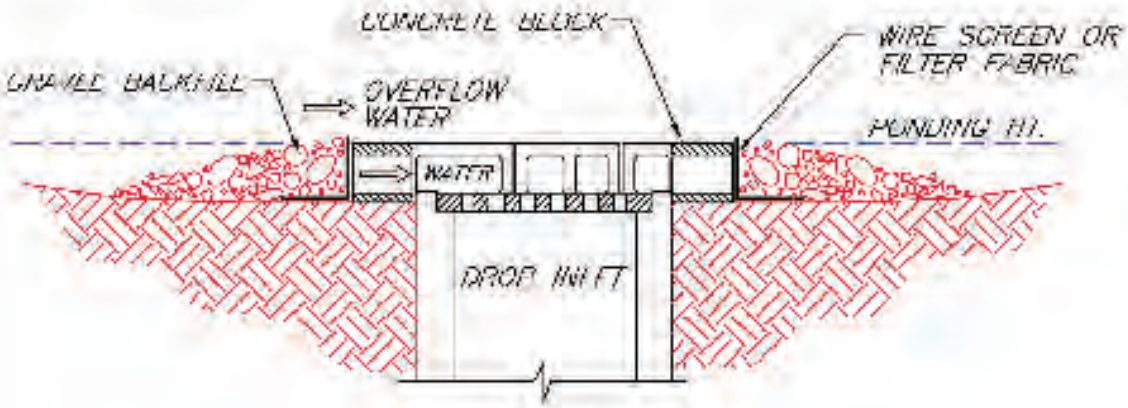
Silt fencing can be used as an inlet protection device if flow volumes and velocities are low. When using a silt fence frame to construction in inlet protection dike, add wire reinforcement and cross-bracing to prevent collapse in areas of heavy flows.

Commercial inlet frames and filters, ponding devices, and other products are often economical and effective approaches for inlet protection. Many can be cleaned and reused.

Side slot in drop inlet protected by half-round section of corrugated metal pipe with one-inch holes, held in place by stone berm. This modification can also be used on sediment basin outlet risers.



PLAN VIEW



SECTION A – A

NOTES:

1. DROP INLET SEDIMENT BARRIERS ARE TO BE USED FOR SMALL, NEARLY LEVEL DRAINAGE AREAS. (LESS THAN 5%)
2. EXCAVATE A BASIN OF SUFFICIENT SIZE ADJACENT TO THE DROP INLET.
3. THE TOP OF THE STRUCTURE (PONDING HEIGHT) MUST BE WELL BELOW THE GROUND ELEVATION DOWNSLOPE TO PREVENT RUNOFF FROM BYPASSING THE INLET. A TEMPORARY DIKE MAY BE NECESSARY ON THE DOWNSLOPE SIDE OF THE STRUCTURE.

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

DROP INLET SEDIMENT BARRIER BLOCK AND GRAVEL

4.6.3 Culvert Inlet Sediment Barrier

Stone berms placed in front of culvert inlets can trap large volumes of sediment. Make sure sediment is removed as it accumulates to preserve storage capacity for the next storm.

Definition

A culvert inlet sediment barrier is a temporary rock barrier at a culvert inlet.

Purpose

The purpose of the barrier is to reduce the amount of sediment that enters the culvert by creating a small ponding area for the sediment to settle out.

Design Criteria

The barrier should surround all sides of the culvert that receives runoff and should be placed a minimum of 4 feet from the culvert. Ensure adequate ponding area for incoming flows. The barrier must be designed to ensure that no bypasses occur and that adjacent property will not be damaged by the ponded water.

Control the location of the sediment barrier spillway by placing an overflow notch at a selected location in the middle portion of the barrier. The notch should be at least six inches lower than the rest of the barrier. The downgradient portion of the overflow notch should be protected from spillover scouring with rock, turf matting, or other appropriate energy dissipator.

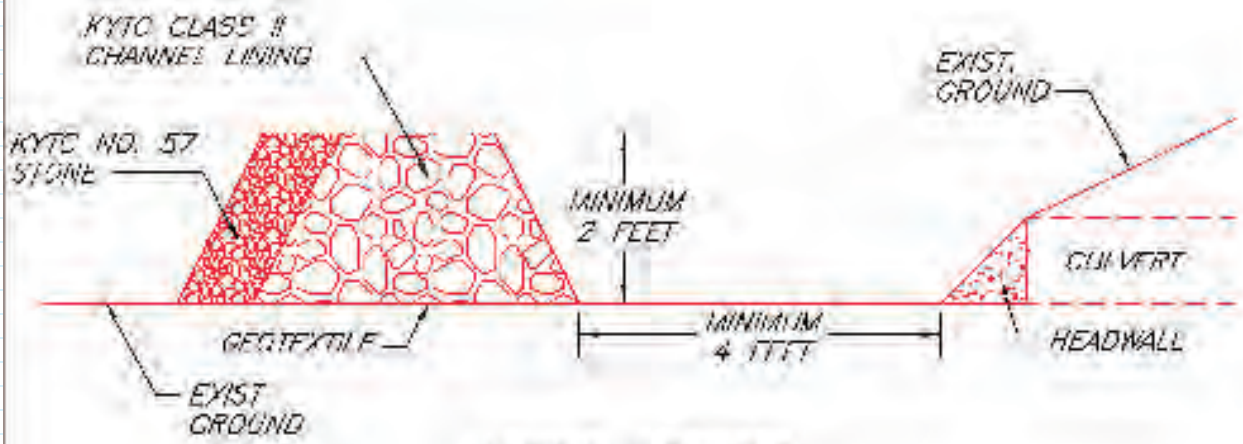
Construction Specifications

The stone should be KYTC Class II Channel Lining. The upstream face of the barrier should consist of smaller stone such as KYTC No. 57 to decrease the flow rate through the stone. A geotextile should be placed between the stone and the soil.

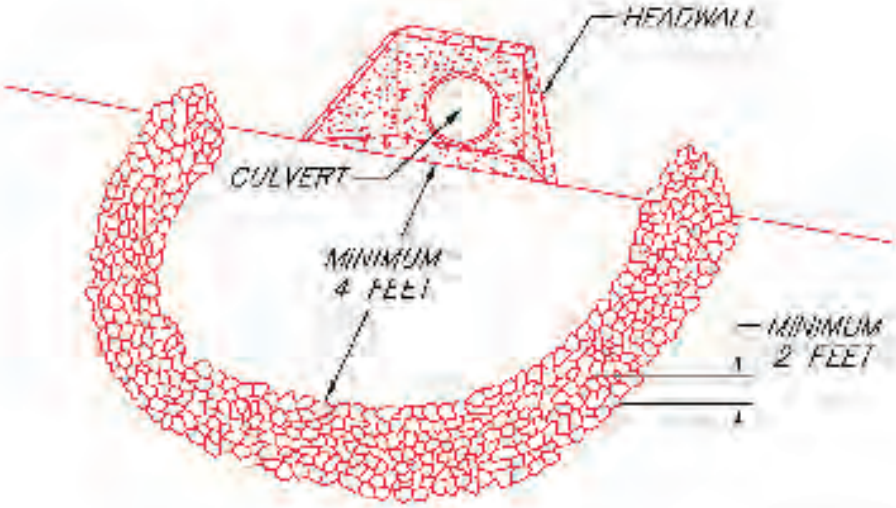
Inspection and Maintenance

The barrier should be inspected weekly and after every rainfall greater than one-half inch. The barrier must be kept free of trash and debris, and sediment should be removed when it reaches one-half the height of the barrier. The barrier should be removed after the disturbed area has been stabilized.

This is a good example of using smaller stone to face off ponding berm built of larger stone. The small rock ensures long ponding times, which maximizes sediment settling and removal.



CROSS SECTION



CULVERT INLET SEDIMENT BARRIER

4.6.4 Culvert Outlet Energy Dissipator

Surging flows from culverts can erode large amounts of sediment from ditches and sidewalls near outlets. Rock, well-vegetated TRMs, or cellular products can be used to reduce scour erosion at outlets.

Definition

An energy dissipator is a rock, gabion, mat, or other structure designed to control erosion at the outlet of a channel or stormwater conveyance pipe.

Purpose

Energy dissipators are used to prevent erosion at the outlet of a channel or pipe by reducing the velocity of flow and dissipating the energy before discharge into the rest of the receiving channel or area. Applications include outlets of culverts, temporary slope drains, where lined ditches discharge into unlined ditches, and outlet or overflow areas for sediment traps and basins.

Design Criteria

Design considerations are the volume and velocity of flow to be controlled, characteristics of the bank or other area receiving the brunt of the flow, and the slope of the receiving channel or area, all of which will define the shape and structure of the energy dissipator. Dissipators designed for high-energy flows are usually rock aprons; those handling smaller flows with lesser velocities can consist of TRMs if shear and other stresses can be accommodated by the chosen product. The following criteria are key to dissipator design analysis:

Capacity—Design dissipators to handle the 10-year, 24-hour peak flow event

Tailwater Depth—Determine the depth of the tailwater immediately below the pipe outlet based on the design discharge plus other contributing flows. If the tailwater depth is less than half the diameter of the outlet pipe and the receiving stream is sufficiently wide to accept the divergence of flow, it is classified as a minimum tailwater condition. If the tailwater depth is greater than half the pipe diameter, it is classified as a maximum tailwater condition. Pipes that outlet onto broad flat areas with no defined channel may be assumed to have a minimum tailwater condition unless site conditions indicate otherwise.

Apron size—See the table below.

Grade—There should be no overfall at the end of the apron; that is, the elevation of the top of the apron at the downstream end should be the same as the elevation of the bottom of the receiving channel or the adjacent ground if there is no channel.

Alignment—The apron should be straight throughout its entire length, but if a curve is necessary to align the apron with the receiving stream, locate the curve in the upstream section of riprap. Additional armoring of the outside portion of the curve receiving the greatest scouring flows might be needed.

Materials—Ensure that riprap consists of a well-graded mixture of stone. Larger stone should predominate, with sufficient smaller sizes to fill the voids between the stones. The diameter of the largest stone size should be no greater than 1.5 times the d50 size.

Thickness—The minimum thickness of riprap must be 1.5 times the maximum stone diameter.

Stone quality—Select stone for riprap from fieldstone or quarry stone. The stone should be hard, angular, and highly weather-resistant. The specific gravity of the individual stones should be at least 2.5.

Filter—Install a non-woven geotextile liner (filter) under the rock to prevent soil movement through the openings in the riprap. Geotextile underliners for rock outlet energy dissipators are highly recommended to prevent erosion and undermining of the dissipator. Specify non-woven fabric tailored to the strength needed to support the rock load.

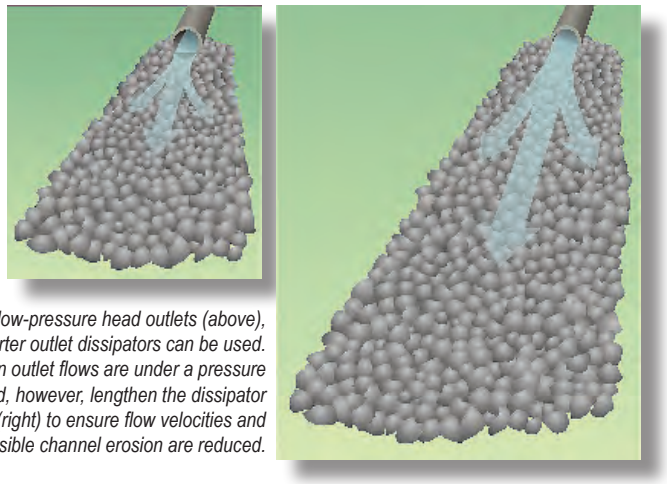
Construction Specifications

Ensure that the subgrade for the underliner and riprap follows the required lines and grades shown in the plan. Compact any fill required in the subgrade to the density of the surrounding undisturbed material. Low areas in the subgrade on undisturbed soil can also be filled by increasing the riprap thickness.

- The riprap and gravel underliner must conform to the specified grading limits shown on the plans.
- Filter (non-woven geotextile) cloth, when used, must meet design requirements and be properly protected from punching or tearing during installation. Repair any damaged fabric by removing the riprap and placing another piece of filter cloth over the damaged area. All connecting joints should overlap a minimum of 1 foot. If the damage is extensive, replace the entire filter cloth.
- Riprap can be placed by equipment, but take care to avoid damaging the filter.
- The minimum thickness of the riprap should be 1.5 times the maximum stone diameter.
- Riprap may be field stone or rough quarry stone. It should be hard, angular, highly weather-resistant and well graded.
- Construct the apron with no overfall at the end. Make the top of the riprap at the downstream end level with the receiving area or slightly below it.
- Ensure that the apron is properly aligned with the receiving stream and preferably straight throughout its length. If a curve is needed to fit site conditions, place it in the upper section of the apron.
- Immediately after construction, stabilize all disturbed areas with vegetation.

Inspection and Maintenance

Inspect riprap outlet structures weekly and after every rainfall greater than one-half inch to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.



For low-pressure head outlets (above), shorter outlet dissipators can be used. When outlet flows are under a pressure head, however, lengthen the dissipator (right) to ensure flow velocities and possible channel erosion are reduced.

Table of Riprap Apron Dimensions

The tables below can be used to determine the length, width, and D50 stone size of a riprap apron based on circular culverts flowing full.

Riprap Aprons for Low Tailwater (downstream flow depth < 0.5 x pipe diameter)

Culvert Diameter	Lowest Value			Intermediate Values to Interpolate From									Highest Value		
	Q	L_A	D_{50}	Q	L_A	D_{50}	Q	L_A	D_{50}	Q	L_A	D_{50}	Q	L_A	D_{50}
	Cfs	Ft	In	Cfs	Ft	In	Cfs	Ft	In	Cfs	Ft	In	Cfs	Ft	In
12"	4	7	6	6	10	6	9	13	6	12	16	7	14	17	8.5
15"	6.5	8	6	10	12	6	15	16	7	20	18	10	25	20	12
18"	10	9	6	15	14	6	20	17	7	30	22	11	40	25	14
21"	15	11	6	25	18	7	35	22	10	45	26	13	60	29	18
24"	21	13	6	35	20	8.5	50	26	12	65	30	16	80	33	19
27"	27	14	6	50	24	9.5	70	29	14	90	34	18	110	37	22
30"	36	16	6	60	25	9.5	90	33	15.5	120	38	20	140	41	24
36"	56	20	7	100	32	13	140	40	18	180	45	23	220	50	28
42"	82	22	8.5	120	32	12	160	39	17	200	45	20	260	52	26
48"	120	26	10	170	37	14	220	46	19	270	54	23	320	64	37

Source: Knoxville Engineering Department
L_A = Apron Length
Apron Width = L_A + Culvert Diameter

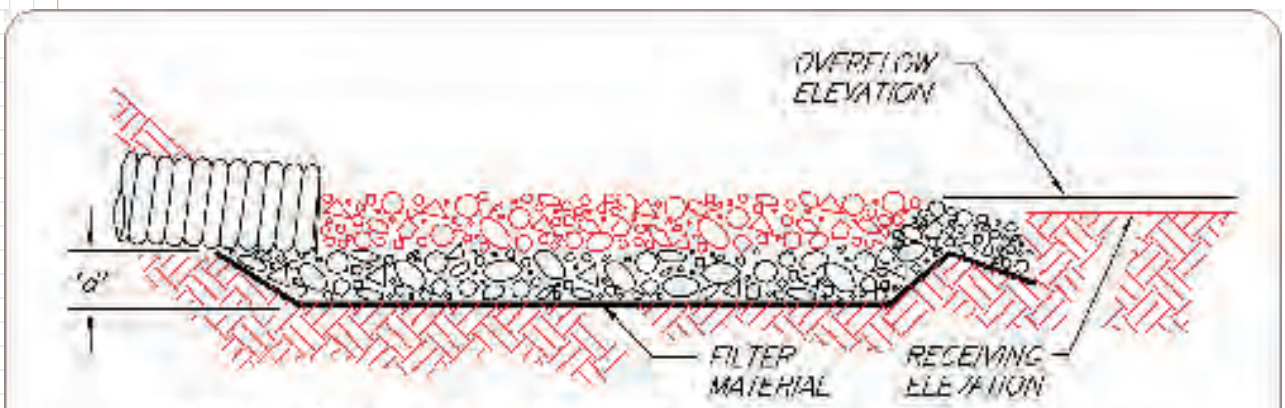
Riprap Aprons for High Tailwater (downstream flow depth > 0.5 x pipe diameter)

Culvert Diameter	Lowest Value			Intermediate Values to Interpolate From									Highest Value		
	Q	L_A	D_{50}	Q	L_A	D_{50}	Q	L_A	D_{50}	Q	L_A	D_{50}	Q	L_A	D_{50}
	Cfs	Ft	In	Cfs	Ft	In	Cfs	Ft	In	Cfs	Ft	In	Cfs	Ft	In
12"	4	8	6	6	18	6	9	28	6	12	36	7	14	40	8
15"	7	8	6	10	20	6	15	34	6	20	42	7.5	25	50	10
18"	10	8	6	15	22	6	20	34	6	30	50	9	40	60	11
21"	15	8	6	25	32	6	35	48	7	45	58	11	60	72	14
24"	20	8	6	35	36	6	50	55	8.5	65	68	12	80	80	15
27"	27	10	6	50	41	6	70	58	10	90	70	14	110	82	17
30"	36	11	6	60	42	6	90	64	11	120	80	15	140	90	18
36"	56	13	6	100	60	7	140	85	13	180	104	18	220	120	23
42"	82	15	6	120	50	6	160	75	10	200	96	14	260	120	19
48"	120	20	6	170	58	7	220	85	12	270	105	16	320	120	20

Source: Knoxville Engineering Department
L_A = Apron Length
Apron Width = 0.4 L_A + Culvert Diameter

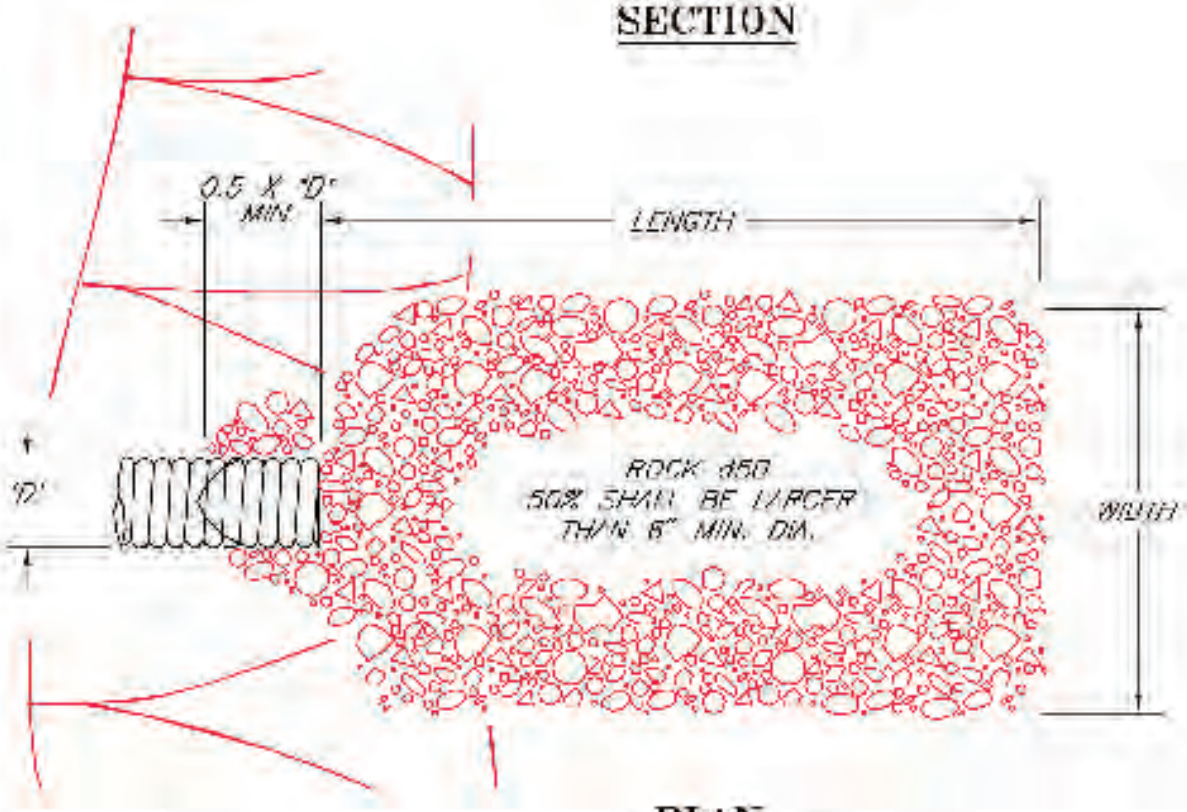
Good example of dissipator apron construction for low tailwater conditions.

Poor placement of outlet dissipator rock; poor ditch lining (no grass, mulch, or blanket); poor slope protection.



THICKNESS ('d') = 1.5 x MAX. ROCK DIAMETER 6" MIN.

SECTION



PLAN

NOTES:

1. THE LENGTH AND WIDTH SHALL BE DETERMINED BY THE ENGINEER.
2. APRON SHALL BE SET AT / ZERO GRADE AND ALIGNED STRAIGHT.
3. FILTER MATERIAL SHALL BE FILTER FABRIC OR 6" THICK MINIMUM GRADED GRAVEL LAYER.

CULVERT OUTLET ENERGY DISSIPATOR

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

4.6.5 Rock-Lined Ditches and Channels

Rock is plentiful and relatively inexpensive in most locations in Kentucky and works well as a ditch liner. For a "greener" look, use grass with ECBs or TRMs (see the blanket/mat section in the "Slope Protection" chapter).

Definition

Rock-lined channels are stormwater channels or ditches lined with rock or riprap.

Purpose

Rock-lined channels serve to convey concentrated surface runoff without erosion. Grass lining with ECBs or TRMs are recommended instead of rock. Rock lining may be necessary in the following conditions:

- There is not enough time to construct, seed, and establish a stabilized vegetated channel before the channel is expected to carry stormwater flows (i.e., construction during wet seasons).
- Design velocity exceeds 2 feet per second and conditions are not suitable for channel or ditch vegetation even if TRMs are used.
- Ditches or drainage channel slopes are greater than 2 percent and located in highly erodible soils that have a low-maximum permissible velocity that cannot be overcome with TRMs.
- Channel design velocity exceeds that allowable for a grass-lined channel with ECB or TRM liners.
- The channel will continue to down-cut without protection because it is adjusting to increased flow or a new base line (outlet elevation).

KYTC weight and size of riprap rock

Channel Lining Riprap Class	Corresponding Size
1A	Limestone with 100% passing a 5-inch sieve, and no more than 20% passing though square openings 1.5" by 1.5"
II	Limestone with 100% passing a 9-inch sieve, and no more than 20% passing though square openings 5" by 5"
III (Cyclopean Riprap)	> 80% by volume of individual stones ranging from ¼ to 1-½ cubic feet

Design Criteria

The channel must be designed to carry the 10-year, 24-hour peak flow using the formula below:

$Q = VA$, where

Q = flow

V = velocity

A = flow area

The Manning equation below must be used to determine the velocity:

$V = 1.486(R)^{2/3}S^{1/2}/n$, where

V=velocity

R=flow area/wetted perimeter

S=slope in feet/foot

$n = 0.0395\ (D_{50})^{1/6}$

The maximum depth must be determined from the following equation:

$D_{max} = \tau / (62.4*S)$, where

D_{max} = maximum depth of flow

S = slope in feet/foot

τ = maximum tractive force of the liner in lbs/ft^2

The values for KYTC channel lining are shown below:

KYTC Channel Lining Rock Sizing

KYTC Channel Lining	D_{50}	Shear Lb/ft.^{2}	Manning's n
Class 1A	0.2	1.0	0.0302
Class II	0.5	2.5	0.0352
Class III	1.0	5.0	0.0395

Side slopes must be 2:1 or flatter

Riprap thickness—**T = 1.5 times the largest stone diameter or as shown on the plans; 6-inch thick minimum**

Foundation—**Use extra-strength, non-woven filter fabric or an aggregate filter layer, if required.**

The outlet must be stable with a suitable outlet stabilization energy dissipator.

Construction Specifications

Excavate the cross-section to the grades shown on plans. Overcut for thickness of rock and filter.

Place non-woven filter fabric or gravel filter layer, and place the rock as soon as the foundation is prepared.

Place rock so it forms a dense, uniform, well-graded mass with few voids. Hand placement might be necessary to obtain good size distribution.

No overfall of channel construction should exist. Grass-lined channels with riprap bottoms must have a smooth contact between riprap and vegetation.

Channel outlet must be stabilized with a suitable outlet stabilization energy dissipator.

Inspection and Maintenance

Inspect channels weekly and after rainfalls greater than one-half inch. Remove debris and make needed repairs where stones have been displaced. Take care not to restrict the flow area when stones are replaced.

Give special attention to outlets and points where any concentrated flow enters the channel. Repair eroded areas promptly. Check for sediment accumulation, piping, bank instability, and scour holes and repair promptly.

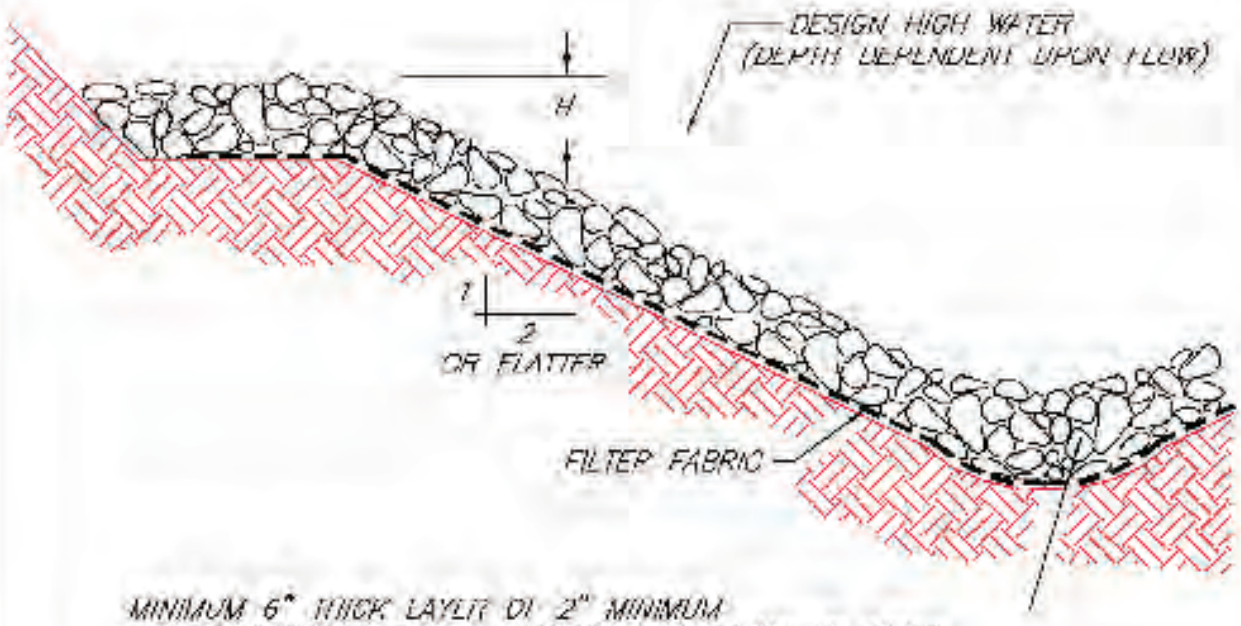
Here is a good example of rock-lined ditch. The seeding is a bit too thick on the side slopes.

This shows a very good stabilization of slope and ditch on highway project. Note the mix of large and small rock, which helps fills voids and deters undermining.

The rock is a little thin along this ditch, but could be acceptable because of the lack of visible channel erosion. Ditches should be monitored so that rock or other protective controls can be added if erosion becomes a problem.

Rock lined ditches can function as slope drains in steep terrain. Flow dissipaters are required to reduce scour forces at slope bottoms, and geotextile should be used under rock to prevent undercutting. Note spotty seeding on this slope - use of erosion control blankets would have helped protect topsoil and seed during germination, and provided better vegetative cover.

DESIGN HEIGHT (H), WIDTH AND STONE SIZE SHALL BE DETERMINED BY THE ENGINEER



MINIMUM 6" THICK LAYER OF 2" MINIMUM DIAMETER DRAIN ROCK. LARGER STONE SHALL BE USED DEPENDENT UPON GRADIENT, SOIL TYPE, AND DESIGN FLOW.

TYPICAL SECTION

ROCK LINED CHANNEL

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

4.6.6 Grass-Lined Ditches and Channels

Wide and relatively flat ditches can be protected with triple-seeding and degradable ECBs or mulch. Steeper ditches (e.g., slopes of up to 10 percent and more in some cases) can also be seeded if TRMs are used (see the Blankets and Mats section in the Slope Protection chapter).

Definition

This consists of vegetation lining a ditch, channel, swale, or diversion berm to protect it from erosion.

Purpose

Grass protection of channels reduces erosion by lowering water velocity over the soil surface and by binding soil particles with roots. Grass-lined channels should be used where

- A vegetative lining can provide sufficient stability for the channel grade by increasing maximum permissible velocity.
- Slopes are generally less than 10 percent, with protection from sheer stress as needed through the use of mulch, ECBs, TRMs, or cellular/geogrid products.
- Site conditions required to establish vegetation (i.e., climate, soils, topography, and temporary/permanent protection for vegetation such as via mulch, ECBs, or TRMs) are present.

Design Criteria

Grass-lined channels resemble natural systems and are usually preferred where design velocities are suitable. Select appropriate vegetation and construct ditches or channels early in the construction schedule before grading and paving increase runoff rates.

- Generally, grass-lined channels are constructed in stable, low areas to conform with the natural drainage system, but they might also be needed along roadways or property boundaries. To reduce erosion potential, design the channel to avoid sharp bends and steep grades.
- For ditches and channels with slopes exceeding 3 percent, use the information in the Erosion Control Blankets and Turf Reinforcement Mats Fact Sheets to design and build grass-lined channels with appropriate scour and erosion protection (i.e., ensure that the ditch liner can appropriately resist sheer stresses, given the slope and length of the ditch).

The channel cross-section should be wide and shallow with relatively flat side slopes (e.g., 3H:1V) so surface water can enter over the vegetated banks without erosion. Riprap might be needed to protect the channel banks at intersections where flow velocities approach allowable limits and turbulence could occur. **Specify that grass be triple-seeded for all ditch/channel applications, and that appropriate mulch, erosion control blanket, or turf reinforcement matting be used.**

Cross-section designs include:

V-shaped Channels

Generally these are used where the quantity of water is relatively small, such as roadside ditches. The V-shaped cross-section is desirable because of difficulty stabilizing the bottom, where velocities may be high. A sod or grass lining protected with ECBs or TRMs might suffice where velocities are low; use rock or riprap lining to protect against higher velocities.

Parabolic Grass Channels

Often these are used where larger flows are expected and sufficient space is available. The shape is pleasing and may best fit site conditions. Riprap should be used where higher velocities are expected and where some dissipation of energy (velocity) is desired. Combinations of grass with riprap centers or turf reinforcement mat centers are useful where there is a continuous low flow in the channel.

Trapezoidal Grass Channels

These are used where runoff volumes are large and slope is low so that velocities are non-erosive to vegetated linings. Low flow channel can be lined with turf reinforcement mats, erosion control blankets, riprap, or pavement if desired.

- Grass-lined channels must not be subject to sedimentation from disturbed areas.
- An established grass-lined channel resembles natural drainage systems and is usually preferred if design velocities are below 5 feet per second.
- Channels with design velocities greater than 2 feet per second will require that turf reinforcement mats or erosion control blankets be installed at the time of seeding to provide stability until the vegetation is fully established. It might also be necessary to divert water from the channel until vegetation is established or to line the channel with sod.
- Whenever design velocities exceed 4 feet per second a permanent type of turf reinforcement mat will be necessary.
- Sediment traps might be needed at channel inlets to prevent entry of muddy runoff and channel sedimentation.

Capacity

The channel must be designed to carry the 10-year, 24-hour peak flow using the formula below:

$Q = VA$, **where**

Q **= flow**

V = velocity

A **= flow area**

The Manning equation below must be used to determine the velocity:

$V = 1.486(R)^{2/3}S^{1/2}/n$, **where**

V**=velocity**

R**=flow area/wetted perimeter**

S**=slope in feet/foot**

n**= 0.045 for grass**

The maximum depth must be determined from the following equation:

$D_{max} = \tau / (62.4*S)$, **where**

D_{max} **= maximum depth of flow**

S **= slope in feet/foot**

τ **= maximum tractive force of the liner in lbs/ft^2**

The maximum shear stress for various liners is shown below:

Maximum Shear Stress of Liners

Material	Shear lb/ft^2
Dense sod, fair condition (Class D/E), moderately cohesive soil	0.4
Bermuda grass, fair stand < 12 cm tall, dormant	0.9
Bermuda grass, good stand <12 cm tall, dormant	1.1
Bermuda grass, excellent stand 20 cm tall, dormant	2.7
Bermuda grass, excellent stand 20 cm tall, green	2.8
Bermuda grass, excellent stand >20 cm tall, green	3.2
Turf (immediately after construction)	0.2
Turf (after 3-4 seasons)	2.0
Turf reinforcement mat, permanent	8.0
Straw reinforcement mat, temporary	0.5
Jute mat	0.5
Straw with net	1.5
Curled wood net	1.6
Synthetic mat	2.0

Source: Salix Applied Earthcare – Erosion Draw 5.0

Cross-section

The channel shape may be parabolic, trapezoidal, or V-shaped, depending on need and site conditions.

Side Slopes

Grassed channel side slopes generally are constructed 3:1 or flatter to aid in the establishment of vegetation and for maintenance.

Grade

Generally restricted to slopes 5 percent or less unless ditch length is less than 200 ft and TRMs are used. Either a uniform or gradually increasing grade is preferred to avoid sedimentation.

Construction Specifications

See the specifications for seeding and ECBs.

Inspection and Maintenance

During the initial establishment, grass-lined channels should be repaired and grass reestablished if necessary.

After grass has become established, check the channel periodically to determine if it is withstanding flow velocities without damage.

Check the channel for debris, scour, or erosion and immediately make repairs. It is particularly important to check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes and make repairs immediately.

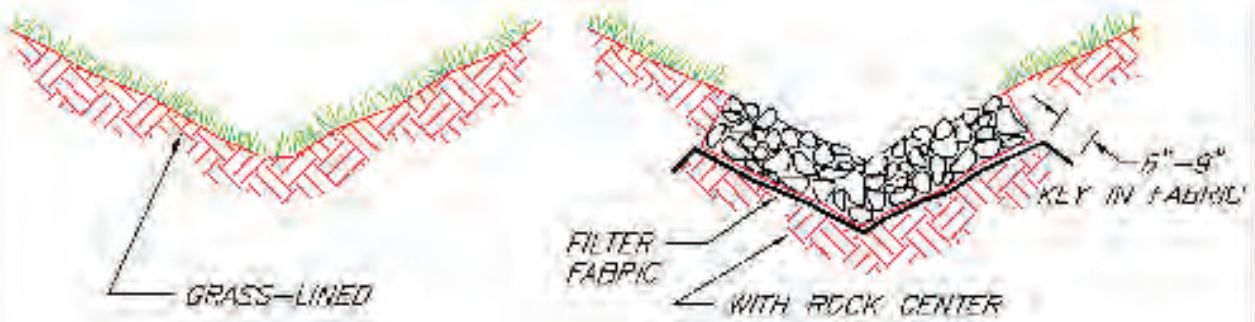
Remove all significant sediment accumulations to maintain the designed carrying capacity.

Keep the grass in a healthy, vigorous condition at all times, because it is the primary erosion protection for the channel.

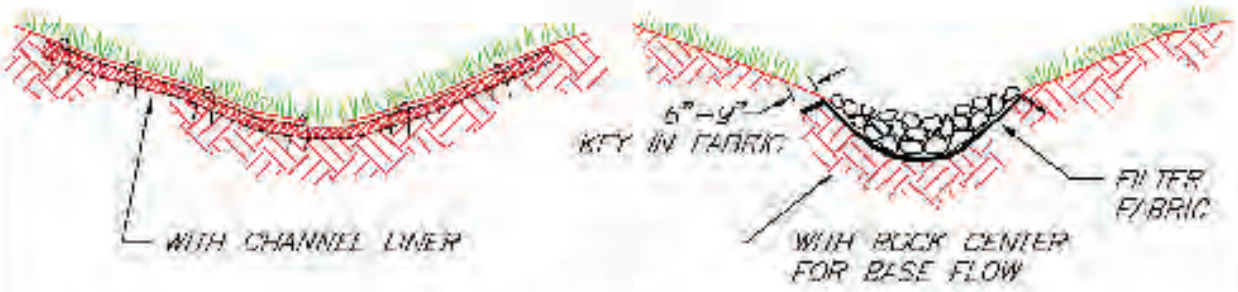
Permanent grassed waterways should be seasonally maintained by mowing or irrigating, depending on the type of vegetation selected. The long-term management of ditches and channels as stable, vegetated, *natural* drainage systems with native vegetation buffers is highly recommended because of the inherent stability offered by grasses, shrubs, trees, and other vegetation; greater visual and other aesthetic benefits provided by native plant buffers; and higher habitat and property values.

Here is an excellent construction of triple-seeded ditch with excelsior blanket. Ditches should be stabilized, seeded, and mulched immediately after construction.

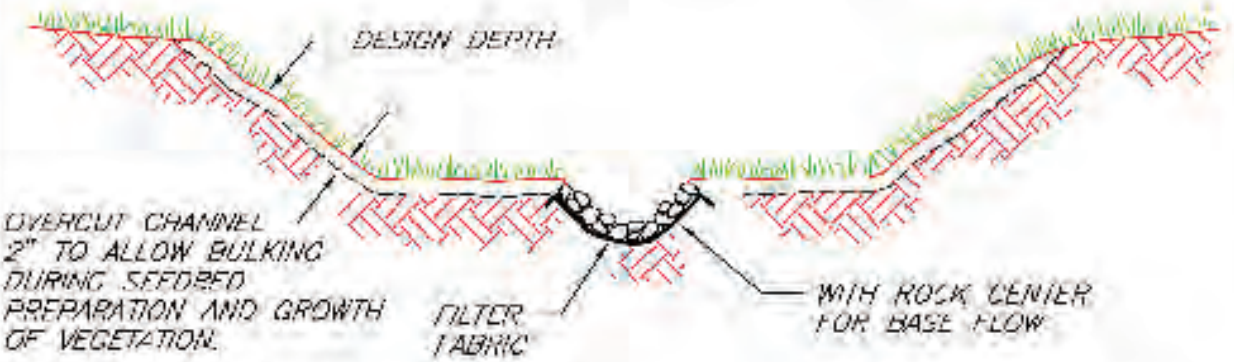
When using blankets and mats, make sure product has good soil contact throughout the ditch. Use plenty of staples to protect against surge flows during heavy rains. Blankets and mats are extremely vulnerable before seed germination, and can be dislodged by high-velocity flows if stapling is insufficient.



TYPICAL V-SHAPED CHANNEL
CROSS-SECTION



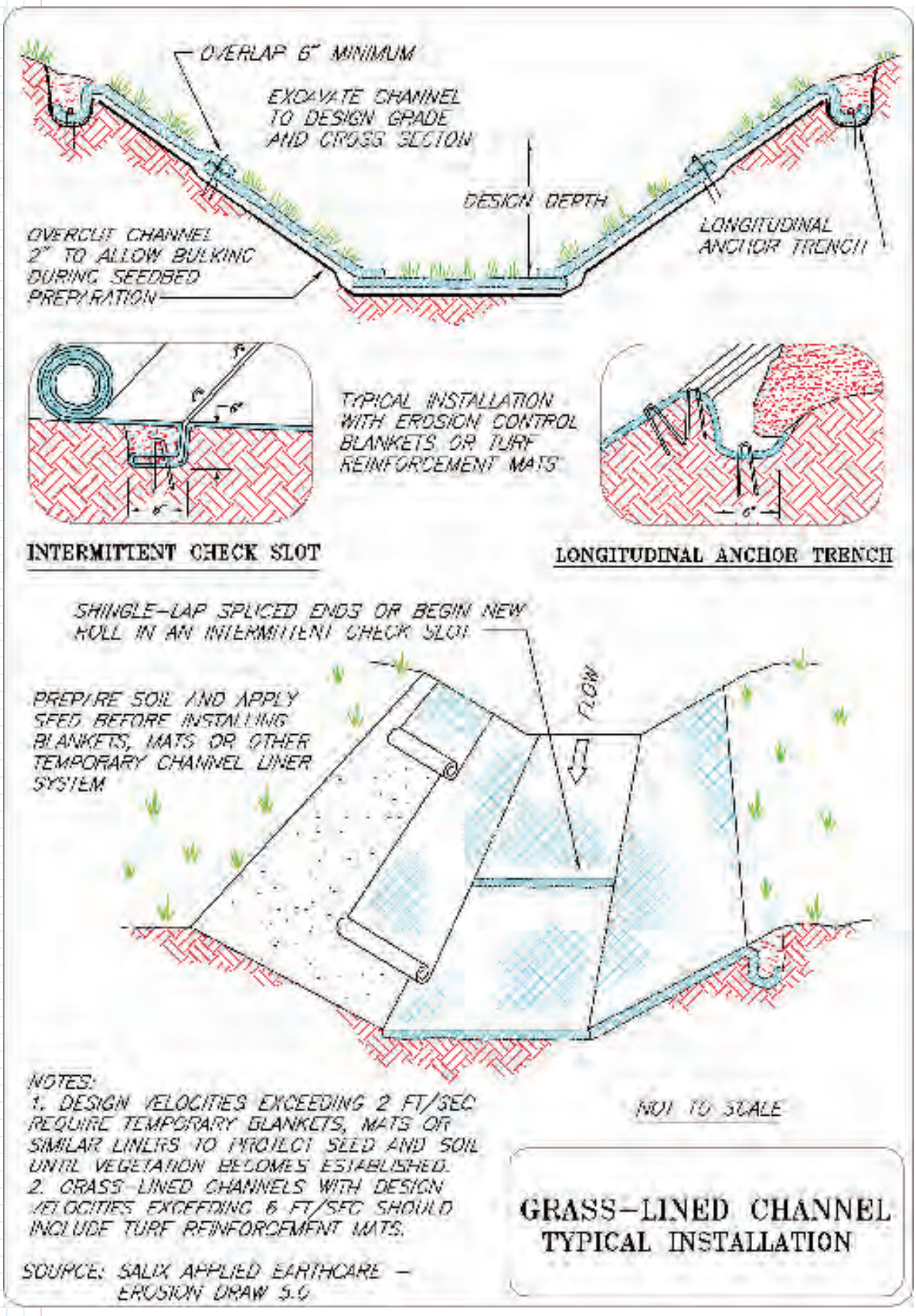
TYPICAL PARABOLIC CHANNEL
CROSS SECTION



TYPICAL TRAPEZOIDAL CHANNEL
CROSS-SECTION

SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0

GRASS-LINED CHANNEL
TYPICAL CROSS SECTIONS


OVERLAP 6" MINIMUM
EXCAVATE CHANNEL TO DESIGN GRADE AND CROSS SECTION
DESIGN DEPTH
OVERCUT CHANNEL 2" TO ALLOW BULKING DURING SEEDBED PREPARATION
LONGITUDINAL ANCHOR TRENCH
TYPICAL INSTALLATION WITH EROSION CONTROL BLANKETS OR TURF REINFORCEMENT MATS
INTERMITTENT CHECK SLOT
LONGITUDINAL ANCHOR TRENCH
SHINGLE-LAP SPLICED ENDS OR BEGIN NEW ROLL IN AN INTERMITTENT CHECK SLOT
PREPARE SOIL AND APPLY SEED BEFORE INSTALLING BLANKETS, MATS OR OTHER TEMPORARY CHANNEL LINER SYSTEM
FLOW
NOTES:
1. DESIGN VELOCITIES EXCEEDING 2 FT/SEC REQUIRE TEMPORARY BLANKETS, MATS OR SIMILAR LINERS TO PROTECT SEED AND SOIL UNTIL VEGETATION BECOMES ESTABLISHED.
2. GRASS-LINED CHANNELS WITH DESIGN VELOCITIES EXCEEDING 6 FT/SEC SHOULD INCLUDE TURF REINFORCEMENT MATS.
SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0
NOT TO SCALE
GRASS-LINED CHANNEL
TYPICAL INSTALLATION

4.6.7 Check Dams for Ditches and Channels

Check dams, also known as "ditch checks," can help to control downcutting in drainage ditches before grass is well established. In this example, checks are working even though ditch seeding and mulching appears to be somewhat poor. Many contractors use half-filled fabric bags of stone for ditch checks because of their ease of handling, acceptability for reuse, and overall effectiveness.

Definition

A check dam (also known as a ditch check or silt check) is a small, temporary, center-overflow dam constructed across a ditch, swale, or channel, consisting of rock, gravel filled bags, fiber rolls, or other commercial products.

Purpose

The purpose of a check dam is to reduce the velocity of concentrated stormwater flows, thereby reducing erosion of the swale or channel. This practice also traps sediment.

Design Criteria

Check dams must be limited to use in small, open ditches that drain 10 acres or less. Check dams must not be used in streams. Straw bales are not to be used as check dams because of past high failure rates.

- Ditches lined with riprap do not usually require check dams; however they can be used in areas with highly erodible soils, steep slopes, and drainage areas of up to 5 acres. Check dams are especially applicable where the slope of ditches or channels is close to the maximum for a grass lining.
- The maximum height of a check dam must be 3 feet above the ground on which the rock is placed.
- The center of the check dam above the flat portion of the channel must be at least 6 inches lower than the outer edges.
- The maximum spacing between rock check dams in a ditch should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
- Check dams for larger projects with greater slopes and wider drainage swales can be constructed of trees and brush cleared from the site, gabions, large rock, or other materials. Design and structural stability requirements for these applications, which can have significant benefits, are very site specific.

Construction Specifications

Stone check dams must be constructed of KYTC Class 2 channel lining. Fiber bags filled with gravel are also acceptable. Bags should be of woven-type geotextile fabric because burlap or cloth bags deteriorate rapidly. The fiber bags must be filled with three-quarter inch drain rock or one-quarter inch pea gravel. Fill

fiber bags just over halfway, so they can be packed tightly together without large gaps.

- Commercial products such as fiber rolls, sediment dikes, and sediment fencing can be used in seeded and lined (or mulched) swales with bottoms not less than 4 feet wide and slopes not more than 3 percent, if appropriate. Follow the manufacturer's instructions for placement, staking, and maintenance. Applications in areas that exceed these parameters must be consistent with product design and performance information.
- Stone must be placed by hand or mechanically as necessary to achieve complete coverage of the ditch bottom and banks and to ensure that the center of the check dam is at least 6 inches lower than the outer edges.
- Gravel bag check dams must be placed in the ditch or channel by hand, with the tied ends of the bags pointing upstream and the center overflow area at least 6 inches lower than the outer edges.
- For all check dams, ensure that the higher elevation outer sidewalls tie into the upper portion of the ditch or channel bank to prevent bypasses.
- If stone check dams are used in grass-lined channels that will be mowed, take care to remove all stone from the channel when the dam is removed. This includes any stone that has washed downstream.

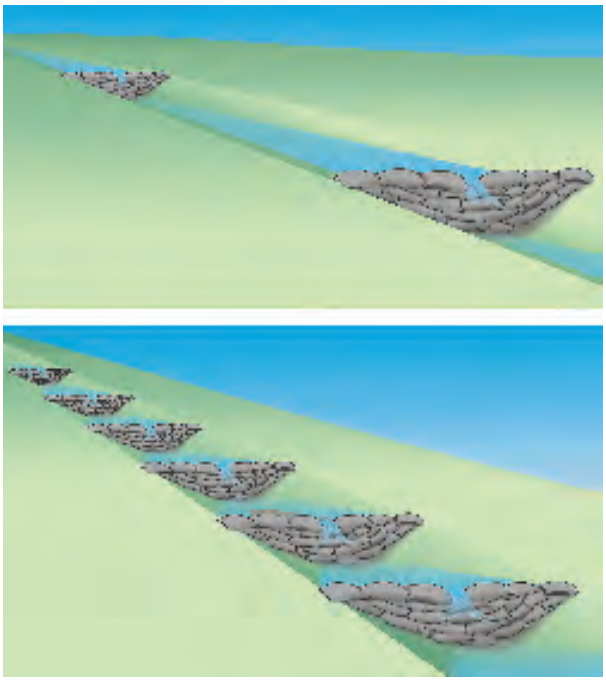
Inspection and Maintenance

Regular inspections must be made to ensure that check dams are in good working order and the center of the dam is lower than the edges. Erosion caused by high flows around the edges of the dam must be corrected immediately, and the dam must be extended upward beyond the repaired area.

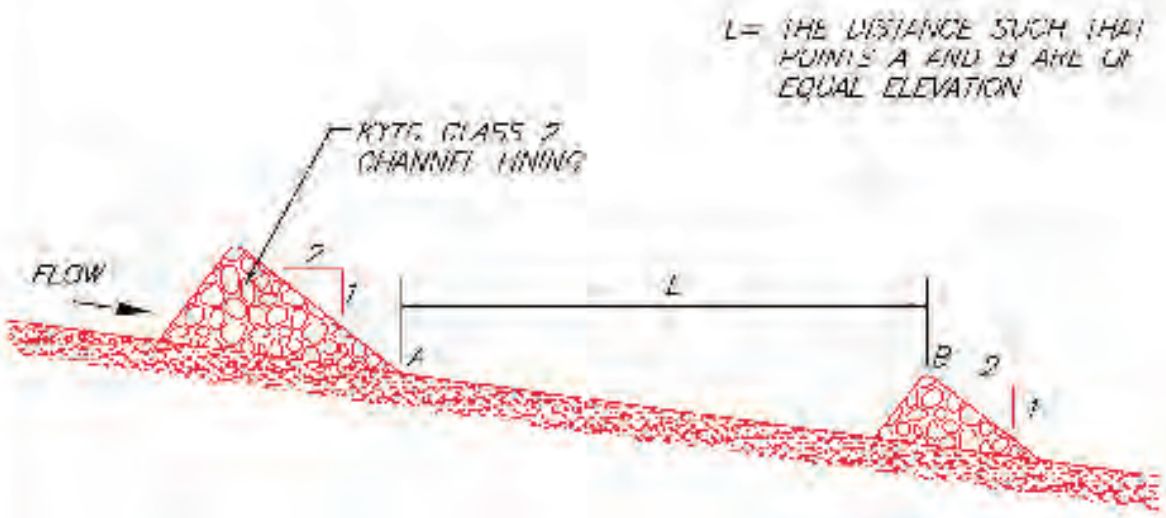
Inspect check dams for sediment accumulation weekly and after each rainfall greater than one-half inch. Sediment must be removed when it reaches one-half of the original height.

Check dams must remain in place and operational until the drainage area and channel are completely stabilized, or up to 30 days after the permanent site stabilization is achieved.

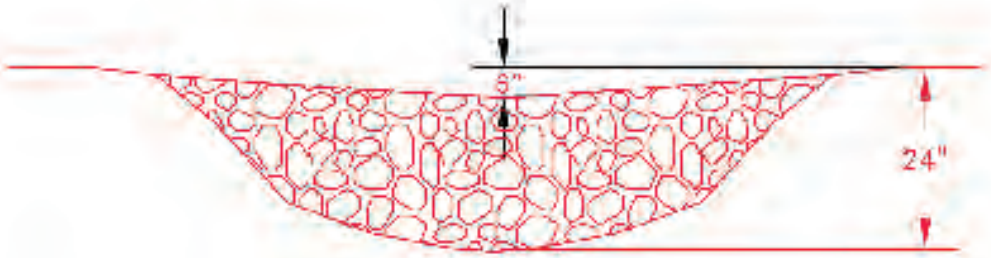
Check dams must be removed when their useful life has been completed. In temporary ditches and swales, check dams must be removed and the ditch filled in when it is no longer needed. In permanent channels, check dams must be removed when a permanent lining can be installed. In the case of grass-lined ditches, check dams must be removed when the grass has matured sufficiently to protect the ditch or swale. The area beneath the check dams must be seeded and mulched or sodded (depending upon velocity) immediately after check dams are removed.



Install check dams closer together in steep ditches (bottom) and farther apart in flatter ditches (top). Make sure overflow is in the center of the dam. Ditch checks are temporary controls, and should be removed when the ditch and upland areas are stabilized.



LONGITUDINAL SECTION SHOWING SPACING BETWEEN CHECK DAMS



SECTION ACROSS CHANNEL

CHECK DAM

4.7 Sediment Traps and Basins

General Information

The purpose of a temporary trap or basin is to provide an area where muddy runoff is allowed to pond, so sediment will settle out. Sediment traps and basins should be installed in selected drainage areas before excavation or fill work begins. **Do not depend on sediment traps and basins alone to control sediment loss from your construction site.** Sediment basins and traps should fill with muddy runoff during and immediately after a rain storm and drain down slowly over the next 1–2 days.

Containment for the ponding area can be provided by an excavation or a dike made of earth or stone. Low-lying sites on the downhill side of bare soil areas are ideal places to install temporary sediment traps and basins. In general, sediment traps are designed to treat runoff from about 1 to 5 acres. Sediment basins are larger, and serve areas larger than 5 acres. Basins draining areas larger than 10 acres require an engineered design and are often designed to function as a permanent stormwater treatment pond after construction is complete.

If feasible, do not put sediment traps or basins in or next to flowing streams or other waterways. Make sure pooled water does not flood buildings, roadways, utilities, or other structures. Construction of a permanent, stable outlet is key to long-term performance.

Temporary Sediment Traps

Any depression, swale, or low-lying place that receives muddy flows from exposed soil areas can serve as a sediment trap site. Installing several small traps at strategic locations is often better than building one large basin. The simplest approach is to dig a hole or build a dike (berm) of earth or stone where concentrated flows are present. This will help to detain runoff so sediment can settle out. The outlet can be a rock-lined depression in the containment berm.

Sediment Basins

Sediment basins are somewhat larger than traps, but the construction approach is similar. Sediment basins usually have more spillway protection because of their larger flows. Most have risers and outlet pipes rather than rock spillways to handle the larger flows. Sediment basins are often designed to serve later as stormwater treatment ponds. If this is the case, agreements might be required assigning responsibility for long-term sediment removal and general maintenance.

Small, temporary sediment traps intercept and detain construction site runoff so soil particles can settle out. Note how the outlet riser for this trap has been wrapped with filter fabric to increase detention time and trap suspended sediment. Designing traps and basins with long flow paths between the inlet and outlet also helps to increase sediment removal efficiency by extending the detention time. Where space restrictions prevent long basin designs, barriers placed in the basin can lengthen detention times by creating a serpentine flow path between the inlet and outlet.

4.7.1 Temporary Sediment (Silt) Traps

Simple traps or "checks" with rock berm containment structures can be installed as needed by field personnel with or without specific notations on plan documents. Standard notes on plans should call for installation of temporary traps in concentrated flow areas subject to rutting on an as-needed basis. Make sure containment berms are designed for overflow in the center of the berm, to prevent sidecutting and bypasses. Install traps in a series to control sediment from large upland areas.

Definition

A temporary sediment or silt trap is formed by excavation or by constructing a small embankment of stone, stone-filled bags, or other material to retain sediment. Sediment traps are considered temporary structures and often placed at the site on an *as needed* basis by field personnel. They should not be placed in flowing streams.

Purpose

Sediment traps pond and settle sediment from muddy runoff. Traps are used where physical site conditions or other restrictions prevent other erosion control measures from adequately controlling erosion and sedimentation. Sediment traps can be used downslope from construction operations that expose areas to erosion.

Design Criteria

Bermed sediment traps confined by rock, rock-filled fiber bags, or other material are preferred over excavated traps or those with soil berms. Traps are placed in converging flow areas (i.e., where ruts or washouts can form) or in ditches, where they are often called ditch checks or check dams. All traps are sized according to a design volume of 3,600 cubic feet per disturbed acre in the upstream drainage area. Multiple sediment traps constructed in a series are needed when the storage volume of each cannot meet this design requirement.

Sediment traps are generally used to treat a drainage area of 5 acres or less. When the total drainage area exceeds 10 acres, an engineered sediment basin is usually necessary. Traps cannot be placed in blue-line streams or other regulated waters unless space limitations or design limitations provide no other feasible option. A USACE Clean Water Act (CWA) section 404 permit is required in these cases. Sediment traps must be cleaned out when they are one-third full of sediment.

KYTC Silt Trap Types A, B, and C

The KYTC specifies three types of temporary sediment or silt traps. Type A is an excavated basin with or without a soil berm constructed in a ditch or drainageway. Type B is one or more small berms of rock (KYTC No. 2 or shot rock) placed in a drainageway or ditch, with a geotextile underliner covered by 4 inches of KYTC No. 4 stone. A 12-inch overflow depression appears in the middle of the berm(s). Type C traps are berms constructed of porous fabric bags filled with crushed aggregate (e.g., KYTC No. 57), placed individually or in a series to create small ponding dams around drop inlets, curb inlets, or to form check dams in a drainageway or ditch.

General

- Construct traps of rock (KYTC No. 2 mixed with smaller stone), rock-filled fiber bags, or use approved commercial sediment trap products installed and spaced according to manufacturer's instructions.
- Site sediment traps in areas where they can be maintained (i.e., sediment removed).
- Set traps back from property lines or water bodies as much as possible.
- Do not site sediment traps at culvert or pipe outlets if possible.
- Minimum sediment storage capacity is 3600 cubic feet per acre of upland area drained by the trap. Where space restrictions exist, install multiple traps in a series at least 50 feet apart.
- Maximum drainage area is 5 acres.
- Basin flow length should be at least two times the flow width.
- Recommended trap depth for open areas is 2 feet at the inlet and 4 feet at the outlet.
- Trap height must be 1.5 feet minimum in ditches, 3–5 feet in open area drainageways.
- Trap berm width at base must be sufficient to support 2H:1V berm.
- Trap length must be sufficient to tie into upper banks in ditches or high enough to prevent side bypasses in drainageways. Overflows must be in the center of the berm.
- Construct the trap, seed and stabilize before clearing and grading work begins.

Embankment requirements

- Maximum height of 5 feet.
- Maximum inside and outside slopes of 2:1.
- Side slopes, containment berms, and inflowing ditches should be seeded and mulched or blanketed as soon as possible after construction.

Outlet requirements

- The outlet must consist of an overflow spillway wide made of stone (KYTC No. 2 minimum).

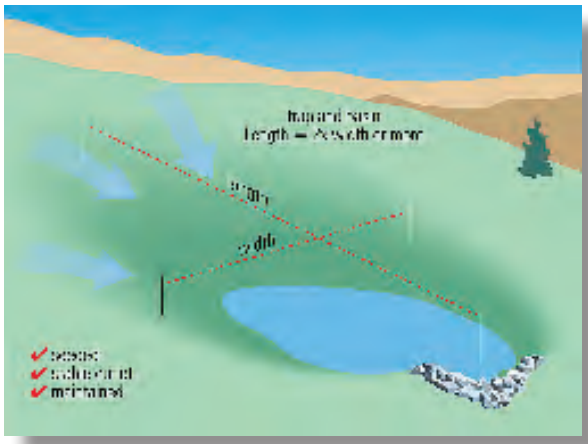
Construction Specifications

- Construct initial series of sediment traps before general site clearing and grading.
- The area to be excavated or ponded must be cleared of all trees, stumps, roots, brush, boulders, and debris. All topsoil containing excessive amounts of organic matter must be removed.
- Seeding, fertilizing, and mulching of the material taken from the excavation must comply with the applicable soil stabilization sections of this manual.
- Any material excavated from the trap must be uniformly spread to a depth not exceeding 3 feet and graded to a continuous slope away from the trap.
- Field-approved installations should be noted on weekly or bi-weekly inspection reports and on plan documents within 7 days.

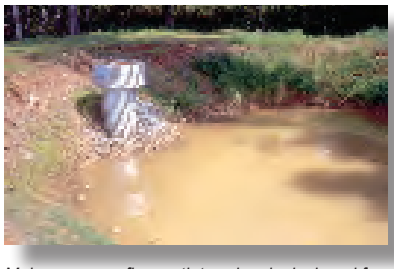
Inspection and Maintenance

The trap must be inspected weekly or every 14 days and after every rainfall greater than one-half inch. Sediment must be removed from the trap when it consumes one-third of the design volume. Plans for the sediment trap must indicate the methods for disposing of the sediment removed.

Temporary sediment traps are removed upon stabilization or cover of the upland drainage area with vegetation, pavement, and so on. The trap area should be graded, seeded, and mulched or blanketed. Excess sediment should be spread and stabilized where it will not enter the drainage system.



Design sediment traps with long flow paths if possible. Make sure overflow area is protected with rock or other armoring. For best results, seed trap and upland areas immediately after construction.

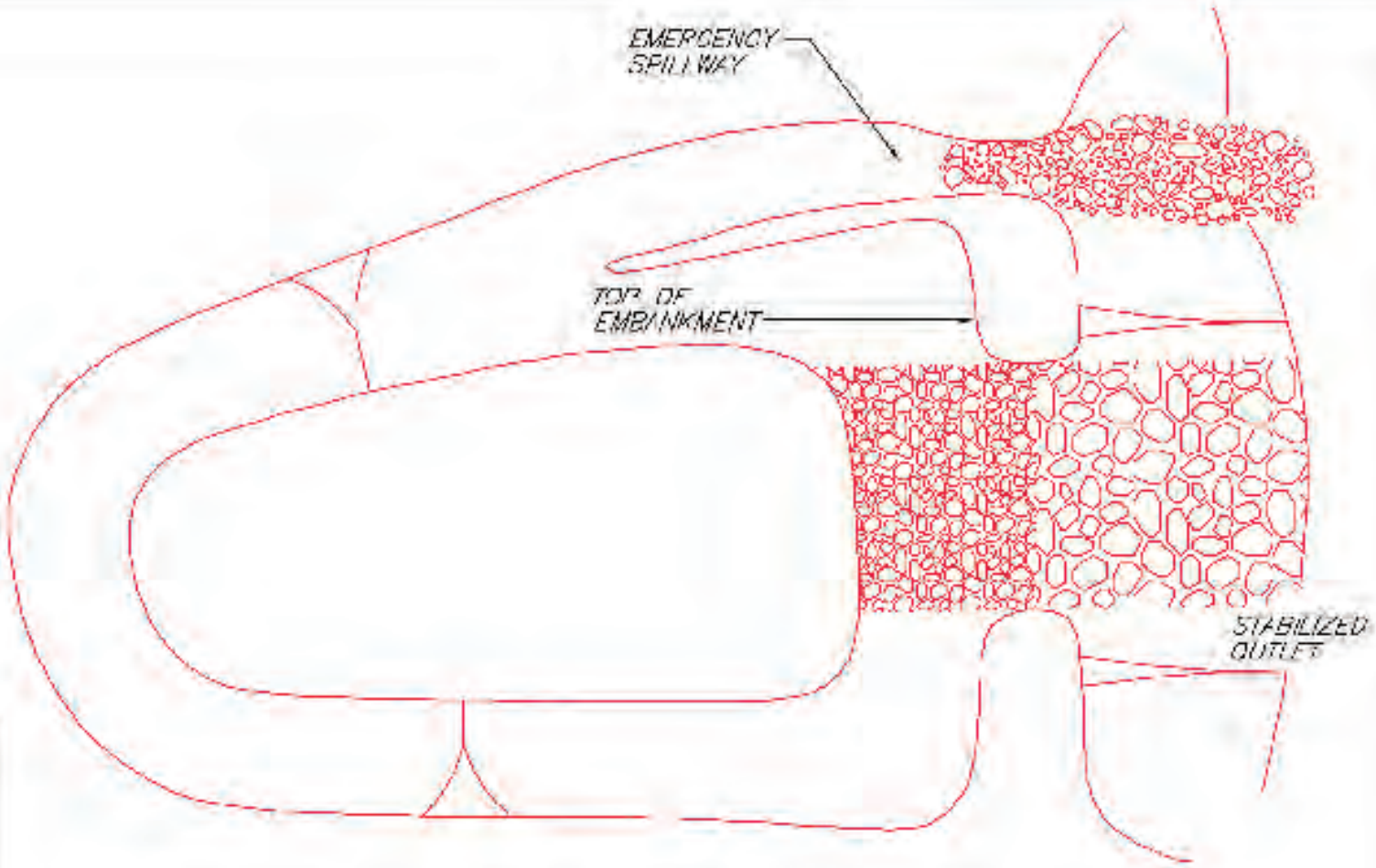


Make sure overflow outlet or riser is designed for maximum detention times. Note the rock berm around riser, which ensures maximum detention for muddy flows after small storms.

Good trap placement and performance; poor maintenance. Remove accumulated sediment before trap is half full. Spread material removed in a vegetated upland area or other site where it will not wash into nearby surface waters.

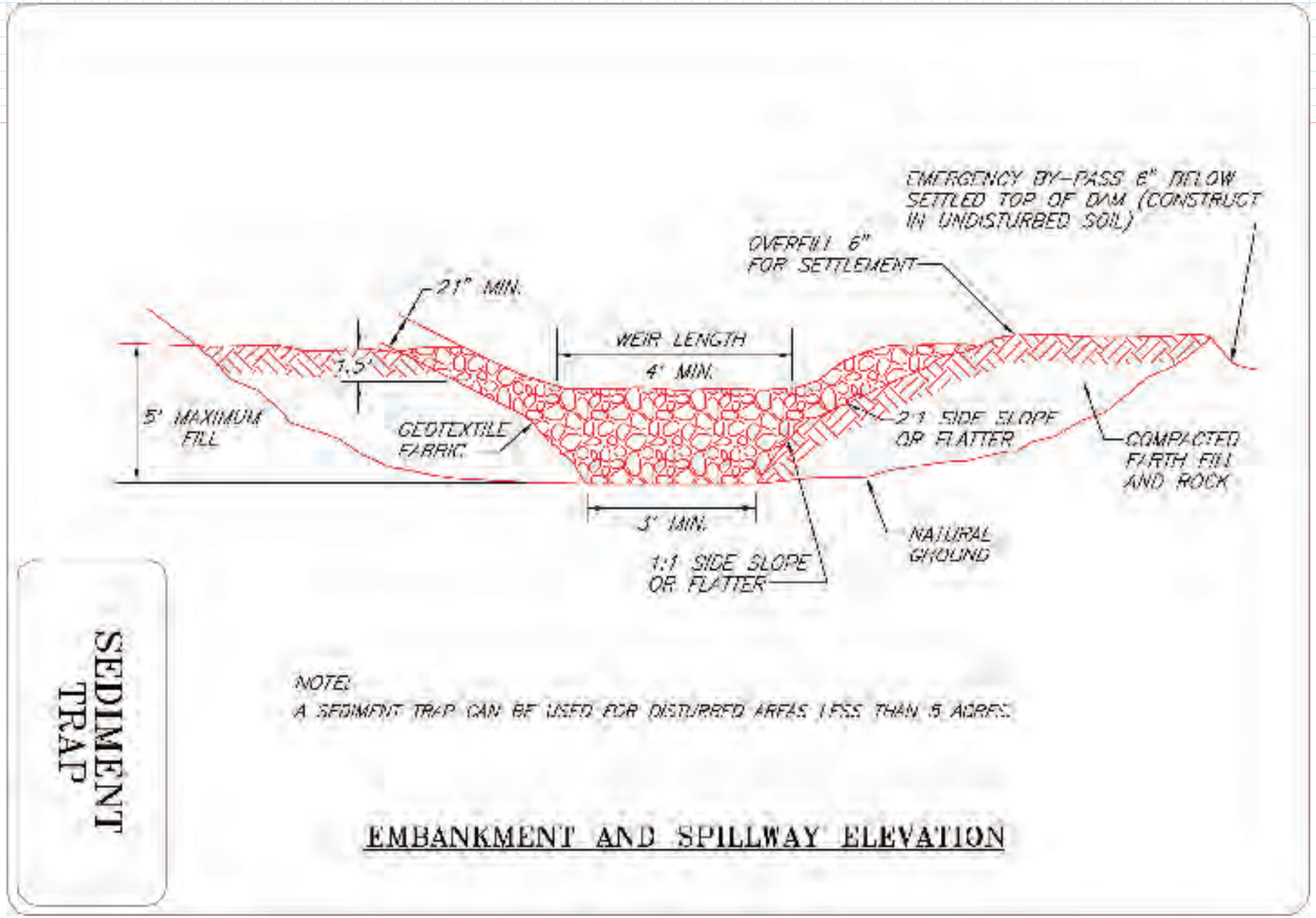
In areas where space is restricted, use multiple traps in a series to meet the design goal of 3600 cubic ft per acre of upland drainage. Get to final grade, seed and mulch as soon as possible to reduce trap maintenance and upkeep.

SEDIMENT TRAP

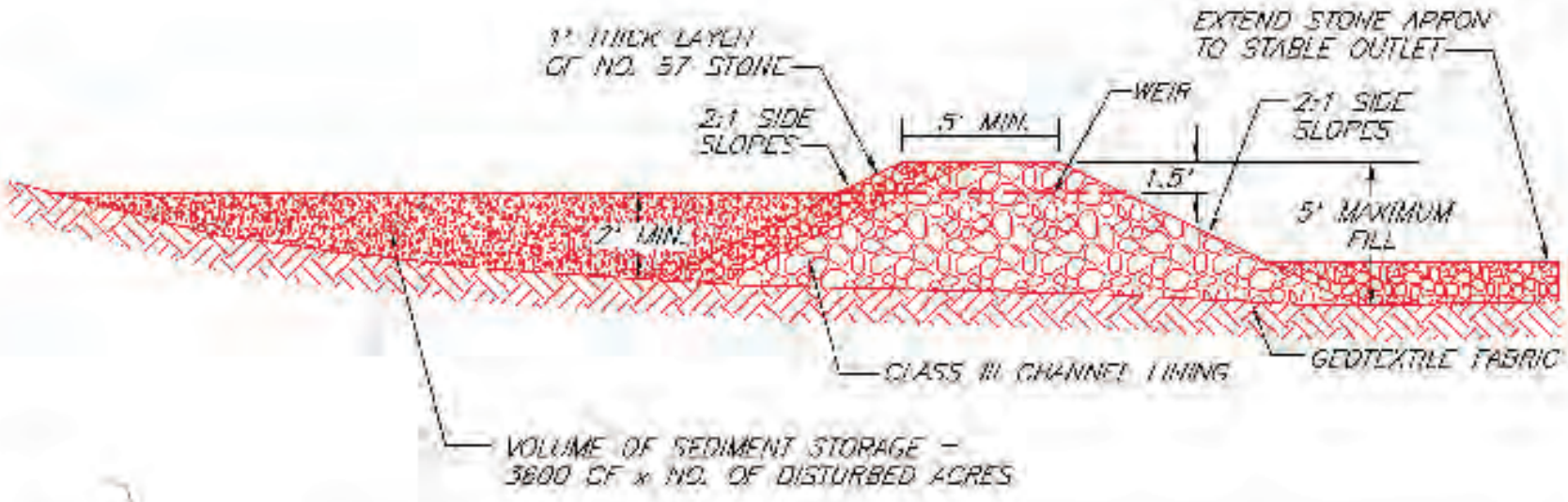


NOTE:
A SEDIMENT TRAP CAN BE USED FOR DISTURBED AREAS LESS THAN 5 ACRES.

PLAN


SEDIMENT TRAP
EMERGENCY BY-PASS 6" BELOW SETTLED TOP OF DAM (CONSTRUCT IN UNDISTURBED SOIL)
OVERFILL 6" FOR SETTLEMENT
21" MIN.
1.5'
WEIR LENGTH
4' MIN.
5' MAXIMUM FILL
GEOTEXTILE FABRIC
2:1 SIDE SLOPE OR FLATTER
COMPACTED EARTH FILL AND ROCK
3' MIN.
NATURAL GROUND
1:1 SIDE SLOPE OR FLATTER
NOTE:
A SEDIMENT TRAP CAN BE USED FOR DISTURBED AREAS LESS THAN 5 ACRES.
EMBANKMENT AND SPILLWAY ELEVATION

SEDIMENT TRAP



NOTE:
A SEDIMENT TRAP CAN BE USED FOR DISTURBED AREAS LESS THAN 5 ACRES.

STONE SECTION

4.7.2 Sediment (Detention) Basins

Well-stabilized detention basin with erosion control blankets protecting sidewalls during grass seed germination. Note the temporary stone berming in front of outlet, which increases detention time and promotes maximum settling of soil particles. Design of this basin could be greatly improved by adding a temporary baffle or barrier between the inlet and outlet, which would force inflows from the culvert around the baffle. The longer flow path and settling time would improve soil removal and prevent short-circuiting of the basin.

Definition

A sediment basin is a pond created by excavation and construction of an embankment and designed to retain or detain runoff sufficiently to allow excess sediment to settle out.

Purpose

The sediment basin is intended to collect and store sediment from sites that are cleared or graded during construction or for extended periods of time before permanent vegetation is reestablished or before permanent drainage structures are completed. It is intended to intercept and trap sediment before it leaves the construction site. Some basins are temporary, with a design life of 12 to 18 months, and are to be maintained until the site area is permanently stabilized. Basins that will serve as permanent stormwater treatment ponds often require modified outlet risers during construction to ensure adequate ponding times and sediment removal.

Basins should be located at the stormwater outlet from the site, not in any natural or undisturbed stream. Use of temporary dikes, pipes or channels might be necessary to divert runoff from disturbed areas into the basin and to divert runoff originating from undisturbed areas around the basin.

Design Criteria

Sediment basins must be designed by a professional engineer licensed in Kentucky. The basin should be designed using SEDCAD or other computer program. The design criteria are listed below:

General

Site sediment basins where they will provide the best treatment (longest flow path between inlet and outlet, longest settling times) for the greatest area of the site. It is recommended that dams be located in a natural drainageway in a deep constriction that has a wide area upstream for ponding detained stormwater.

- Do not locate dams where a failure would result in severe property damage or danger to human life.
- Sediment basins should be designed or modified to drain down slowly for 2–4 days after a storm event. Modify the outlet if necessary to achieve the maximum detention time.
- Minimum design storage capacity is 3600 cubic feet per acre of upland area drained. The maximum capacity for the impoundment must not exceed 10 acre-feet. If more impoundment capacity is needed, install basins in a series or site them to intercept tributary drainage areas.

- Construction phase performance goal is to reduce the total suspended solids by 80 percent for the 10-year, 24-hour storm, or provide a detention time of 24 to 48 hours for the 10-year, 24-hour storm.
- Minimum drainage area is 5 acres; the maximum drainage area is 120 acres.
- Basin flow length should be at least two times the flow width; the longer, the better. Baffles constructed of filter fabric and metal posts can be used inside the basin to create a longer (e.g., serpentine) flow path between inlet(s) and the outlet.
- Construct the basin before clearing and grading work begins.
- Basins, side slopes, berms, inlets, and downstream outlet channels must be seeded and mulched or blanketed immediately after construction.
- Basins that drain more than 10 acres can be designed as retention (rather than detention) basins (i.e., *wet* ponds). Design outlet to drain top of the pool farthest away from muddy inflows. Incorporating a sediment collection forebay is recommended to aid in maintenance.

Embankment requirements

- Dam height should not exceed 20 feet
- Maximum inside and outside slopes of the dam must be 3H:1V
- Minimum 1 foot freeboard during the 100-year, 6-hour storm
- Antiseep collars around discharge pipe are required
- Minimum top width of the dam must be 12 feet

Principal spillway (riser and barrel) requirements

Use a subsurface drain, a solid riser pipe, or both, with sufficient dewatering holes to provide sufficient detention time. Risers with one-half inch holes every 3 to 6 inches apart are recommended.

- No large holes or slots should appear in the lower two-thirds of the riser. Risers with large openings can be modified as described below or wrapped with filter fabric to cover lower openings during the construction period.
- During construction, risers should be modified with an inlet protection dike, pile of stone at the riser base, or other structure to provide longer ponding times (e.g., 1-2 days) for small flow events.
- Operational design goal is to reduce the peak flow to predevelopment levels for the 2-year and 10-year, 24-hour storms.
- Minimum diameter of pipe outlet is 12 inches; anti-vortex baffle and trash rack are required
- Minimum one foot freeboard required from top of riser to crest of emergency spillway

KY Division of Water Dam Safety Requirements

The sediment basin might have to be designed in accordance with dam safety requirements of the KY Division of Water. A dam is defined as any impounding structure that is either 25 feet in height, measured from the downstream toe to the crest, or has a maximum impounding capacity of 50 acre-feet of water. Structures that do not meet these criteria but have the potential to cause significant property damage or pose a threat to loss of life in the downstream area are regulated in the same manner as dams.

Emergency spillway requirements

- Designed to pass the 100-year, 6-hour post development peak flow
- Crest elevation at least one foot above the tip of the riser pipe
- Minimum one foot freeboard during the 100-year, 6-hour storm to the top of the embankment
- Rock used for the emergency spillway must be KYTC No. 2 or larger, depending on flow volumes and spillway slope (see sections on rock-lined channels and outlet stabilization energy dissipator)
- Emergency spillway energy dissipator must be extended at least 4 feet beyond the toe of the dam

Construction Specifications

- Construct the basin by excavating or building an embankment dike before any clearing or grading work begins.
- Areas under the embankment and any structural works must be cleared, grubbed and stripped of any vegetation and rootmat as shown on the erosion and sediment control plan.
- To facilitate cleanout and restoration, the basin area must be cleared, grubbed and stripped of any vegetation.
- A cut-off trench must be excavated along the centerline of the earth fill embankments. The minimum depth must be 2 feet. The cut-off trench must extend up both abutments to the riser crest elevation.
- Fill material for the embankment must be clean, low-permeability, mineral soil free of roots, woody vegetation, oversized stones, rocks, or other objectionable material.
- Fill material must be placed in 6 inch lifts, continuous layers over the entire length of the fill. Compacting must be obtained by routing the hauling equipment over the fill so that the entire surface of each layer of the fill is traversed by at least one wheel or tread track of the equipment or by the use of a compactor. Each layer must be compacted to 95 percent of maximum density and +/– 2 percent of optimum moisture content.
- The embankment should be constructed to an elevation of 10 percent higher than the design height to allow for settlement if compacting is achieved with hauling equipment. If compactors are used for compacting, the overbuild may be reduced to not less than 5 percent.
- The principle spillway riser must be securely attached to the discharge pipe by welding all around. All connections must be watertight.
- The pipe and riser must be placed on a firm, smooth soil foundation. The connection between the riser, and the riser base must be watertight. Pervious materials such as sand, gravel, or crushed stone must not be used as backfill around the pipe or anti-seep collars.
- The fill material around the pipe spillway must be placed in 4-inch layers and compacted under the shoulders and around the pipe to at least the same density as the adjacent embankment. A minimum of 2 feet of compacted backfill must be placed over the pipe spillway before crossing it with construction equipment.
- Risers might require a rock berm or other flow restrictor during the construction phase to ensure that muddy flows are detained sufficiently to promote settling of sediment.

- Steel base plates must have at least 2.5 feet of compacted earth, stone, or gravel over them to prevent flotation.
- An emergency spillway is required, and must not be installed in fill. Appropriate overflow channel lining and energy dissipator must be constructed.
- Baffles, if used, must be constructed of 4 inch by 4 inch posts and of 4 foot by 8 foot half-inch exterior plywood. The posts must be set at least 3 feet into the ground, no farther apart than 8 feet center to center, and must reach a height 6 inches below the riser crest elevation. Silt fencing with metal posts can also be used if flow velocities in the basin are low and ponding heights during the 2-year, 24-hour storm will not exceed 5 feet.
- The embankment, emergency spillway, incoming channels, and other site features must be stabilized with vegetation and mulched or blanketed immediately following construction.
- Construction operations must be carried out in such a manner that erosion and water pollution will be minimized.
- Local and state requirements must be met concerning fencing and signs warning the public of hazards of soft sediment and floodwater.

Inspection and Maintenance

Inspect the sediment basin weekly and after each rainfall greater than one-half inch. If incoming flows are exiting the basin quickly because of large holes in the outlet, modify the lower portion of the riser with a stone berm, filter fabric, or other flow restrictor that retains incoming flows for at least 12–24 hours.

- All damages caused by soil erosion or construction equipment must be repaired before the end of each working day.
- Remove sediment when the sediment storage zone is half full. This sediment must be placed in such a manner that it will not erode from the site. The sediment must not be deposited downstream from the embankment or in or adjacent to a stream or floodplain.
- When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposit must be leveled or otherwise disposed of according to the approved erosion and sediment control plan.
- If the sediment basin is designed to function as a permanent stormwater treatment pond, the basin and riser will be configured to that mode upon stabilization of the upland drainage area. Temporary flow restrictors on risers and other construction phase modifications must be removed.

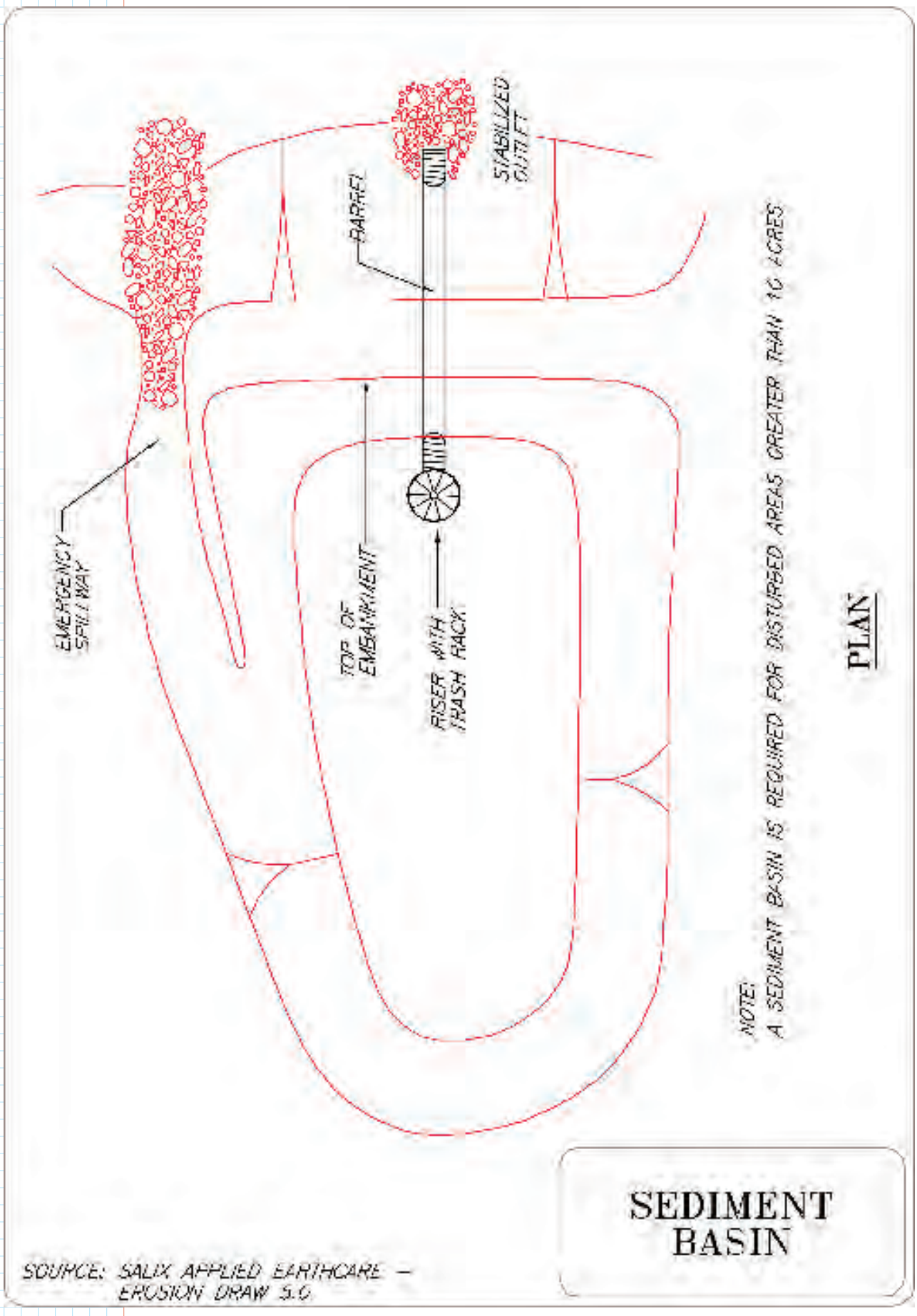
For best results, seed basin sidewalls and upland drainage areas as soon as possible. Make sure outlet structure does not allow rapid flow through the basin—use a rock berm, filter fabric, or other means to maximize ponding and detention time.

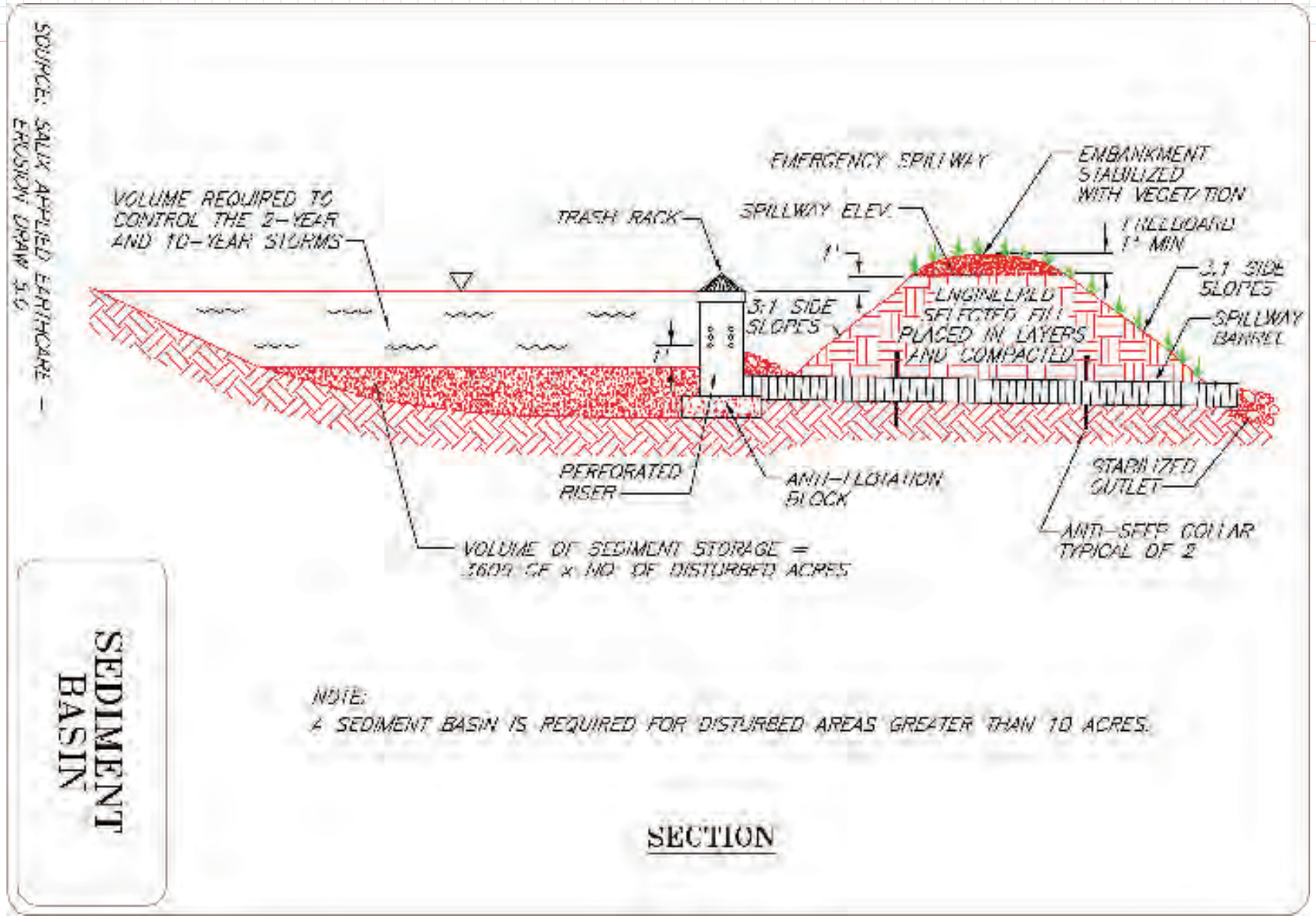
This is a well-constructed sediment basin. Note the rock flow restrictor around outlet riser, which filters and detains inflows. Basin sidewalls should be seeded immediately after construction.

The flow path through this basin has been lengthened by using filter fabric baffles constructed to create a serpentine flow path. Note the rock pile around outlet riser to maximize detention and grass on sidewalls.

This outlet riser intake hole has been modified with a "half round" section of pipe with 1-inch holes on 6-inch centers and rock berm. This temporary dike provides additional detention during the construction phase, which improves soil removal.

This shows a very well designed detention basin, featuring long flow path between inlet and outlet and V-notched outlet riser, which provides longer detention times for low flow events while still accommodating larger storms. Operation of this basin during the construction phase, however, is very poor. Note the lack of grass on sidewalls; no temporary dike in front of the outlet. This basin appears to be filling rapidly and requires sediment removal. For best results, seed and mulch basins immediately after construction, and modify the outlet to achieve 1 to 2 days of drain-down time after storm events.


EMERGENCY SPILLWAY
TOP OF EMBANKMENT
RISER WITH TRASH RACK
BARREL
STABILIZED OUTLET
PLAN
NOTE:
A SEDIMENT BASIN IS REQUIRED FOR DISTURBED AREAS GREATER THAN 10 ACRES
SEDIMENT BASIN
SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW S.C.


SOURCE: SALYK APPLIED EARTHCARE - EROSION DRAW 5.0
SEDIMENT BASIN
VOLUME REQUIRED TO CONTROL THE 2-YEAR AND 10-YEAR STORMS
TRASH RACK
EMERGENCY SPILLWAY
SPILLWAY ELEV.
EMBANKMENT STABILIZED WITH VEGETATION
FREEBOARD 1' MIN
1'
3:1 SIDE SLOPES
ENGINEERED SELECTED FILL PLACED IN LAYERS AND COMPACTED
2:1 SIDE SLOPES
SPILLWAY BARREL
1'
PERFORATED RISER
ANTI-FLOTATION BLOCK
STABILIZED OUTLET
ANTI-SEEP COLLAR TYPICAL OF 2
VOLUME OF SEDIMENT STORAGE = 3600 CF x NO. OF DISTURBED ACRES
NOTE:
A SEDIMENT BASIN IS REQUIRED FOR DISTURBED AREAS GREATER THAN 10 ACRES.
SECTION

4.7.3 Dewatering Devices

This shows a dewatering sediment filter bag (center) in use at residential construction site. Muddy water pumped into the bag is physically filtered, with clear water passing through the bag fabric. Pumping muddy, unfiltered water directly into curb drains (center left) or surface streams constitutes a direct KPDES permit violation.

Definition

Dewatering is the pumping of stormwater or groundwater from excavation pits or trenches. The sediment-laden water must be pumped to a dewatering structure for sediment removal before it is discharged off-site.

Purpose

The purpose of a dewatering device is to remove sediment from the water before it is discharged off-site.

Design Criteria

Dewatering operations should not discharge to a ditch, pipe, or other conveyance that leads to a regulated water body (e.g., stream, river, wetland, lake) except as authorized by a KPDES permit. (Note: The KPDES Construction General Permit covers dewatering discharges to surface waters or ditches leading to surface waters as long as all Permit conditions are met).

There are several types of dewatering structures or devices that can be used. A flat, well-stabilized, vegetated area can serve as a filtering *structure* if it can withstand the velocity of the discharged water and infiltrate or assimilate it without erosion. The minimum filter radius or length must be at least 75 feet.

It is recommended that sediment basins or temporary sediment traps receive sediment-laden water from bore pits and trenches. This will ensure that the 80 percent trapping efficiency goal will be upheld. Take special care to ensure that pumping this water does not cause the sediment control structure to fail. Also take care at the outlet of the hose from the pump to ensure that erosion does not occur because of high concentrated flows.

If possible, fill excavations that are not being actively worked to prevent them from becoming ponded deeply with muddy water that must be pumped.

Another option is to use an infiltration trench—a shallow, excavated trench back-filled with stone—to form a reservoir. This reservoir can contain subsurface drainage pipe or just stone. This trench allows water to filter through the stone and then be diverted to a suitable discharge point. The soils and the depth to the water table must be suitable for this sort of dewatering. Typical trench depths range from 2 to 8 feet. The stone fill material consists of washed aggregate 1.5 to 3 inches in diameter.

Other methods that can be used include a portable sediment tank, a silt fence pit, or a commercial sediment filter bag or *sock*. The structure must be sized to allow pumped water to flow through the structure without overtopping.

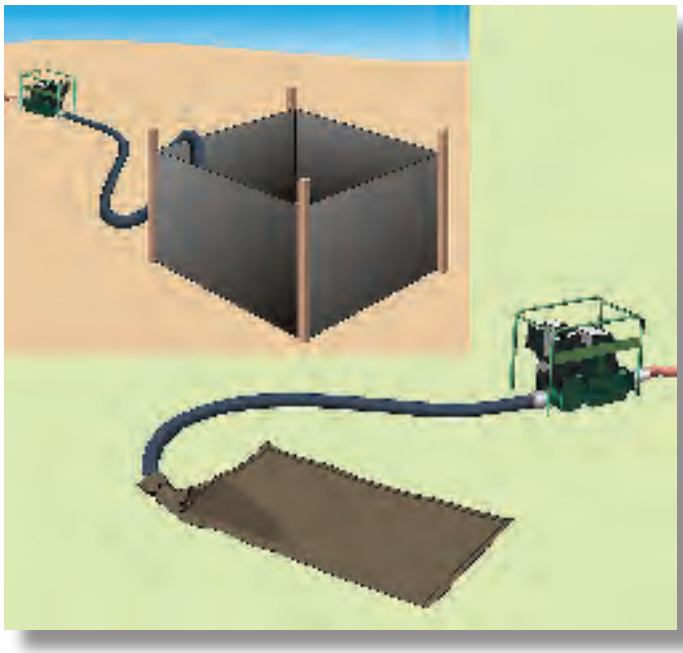
Construction Specifications

See the specifications in this manual for sediment traps and basins. Follow the manufacturer's recommendations for commercial products.

Inspection and Maintenance

Inspect the dewatering structure or device frequently to ensure that it is functioning properly and not overtopping. Accumulated sediment should be spread out on site and stabilized, or disposed of off-site.

Silt fence enclosures and commercial sediment filters will likely require cleaning to remove fine particles and restore performance. This can be done with a stiff brush when the filter is dry, or via other manufacturer's recommendations.



Containment structures for sediment-laden water can be made of rock or filter fabric. Standard notes should require monitoring to make sure the containment structure is not breached during dewatering operations.

Large bags or socks made of filter fabric provide excellent sediment removal and are extremely versatile. Site filtration structures away from surface waters if possible. Dispose of sediment collected in a flat vegetated area or other site where it will not wash into surface waters.

When dewatering sediment or other ponds, wait until several days after the last rain if possible to allow for settling of sediments. Pump from the upper portion of pond, where water is clearer.

Large sediment filter bag in operation. Note the row of straw bales around the bag providing additional treatment for clarified flow oozing out of the bag. A silt fence could also be used.

4.8 Stream and Wetland Protection

General Information

All streams, rivers, lakes, and wetlands are regulated waters in Kentucky. In addition, most small upland drainageways that carry flowing water during part of the year are also regulated, and activities that affect sinkholes and other karst features may be subject to regulatory oversight for certain activities.

No construction activities should occur within 25 ft. of the banks or within the channels of these waterways without specific permit coverage provided by the USACE and the KYDOW. This includes activities such as clearing vegetation from streambanks, placing culverts or temporary creek crossings, channelizing or straightening streams, filling wetlands with soil, or placing dams or sediment barriers across streams. **Disturbed areas within 25 ft. of stream banks (i.e., bank full elevation) must be stabilized within 24 hours.**

The best approach for dealing with streams, wetlands, and other water bodies on construction sites is to designate them and their 25 ft. vegetated buffers as *do not disturb* zones by flagging them off-limits for vehicles and equipment. This can be done on construction plans by designating these areas as *buffer zones*—see the fact sheet that follows for additional information.

Construction activities that seek to stabilize or restore damaged streambanks can use the other fact sheets in this section for information on vegetative practices. These are often accompanied structural measures such as gabion baskets/mattresses, turf reinforcement mats, and rock (see fact sheets on those topics).

Small stabilization or restoration projects can follow the information in the fact sheets for guidance on how to proceed with structural or vegetative approaches. Larger projects involving significant stream channel work (i.e., ≥ 200 feet) should be based on stream geomorphological and flow analyses to ensure that vegetative and structural installations are not washed out.

Vegetative measures—armored with permanent turf reinforcement mats or geogrid structures—are preferred over riprap for restoring or stabilizing stream banks. All work within stream channels and wetlands requires permit coverage by the USACE and the KYDOW.

Plan sheets and work orders for projects near streams and wetlands should specify the posting of "do not mow" warning signs along vegetated buffer areas. Flagging buffer zones during construction helps keep equipment away from areas where violations of federal or state clean water rules might occur.

Trees, Shrubs, and Herbaceous Vegetation for Streams and Wetlands

Use native species for vegetated areas, landscaping, and stream or wetland buffer areas wherever possible. Native species can provide year-round attractive scenery, important habitat, pollutant buffering, and structural stability for soils. Native trees and shrubs are adapted to Kentucky's climate and will not need as much care and maintenance as ornamentals or nonnatives. In addition, prices for native species are often as low or lower than other landscaping plant material.

For best results, protect soils where trees and shrubs will be planted by marking off areas and restricting equipment movement and resulting soil compaction. Compacted soils, low soil organic matter, and low fertility might require soil amendments and preparation before planting. Use species from the list below, or consult local UK Extension Service or Natural Resources Conservation Service (NRCS) offices for more information. The species below are suggested for planting along creek banks, lake shores, rivers, wetlands, and other riparian areas.

Suggested Vegetation for Stream Buffer Areas

Tree	Species
Pin Oak	*Quercus palustria*
Cherrybark Oak	*Quercus pagoda*
Bur Oak	*Quercus macrocarpa*
Swamp Chestnut Oak	*Quercus michauxii*
Shingle Oak	*Quercus imbricaria*
Northern Red Oak	*Quercus rubra*
Post Oak	*Quercus stellata*
Red Maple	*Acer rubrum*
Green Ash	*Fraxinus pennsylvanica*
Shellbark Hickory	*Carya laciniosa*
Blackgum	*Nyssa sylvatica*
American Elm	*Ulmus americana*
Eastern Cottonwood	*Populus deltoides*
Black Walnut	*Juglans nigra*
River Birch	*Betula nigra*
Yellow Poplar	*Liriodendron tulipifera*
Persimmon	*Diospyrus virginiana*
Shrubs	
Arrow-wood	*Viburnum dentatum*
American Plum	*Prunus americana*
Deciduous Holly	*Ilex decidua*
Gray Dogwood	*Cornus racemosa*
Silky Dogwood	*Cornus amomun*
Spicebush	*Lindera benzoin*
Sassafrass	*Sassafras albinum*
Herbaceous Plants	
Rice Cutgrass	*Leersia oryzoides*
Managrass	*Glyceria striata*
Spangle Grass	*Chasmanthium latifolium*
Barnyard Grass	*Echinochloa crus-galli*
Switchgrass	*Panicum virgatum*
Annual Rye	*Secale cereale*
Wild Rye	*Elymus virginicus*
Deertongue Grass	*Panicum clandestinum*
Panic Grass	*Panicum microcarpon*
Kentucky Cane	*Bamboo Arundinaria gigantea*

4.8.1 Buffer Zones

Stream buffer zones can be enhanced with plantings of native trees and shrubs, which also help to stabilize banks and mediate erosive scour forces. Permanent TRMs, geogrid structures, or rock can be used to provide supplemental armoring. Kentucky requires a minimum 25 ft. buffer for all streams, lakes, rivers, wetlands, and sinkholes. An adequately protective alternative practice can be used if it is not possible to meet the setback requirement, such as with bridge construction.

Definition

Buffer zones are setback requirements that establish 25 to 50 ft. no-disturbance protection zones along and around streams, wetlands, rivers, ponds, and lakes.

Purpose

The purpose of a buffer zone or setback is to restrict activities near waterways and to maintain a vegetative buffer strip so that soil disturbance is avoided and waterways retain the natural filtration, structural protection, and infiltration capacity offered by natural vegetated buffers.

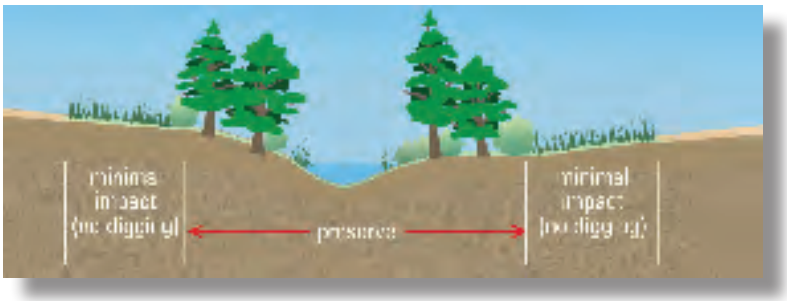
Design Criteria

Site plans should specify buffer zones along existing site drainage features such as upland swales, ditches, intermittent and ephemeral (i.e., flowing only after rains or during snowmelt) and streams, ponds, wetlands, sinkholes, lakes, and rivers. Establishing buffer zones along existing drainage features preserves the drainage system, which promotes greater site stability, less erosion, higher aesthetic potential, increased habitat value, and more economical site development.

Site development design should attempt to *lay in* desired structures such as buildings, roads, utilities, and so forth with minimal disturbance to the existing drainage system and its adjacent vegetated buffer zone. Where this is not possible, site plans can specify that newly constructed drainage features be vegetated with native material, with new buffer zones established around the new drainage system (see the Vegetated Buffer section).

Some jurisdictions have mandatory setback requirements regarding limits of disturbance near water bodies and karst features. Check with the local planning and zoning office before working near waterways. Recommended setbacks from waterways are shown in the table on the following page.

Zones for a Vegetated Stream Buffer



Buffer zone widths vary according to stream size. In general, the near-bank area (25–50 ft for streams, 50–100 ft for rivers) should contain an undisturbed mix of native trees, shrubs, and herbaceous vegetation. The upgradient secondary buffer zone can be managed as mowed grass or hay land, or planted with no-mow native grasses.

Recommended Setbacks From Top of the Streambank or Lakeshore

Bank Slope	Soil Type Along Banks		
	Sandy	*Silty*	*Clays*
Very Steep (2:1 or more)	100 ft	80 ft	60 ft
Steep (4:1 or more)	80 ft	60 ft	40 ft
Moderate (6:1 or more)	60 ft	40 ft	30 ft
Mostly Flat (less than 10:1)	40 ft	30 ft	25 ft

Construction Specifications

See the section on Vegetated Filter Strips (next) in this manual.

Inspection and Maintenance

See the section on Vegetated Filter Strips (next) in this manual.

Kentucky regulations require an undisturbed 25 ft buffer for all surface waters. Buffer width is 50ft for waters impaired for sediment with no TMDL.

Vegetated buffers provide excellent protection against sediment from muddy sheet flows. Control of concentrated flows of runoff through the buffer is also required.

Native trees and shrubs can resist scour forces that cause streambank and lakeshore erosion. Management of these areas should include only removal of invasive species.

Kentucky cane (Arundinaria gigantea, above) and other native grasses can slow down and filter sediment runoff. Buffers that are too narrow (right) offer little protection against high water bank erosion.

4.8.2 Filter Strips

Vegetated filter strips can be designed into projects as attractive natural areas, with showy wildflowers and interesting fall colors. These amenities are in addition to the important functions of intercepting, filtering, and processing contaminants in storm runoff.

Definition

A filter strip is a planted strip of native grasses or other vegetation adjacent to and upgradient from a drainage ditch, stormwater system inlet, or natural water body such as a stream, river, lake, wetland, or sinkhole. They can also be used to protect lawns and paved areas. Filter strips are typically managed as a *natural* vegetative filter rather than mowed turf grass.

Purpose

The purpose of a vegetated filter strip is to act as a natural, vegetated buffer (see the Buffer Zone section) in reducing the amount of sediment in incoming runoff, the velocity of the runoff, and the temperature of the runoff during hot weather. Vegetated filter strips promote stormwater infiltration, deposition of sediment, absorption of other pollutants, and decomposition of organics to reduce or assimilate pollutants in the runoff.

Vegetated Filter Strip Width Recommendations for Kentucky

Stream Type	Conditions	Minimum Buffer Width	General Considerations
Urban streams	> 25% imperviousness in drainage area	25 ft each bank	At least two-thirds of the buffer—nearest to the water—should be undisturbed native or natural vegetation.
Suburban streams	10% to 25% imperviousness in drainage area	50 ft each bank	
Rural streams	< 10% imperviousness in drainage area	≥ 60 ft each bank	Remainder can be permanent managed vegetation.
Large rivers	Rivers with floodplains > 500 ft wide	≥ 100 ft each bank	
Wetlands	For sloping sites, add more buffer	25 to 50 ft	Avoid turf grass in managed area if possible; use native grasses, wildflower mixes. Mow annually or less.
Sinkholes or other karst features	Will vary according to size and flow characteristics	25 to 50 ft radius	

Design Criteria

Filter strips should be used only to address potential water quality problems associated with overland (sheet) flow. They are not effective in removing sediment from concentrated flows unless those flows are dispersed on flat ground before discharge into the filter strip.

- Vegetative filter strips cannot be expected to remove all sediment or adequately protect adjacent areas from sediment damage when used alone. Vegetative filters should be considered only as one component of the erosion and sediment control system.
- If vegetative filter strips are proposed as a sediment control device and they do not already exist, they must be planned and established before initiating general land-disturbing activities if possible.
- Minimum filter strip width should be 25 feet for urban streams, 50–75 feet for suburban and rural streams, and at least 100 feet for large rivers. Plans should show the location, width, and length of filter strips. The type of vegetation and specifications for soil preparation and seeding must be included. If existing vegetation is to be used, plans for protecting or improving it must be provided.
- The width of filter strips expected to treat runoff from long slopes should be at least one-fourth the length of the slope for slopes up to 20 percent and at least half the slope length for steeper areas.

Material Specifications

When establishing new seeded areas, consideration must be given to aesthetics and wildlife needs and soil conditions on the site. Native grass and wildflower mixtures are attractive, commercially available, and can be seeded with standard equipment for the most part.

- It is easier and cheaper to protect and preserve existing areas than to establish new ones. Existing grass wildflower, or grass/legume areas to be used as filter strips should be flagged off as a *buffer zone* (see the Buffer Zone section). Equipment and vehicular traffic in these areas should be restricted to avoid damage to vegetation. Vegetation should be dense and well established with no bare spots.
- Seed species for native grass and wildflower mixes are available from county extension and NRCS offices. Specify quality seed mixtures selected on the basis of climate, soils, drainage, shading, and other factors. Note that taller grass mixtures might not be appropriate near residential areas because of security concerns regarding visibility.
- Specify planting of grasses and forbs at the same time. Seeding rates will vary by species, but should generally be specialized and low, unlike agricultural seeding rates. Consider a cover/nursery crop of annual or short-lived native species (e.g., rye) to protect the site until grasses and wildflowers emerge.
- Seed should be from current production, no more than one year old, and free of mold or insects and disease. Seed origin should be furnished and have characteristics similar to the site. Seed collected or grown in the region is usually best.

The following chart provides a list of alternative grass and grass/legume mixtures for projects not using other native grass/wildflower mixes:

Filter Strip Seeding Mixture and Site Suitability Chart

Seeding Mixture	Seeding Rate Lbs/Acre	Soil Suitability
1. Alfalfa	10	Well Drained
or Red Clover	10	
Plus		
Timothy	4	
or Orchardgrass	6	
or Bromegrass	6	
2. Ladino Clover	½	Wet or Well Drained
Plus		
Timothy	4	
or Orchardgrass	6	
or Bromegrass	8	
3. Tall Fescue	40	Wet or Well Drained
4. Reed Canarygrass	15	Wet
Plus		
Tall Fescue	10	

Construction Specifications

When planting filter strips, prepare the seedbed, incorporate fertilizer (if necessary), and apply mulch consistent with the seeding sections of this manual. Filter strips using areas of existing vegetation must be overseeded, as necessary, with the above mixtures to obtain an equivalent density of vegetation. The over seeding must be accomplished before the land disturbing activity if no grading will occur in the area. See the Permanent Seeding section of this manual for further details. For areas to be seeded in native grass and wildflower mixes, use the following approach:

***Vegetation removal before seeding*—**If undesirable vegetation exists on the site, kill with nonselective, nonresidual herbicide, a glyphosate without surfactant if possible. After evidence of kill (7–14 days) mow to 2 inches. Mow or rake off.

***Avoid soil disturbance*—**Avoid deep tillage, which pulls up new weed seed to compromise plantings. Scarify soil no deeper than one-half inch, on the contour, to reduce weed and erosion problems. No-till planters are now available to plant into existing dead stubble. Avoid adding imported topsoils unless it is certified to be weed-free.

***Soil amendments*—**Amendments should be limited because of stream contamination and cost concerns. Fertilizers assist weed growth and can leach into surface waters. Native forbs and grasses, if matched to the site, should establish without fertilizers if moisture is available. Amendments, if used, should be monitored for potential runoff impacts. Addition of peat moss has not proven beneficial to these plantings over time. Addition of native mychorizae has proven beneficial.

***Equipment*—**Follow the seed distributor's instructions for planting. Specialized drills, broadcasters, and hydroseeders are available. Choose carefully and experiment on small areas to determine the best approach. The bottom line is that the seed germinates only if it makes contact with the soil and moisture.

***Follow-up*—**Cover the seed by harrowing, dragging, raking or cultipacking. Mulch with weed-free straw or hay or native grass straw. Use ECBs on long, steep slopes if mulch and netting will not suffice. Avoid irrigation unless experiencing periods of drought, when supplementary watering might be in order. A high (6–8 inches) mowing once or twice during the first season reduces weed competition.

Inspection and Maintenance

Inspect filter strips regularly to ensure that a healthy vegetative growth is maintained. Any bare spots or spots where sediment deposition could lead to the destruction of vegetation must be repaired.

If necessary, filter strips must be fertilized once each year in the fall. Construction traffic must not be permitted to drive upon filter strips.

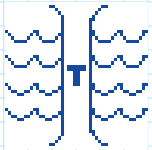
Filter strips should be managed as natural type vegetated areas, with an annual or biennial mowing regimen (typically mowed during the fall), regular litter removal if needed, and reseeding of vegetation where necessary.

These are good examples of vegetated filter strips along a small swale (left) and large stream (below). Protect these areas during construction with flagging ribbon or signs.

Filter strips along lakes and ponds (left) can include mowed access areas for fishing and other activities. Where severe scour forces are present, protect planted filter strips with turf reinforcement mats or other armoring to prevent bank erosion (below).

4.8.3 Temporary Stream Crossing

Temporary stream crossings require a USACE Clean Water Act section 404 permit. Avoid or minimize removal of vegetation and excavation at the crossing site. Cover all bare soil areas with straw or ECBs. Cover the approaches on both sides (25 ft minimum) with No. 2 stone.



Definition

A temporary stream crossing is a temporary structural span installed across a flowing stream use by construction traffic. Structures can include bridges, round pipes, or pipe arches.

Purpose

The purpose of a temporary stream crossing is to provide a means for construction traffic to cross flowing streams without damaging the channel or banks and to keep sediment generated by construction traffic out of the stream.

Design Criteria

Temporary stream crossings are applicable to flowing streams with drainage areas less than one square mile. Structures that must handle flow from larger drainage areas must be designed by a licensed professional engineer.

- Temporary stream crossings must be planned to be in service for the shortest practical period of time and to be removed as soon as their function is completed. Choose crossing sites at straight channel sections (i.e., riffles or glides, not pools) with stable banks and channel bottoms if possible. Avoid areas where trees will need to be removed.
- Such structures are subject to the rules and regulations of the USACE for in-stream modifications (404 permits) and the KYDOW (401 certification).
- The span must be designed to withstand the expected loads from heavy construction equipment that will cross the structure.
- The structure must be large enough to convey the peak flow expected from a 2-year, 24-hour storm without appreciably altering the stream flow characteristics. The structure may be a span, a culvert, or multiple culverts.
- Where culverts are installed, rock must be used to form the crossing (i.e., not soil). The depth of the rock cover over the culvert must be equal to one-half the diameter of the culvert or 12 inches, whichever is greater. The area around the crossing must be protected from erosion using the mulching and seeding erosion control measures specified in this manual. The slope of the culvert must be at least one-quarter inch per foot.

- The approaches to the crossing structure must consist of stone pads at least 25 feet in length also covered with KYTC No. 2 stone.
- Crossing structures can be bridges or culverts/pipes of any material that can support the fully loaded equipment expected. The minimum sized culvert must be 24 inches.

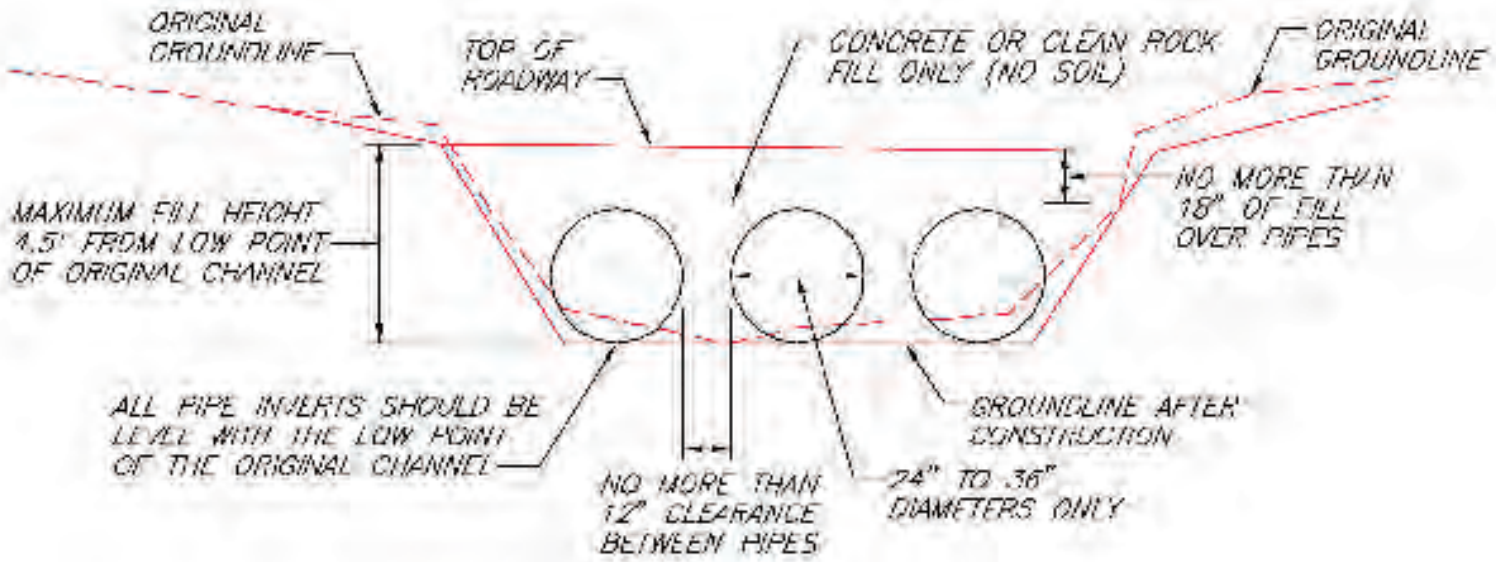
Construction Specifications

- Clearing and excavation of the streambed and banks must be minimized. Do not grade and grub the site. For best results, remove by hand or chainsaw only the vegetation growing within the approach pads and crossing area. Place pipe or structure at the crossing location, and place rock on approach pads and crossing pipe/structure.
- The approaches to the structure must consist of stone pads with a minimum thickness of 6 inches, a minimum width equal to the width of the structure and a minimum approach length of 25 feet on each side.

Inspection and Maintenance

- The structure must be inspected after every rainfall greater than one-half inch and at least once a week. Repair all damages immediately.
- The structure must be removed as soon as it is no longer necessary for project construction. Take care during removal not to damage shrubs, trees, and other vegetation that was left intact when the crossing was built.
- Upon removal of the structure, the stream must immediately be restored to its original cross-section and properly stabilized with vegetation, mulch, ECBs, or TRMs as necessary.

Here are several poor temporary crossing examples (above, and below right). Temporary crossing areas should not be grubbed and stripped if possible. Bare soil areas should be covered with straw or ECBs (top right).



NOTES

1. THIS IS A CONCEPTUAL DRAWING. THE NUMBER AND SIZE OF PIPES AND OTHER DETAILS WILL VARY DEPENDING ON SPECIFIC SITE CONDITIONS.
2. THE PIPES AND BACKFILL MUST BE CONTAINED WITHIN THE STREAM CHANNEL AS SHOWN ABOVE. DURING THE CONSTRUCTION OF THE APPROACHES AND ACCESS ROADWAY ACROSS THE FLOODPLAIN, UNSTABLE AND UNCONSOLIDATED MATERIALS UNSUITABLE FOR ROADWAYS MAY BE EXCAVATED AND REPLACED WITH RIPRAP, CRUSHED STONE, OR OTHER STABLE ROAD CONSTRUCTION MATERIALS. THIS MAY ONLY BE DONE, HOWEVER, WITH THE FOLLOWING PROVISIONS: (1) THE DISPOSAL OF EXCESS, UNCONSOLIDATED MATERIALS THUS EXCAVATED MUST BE OUTSIDE OF THE FLOODPLAIN AND (2) THE FINISHED SURFACE OF THE COMPLETED ROAD MAY BE NO MORE THAN THREE INCHES (3"), ABOVE THE PRE CONSTRUCTION SURFACE OF THE FLOODPLAIN AT ANY POINT BEYOND THE TOP OF BANKS.

STREAM CROSSING

KY DIVISION OF WATER
LOW WATER CROSSING

4.8.4 Bioengineering: Live Staking

Live stakes (center) of willow or other selected hardwoods can be cut during the dormant season and driven into stream banks or shore areas to stabilize erodible soils. Note that some hardwood species require special preparation to ensure growth. All species require contact with moist soil along the lower portions of the live stake.

Definition

Live stake planting involves inserting and tamping live, rootable vegetative tree or shrub cuttings (e.g., willow, ash, alder) into moist streambanks in a manner that allows the stake to take root and grow.

Purpose

Live stakes create a root mat that stabilizes the soil by reinforcing and binding soil particles together and by extracting excess soil moisture. Growing stakes also provide physical armoring of streambanks against high-velocity flows. This practice is commonly used in conjunction with other practices to provide for a more stable site condition (i.e., used to anchor blankets, coir mats, TRMs, straw rolls). Live stakes can be used for the following:

- Repair of small earth slips and slumps.
- Gullies and stream channels can be live-staked. Areas best suited to staking are the bottoms and banks of small gullies and bare gully banks.
- Live stakes can be inserted or driven through interstices or openings in gabions, riprap, articulated block, or cellular confinement systems.

Vegetative Streambank Stabilization

Vegetative streambank stabilization, also known as bioengineering, includes a variety of measures designed to reduce erosion by installing protective vegetation and a few strategically placed structural components such as ECBs, TRMs, geotextiles, tree roots, and other materials.

Vegetative streambank stabilization can incorporate significant structural components such as gabion baskets and mattresses, slope toe protection rock, and cellular geogrid applications. However, the focus for this BMP is to minimize the appearance of so-called "hard armoring" such as rock and gabions and to maximize the "soft look" of trees, shrubs, and other vegetation. The selection, installation, and maintenance of vegetative material is the key to success.

All streambank stabilization practices, structural and vegetative, are subject to Clean Water Act section 404 permit coverage issued by the USACE and KYDOW Clean Water Act section 401 Water Quality Certification and Floodplain Permits.

- Live willow stakes can be used to anchor and enhance the effectiveness of willow wattles, straw rolls, coir rolls, turf reinforcement mats, coir mats, and other erosion control materials.
- Willow staking enhances conditions for natural invasion and the establishment of other plants from the surrounding plant community.
- Willow establishment can improve aesthetics and provide wildlife habitat.
- As a temporary measure, live willow staking performs an important function of stabilizing and modifying the soil, serving as a pioneer species until other plants become established.
- Several species of willow will grow from cuttings in less favorable soil conditions such as road fills and gullies in bare denuded land. Even in very unfavorable sites willow cuttings will often grow vigorously for a few years before they die out.

Design Criteria

Willows have several different growth forms, from shrubs to large trees. Small- to medium-sized, shrub-type and rhizomatous or creeping-type willows are used for planting channel banks. Upland willow species are found in relatively dry areas and should be used on similar sites. Tree-type willows are selected for the upper bank and floodplain area.

Live stakes can be specified for streambanks with slopes of 3H:1V or flatter. Steeper slopes will require grooving or benching and ECBs that can withstand expected shear stresses. The following table shows recorded shear stress withstood by live staking.

Bank Materials and Shear Stress Limits (Live Stakes)

Bank Material	Shear (lb/ft^2)
Live stakes in riprap (immediately after construction)	2.04
Live stakes in riprap (after 3–4 seasons)	6.12
Coarse gravel and stone cover with live cuttings (immediately after construction)	1.02
Coarse gravel and stone cover with live cuttings (after 3–4 seasons)	5.1
Willow cuttings/willow stakes	2.1

Source: Salix Applied Earthcare - Erosion Draw 5.0

- Live stake harvest and installation should be performed during the dormant season, late fall to early spring.
- Use site reconnaissance to identify willow species, growth form, soil and site conditions on adjacent sites and compare their conditions to the construction site. Planting will be more successful as soil, site and species selected match stable, vegetated nearby sites.
- If native willows are not found in the vicinity, live staking might not be a good option.
- Choose plant material adapted to the site conditions and confirm the availability of plant material that will be used on site before construction begins.

Construction Specifications

Harvesting

- Stakes must be harvested and planted when the willows (or other chosen species) are dormant. This period is generally from late fall to early spring or before the buds start to break.
- When harvesting cuttings, select healthy, live wood that is reasonably straight. Harvest live wood at least one-year-old or older. Avoid suckers of the current year's growth because they lack sufficient stored energy reserves to sprout consistently. The best wood is 2–5 years old with smooth bark that is not deeply furrowed.
- Stakes should be cut so that a terminal bud scar is within 1–4 inches of the top. At least two buds or bud scars must be above the ground after planting.
- Cuttings should generally be three-quarters of an inch in diameter or larger depending on the species, and 2 to 3 feet in length. Highest survival rates are obtained from using cuttings 2–3 inches in diameter. Larger diameter cuttings are needed for planting into rock riprap. Cuttings of small diameter stock (up to 1.5 inches) must be 18 inches long minimum. Thicker cuttings should be longer.
- Make clean cuts with unsplit ends. Trim branches from cutting as close as possible. The butt end (i.e., end closest to the ground) of the cutting must be pointed or angled and the top end (away from the soil) must be cut square, to aid in soil penetration, tamping, and knowing which end is up.
- The top, square cut can be painted and sealed by dipping the top 1–2 inches into a 50-50 mix of light colored latex paint and water. Sealing the top of the stake will reduce the possibility of desiccation and disease, assure the stakes are planted with the top up, and make the stakes more visible for subsequent planting evaluations.

Installation

- Install live stakes only on streambanks that have been graded and prepared for planting. ECB installation is strongly recommended for bank areas below the 2-year peak flow line; ECBs are recommended for upper portions of the bank. Stone toe protection is recommended for the toe of the slope at the waterline.
- Stakes must not be allowed to dry out. The cuttings should be installed the same day they are harvested. If this is not possible, they should be soaked in water for a minimum of 24 hours. Stakes can be stored outdoors for a few days in a cool place under damp straw. For longer storage, refrigerate (do not freeze), keep moist, and use as soon as possible.
- Use an iron stake, bar, or other suitable instrument to make a pilot hole in firm soil. Plant stakes 1–3 feet apart, closer on steeper slopes and on the outside of bends, farther apart on flatter slopes and the inside of bends. No less than one-half of total length must be into the ground. Set the stake as deep as possible into the soil, preferably with 80 percent of its length into the soil and in contact with midsummer water table.
- It is essential to have good contact between the stake and soil for roots to sprout. Tamp the soil around the cutting. Do not damage the buds, strip the bark, or split the stake during installation. Split or damaged stakes must be removed and replaced.
- Stakes must be planted with butt-ends into the ground. Leaf bud scars or emerging buds should always point up.

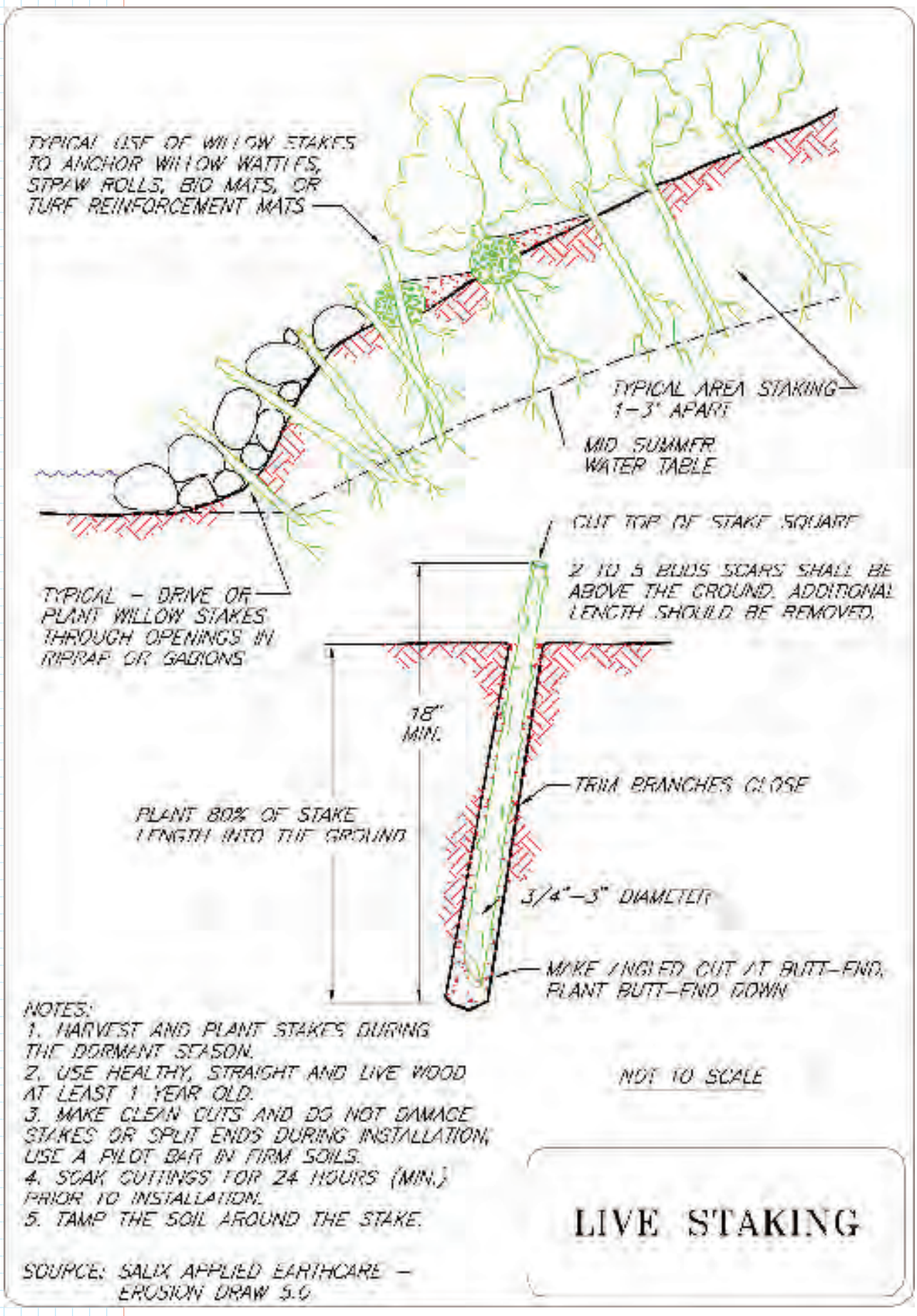
Inspection and Maintenance

- All temporary and permanent erosion and sediment control practices must be maintained and repaired as needed to assure continued performance of their intended function.
- Replace stakes that do not sprout after 45 days if possible, or wait until the following dormant season to harvest and replant.
- Streambanks and steep slopes are highly susceptible to erosion and damage from significant storm events. Willow stakes alone provide very little initial site protection during the establishment period. Use TRMs for temporary protection until stakes are established and to protect any bare areas.
- Periodic inspection repair and maintenance will be required during the first 2 years or until the vegetation is established.

This is a sprouting willow stake. To avoid upside-down installation of stakes, require that the lower ends be cut at an angle, with the upper end cut flat, i.e., perpendicular to stake length.

Willow stakes and other woody vegetation planted along the water's edge provide structural protection for colonization by other species, which promotes stable banks and improves habitat.

Soil wrap stabilization of steep stream bank using geotextile wrapping in 2 ft lifts. Live stakes can be driven into prepared banks using a dibble bar or iron stake to create a guide hole.



NOTES:
1. HARVEST AND PLANT STAKES DURING THE DORMANT SEASON.
2. USE HEALTHY, STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD.
3. MAKE CLEAN CUTS AND DO NOT DAMAGE STAKES OR SPLIT ENDS DURING INSTALLATION. USE A PILOT BAR IN FIRM SOILS.
4. SOAK CUTTINGS FOR 24 HOURS (MIN.) PRIOR TO INSTALLATION.
5. TAMP THE SOIL AROUND THE STAKE.

SOURCE: SALIX APPLIED EARTHCARE - EROSION DRAW 5.0

NOT TO SCALE

LIVE STAKING

4.8.5 Wattles (Live Fascines)

Installation of live fascines along bank area, before backfilling. Fascines provide quick, thick growth to stabilize banks and can be specified where willow or other suitable plant material is plentiful and erosive forces are moderate. Use turf reinforcement mats in areas where bank shear stress exceeds 2 pounds per square foot.

Definition

Wattles or live fascines are long, small-diameter, live branch cuttings, usually willows, bound together into long, cigar-shaped bundles and buried in shallow trenches to help stabilize slopes and streambanks.

Purpose

Thickly vegetated wattle and fascine bundles reduce erosion and stabilize streambank slopes in several ways:

- The wattle bundles, binding rope, and stakes are all structural components that combine to physically stabilize the surface layers of the slopes by resisting hydraulic and gravitational forces.
- Wattle bundles prevent rills and gullies by reducing the effective slope length, which dissipates the energy of water moving downslope. Wattles immediately reduce surface erosion.
- The terraces formed by a series of wattles trap sediment, detritus, and seed. Infiltration is increased as runoff is slowed, and on dry sites, this increases the available water for plant establishment.
- Vegetation establishment is enhanced because wattling provides a suitable microsite for plants by reducing surface erosion, increasing infiltration rates and by forming a series of terraces with shallower slope angles.

Wattling can be used for road fills, road cuts, gullies or slumped areas, eroded slopes or eroding streambanks as follows:

- Repair of small earth slips and slumps or to protect slopes from shallow slides 1–2 feet deep.
- Wattling can be used to stabilize entire cut or fill slopes, step-grades or small benches, or localized gully areas of slopes along water bodies.
- Wattling can be installed during construction (dormant season) or as a remedial action on existing slopes.
- Wattling is useful on slopes requiring other planting materials such as woody vegetation, transplants, grasses, and forbs. Wattling also enhances conditions for natural invasion and the establishment of other plants from the surrounding plant community.

Design Criteria

Wattles can be specified for streambanks with slopes of 3H:1V or flatter. Steeper slopes will require grooving, step-grading, or benching and ECBs that can withstand expected shear stresses. The following chart shows recorded shear stress withstood by willow wattles and fascines.

Bank Materials and Shear Stress Limits (Wattles)

Bank Material	Shear (lb/ft^2)
Wattles (coarse sand between)	0.2
Wattles (gravel between)	0.31
Wattles (parallel or oblique to current)	1
Fascine revetment	1.4
Live fascine (immediately after construction)	1.22
Live fascine (after 3–4 seasons)	1.63
Fascine	2.1

Source: Salix Applied Earthcare - Erosion Draw 5.0

Choose plant material adapted to the site conditions and confirm the availability of plant material that will be used on-site before construction begins.

- The ideal plant materials for wattling are those that (1) root easily; (2) are long, straight and flexible; and (3) are in plentiful supply near the job site. Willow makes ideal wattling material.
- Wattle material harvesting and installation should be performed during the dormant season—late fall to early spring. Use site reconnaissance to identify appropriate willow or other species, growth form, soil and site conditions on adjacent sites, and compare their conditions to the construction site. Planting will be more successful as soil, site and species selected match stable, vegetated nearby sites.
- When choosing live willow material for bioengineering applications, remember that young (less than one year old) wood or suckers will often sprout easier under optimum conditions but healthy, older wood (1 to 4 years old) has greater vegetative (energy) reserves necessary to consistently sprout, and the older wood is much stronger. If possible, mix younger wood with older wood for the bioengineering application so that a majority of the material is 1 to 4 years old.
- Willows have several different growth forms, from shrubs to large trees. Small- to medium-sized shrub-type and rhizomatous or creeping-type willows are used for planting channel banks. Upland willow species are found in relatively dry areas and should be used on similar sites. Tree-type willows are selected for the upper bank and floodplain area.
- Spacing of contour trenches (wattles) is determined by soil type, potential for erosion, and slope steepness. Addition of rock toe slope protection where water surface meets the streambank is often helpful in reducing scour and bank slump. Installation of mulch or ECBs on slopes flatter than 4:1 and TRMs on steeper slopes is highly recommended.

General Installation Guidelines for Wattles

Slope	Slope distance between wattles feet	Recommended maximum slope length feet
1:1 to 1.5:1	3–4	15
1.5:1 to 2:1	4–5	20
2:1 to 2.5:1	5–6	30
2.5:1 to 4:1	6–8	40
3.5:1 to 4:1	8–12	50
4.5:1 to 5:1	10–20	60

Source: Salix Applied Earthcare - Erosion Draw 5.0

Construction Specifications

Wattle Preparation

- Cuttings must be harvested and planted when the willows, or other chosen species, are dormant. This period is generally from late fall to early spring.
- Choose plant materials that are adapted to the site conditions from species that root easily. A portion (up to 50 percent) of the bundle can be of material that does not root easily or dead material.
- The cuttings should be long (3 feet minimum), straight branches up to 1.5 inches in diameter. Trimmings of young suckers and some leafy branches can be included in the bundles to aid filtration. The number of stems varies with the size and kind of plant material.
- Cuttings must be tied together to form bundles, tapered at each end, 6–30 feet in length, depending on site conditions or limitations in handling.
- The completed bundles should be 6–12 inches in diameter, with the growing tips and butt ends oriented in alternating directions.
- Stagger the cuttings in the bundles so that the tips are evenly distributed throughout the length of the wattle bundle.
- Wattle bundles must be compressed and tightly tied with rope or twine of sufficient strength and durability. Polypropylene *tree rope* approximately 3/16 inch diameter provides the necessary strength and durability.
- Wattle bundles must be tied 12–15 inches apart.
- For optimum success, wattles should be pre-soaked for 24 hours or installed on the same day they are harvested and prepared. The wattles should be installed within 2 days after harvest unless pre-soaked. Wattles must be stored in the shade and under cover or under water. They are live material and should be treated as such.

Installation

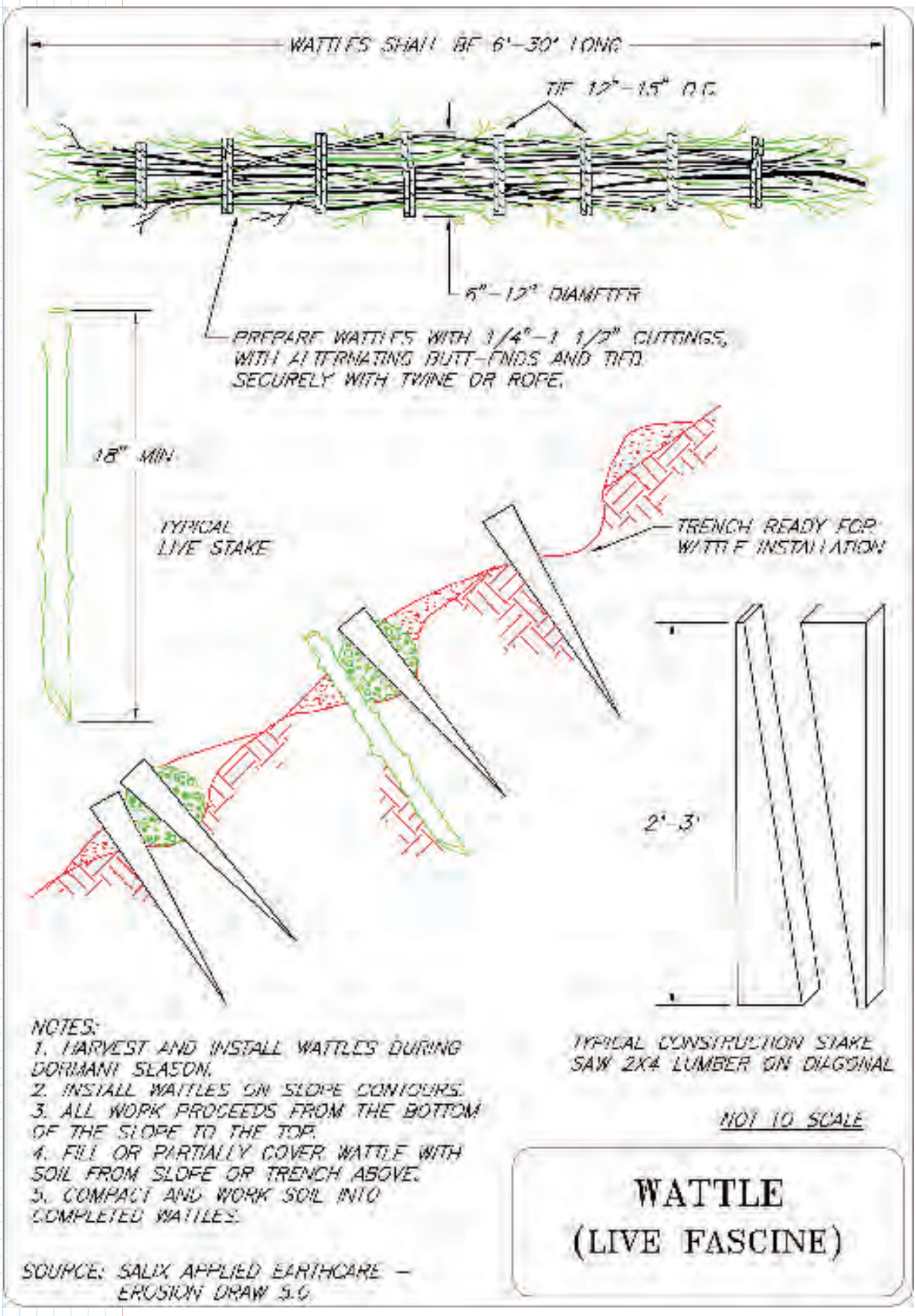
- Work must progress from the bottom to the top of the slope. See the design section for spacing and use of blankets/mats on slopes.
- Perform any slope repairs, such as gully repair, slope scaling, diversion dike, gabion, or toe wall construction, before installing the wattle.

- Beginning at the base of the slope, dig a trench on contour. The trench must be shallow, about one-half the diameter of the wattle. The trench width will vary from 12–18 inches depending on the slope angle.
- Install wattles into trenches dug into the slope on contour. Place the wattles immediately after trenching to reduce desiccation of the soil.
- Wattles must be staked firmly in place with one row of construction stakes on the downhill side of the wattling, not more than 3 feet apart. A second row of stakes must be placed through the wattles, near the ties, at not more than 5 feet apart.
- Overlap the tapered ends of adjacent wattles so the overall wattle thickness of the wattle is uniform. Two stakes must be used at each bundle overlap such that a stake can be driven between the last two ties of each wattle.
- Live stakes, if specified, are generally installed on the downslope side of the bundle. Drive the live stakes below and against the bundle between the previously installed construction stakes.
- Proper backfilling is essential to the successful rooting of the wattles. Backfill wattles with soil from the slope or trench above. The backfill must be worked into the wattle interstices and compacted behind and below the bundle by walking on and working from its wattling terrace.
- Place moist soil along the sides of the live bundle. The top of the bundle should be slightly visible when the installation is completed.
- Repeat the preceding steps for each row, up to the top of the slope.
- Plant the slope with other vegetation (e.g., live stakes, tree seedlings) as specified.
- Seed and mulch slope. Shallow slopes, generally 3:1 or flatter can be seeded and mulched by hand. Steeper slopes should have seed applied hydraulically, and the mulch must be anchored with tackifier or other approved methods if TRMs are not used.

Inspection and Maintenance

- Inspect and maintain the wattle installations regularly, particularly during the first year.
- Repairs must be made promptly. Stakes that loosen because of saturation of the slope or frost action must be reinstalled.
- Rills and gullies around or under wattles must be repaired. Use ECBs or TRMs if necessary to control scouring and gullying.
- Repairs to vegetative practices must be made promptly.
- All temporary and permanent erosion and sediment control practices must be maintained and repaired as needed to assure continued performance of their intended function.

Coconut logs, fiber rolls, and other products can be used in conjuction with wattles to ensure adequate protection while plant material is becoming rooted. Follow manufacturer's installation information.


WATTLES SHALL BE 6'-30' LONG
TIE 12"-15" O.C.
6"-12" DIAMETER
PREPARE WATTLES WITH 1/4"-1 1/2" CUTTINGS, WITH ALTERNATING BUTT-ENDS AND TIED SECURELY WITH TWINE OR ROPE.
18" MIN.
TYPICAL LIVE STAKE
TRENCH READY FOR WATTLE INSTALLATION
2'-3'
NOTES:
1. HARVEST AND INSTALL WATTLES DURING DORMANT SEASON.
2. INSTALL WATTLES ON SLOPE CONTOURS.
3. ALL WORK PROCEEDS FROM THE BOTTOM OF THE SLOPE TO THE TOP.
4. FILL OR PARTIALLY COVER WATTLE WITH SOIL FROM SLOPE OR TRENCH ABOVE.
5. COMPACT AND WORK SOIL INTO COMPLETED WATTLES.
SOURCE: SALIX APPLIED EARTHCARE – EROSION DRAW 5.0
TYPICAL CONSTRUCTION STAKE SAW 2X4 LUMBER ON DIAGONAL
NOT TO SCALE
WATTLE
(LIVE FASCINE)

4.8.6 Brushlayering

Brushlayering is similar to installation practices for live fascines. As in other vegetative practices using woody material, willows are preferred because of their low price, wide availability, and hardiness. Supplement brush layers with TRMs if bank shear stress exceeds 2 lbs per sq ft.

Definition

Brushlayering is the installation of cuttings or branches of easily rooted tree species, which are layered between successive lifts of soil fill to construct a reinforced slope or embankment.

Purpose

This technique is used to stabilize slopes, particularly road fill slopes where construction has or will result in unstable soil conditions. The brushlayer branches, especially after rooting, reinforce slopes by serving as tensile inclusions that provide frictional resistance to sliding or other types of displacement. The protruding brush retards runoff and reduces surface erosion.

Brushlayering is best used concurrently with construction of fill slopes or embankments. Cuttings are placed by hand, while heavy equipment is used to fill and compact each successive lift of soil fill. Brushlayering is similar in principle to other reinforced earth practices except that the reinforcing material is live branches. This practice is also a good remedial action intended to repair gullies or existing slopes. Brushlayering performs several functions for erosion control, earth reinforcement, and slope stability:

- Breaking up the slope length into a series of shorter slopes separated by rows of brush layer
- Reinforcing the soil with the unrooted branch stems
- Reinforcing the soil as roots develop, adding significant resistance to sliding or shear displacement
- Providing slope stability and allowing vegetative cover to become established
- Trapping debris on the slope
- Aiding infiltration on dry sites and drying excessively wet sites
- Adjusting the site's microclimate, thus aiding seed germination and natural regeneration
- Redirecting and mitigating adverse slope seepage by acting as horizontal drains

Design Criteria

Brushlayering is specified where significant streambank grading work or new streambank construction occurs. Live branch cuttings are oriented perpendicularly to the slope contour (i.e., up and down the hill), placed in a series of stair-step trenches on the slope, and covered with soil. The following chart shows recorded shear stress withstood by brushlayering.

Brush Materials and Shear Stress Limits (Brush Layers)

Brush Material	Shear (lb/ft^2)
Willow brushlayer (immediately after construction)	0.41
Willow brushlayer (after 3–4 seasons)	2.86
Willow cuttings/willow stakes	2.1

Source: Salix Applied Earthcare - Erosion Draw 5.0

- Plant material harvest and installation should be performed during the dormant season, late fall to early spring.
- Use site reconnaissance to identify willow or other species, growth form, soil and site conditions on adjacent sites and compare their conditions to the construction site. Planting will be more successful as the soil, site conditions and species selected match stable and vegetated nearby sites.
- The ideal plant materials are those that (1) root easily; (2) are long, straight and flexible; and (3) are in plentiful supply near the job site. Willow makes ideal material.
- Choose plant material adapted to the site conditions and confirm the availability of plant material that will be used on site before construction begins.
- When choosing live willow material for bioengineering applications, remember that young (less than one year old) wood or suckers will often sprout easier under optimum conditions but healthy, older wood (1 to 4 years old) has greater vegetative (energy) reserves necessary to consistently sprout, and the older wood is much stronger. If possible, mix younger wood with older wood for the bioengineering application so that a majority of the material is 1 to 4 years old.
- Willows have several different growth forms—from shrubs to large trees. Small- to medium-sized shrub-type and rhizomatous or creeping-type willows are used for planting channel banks. Upland willow species are found in relatively dry areas and should be used on similar sites. Tree-type willows are selected for the upper bank and floodplain area.
- If branch cuttings are not pre-soaked for at least 24 hours, then they must be harvested no earlier than 48 hours before installation. Cuttings must be kept moist and cool at all times between cutting and installation. All cuttings need to be thoroughly wet and covered with moistened wrapping before being transported.
- Construction personnel must be made aware that brushlayering uses live plant material and must be treated as such.
- Spacing between the brushlayers is determined by the erosion potential of the slope (i.e., soil type, rainfall, and length and steepness of the slope). Spacing can be from 3 to 8 feet. On long slopes, brushlayer spacing should be closer at the bottom and spacing can increase near the top of the slope.

- Slopes flatter than 4H:1V can be layered, seeded, and protected with mulch or ECBs. Steeper slopes will require turf reinforcement mats below the 2-year peak flow line. Steep slopes (1H:1V) should not exceed approximately 30 feet in slope length. Reinforced earth design guidelines suggest that the slope height should not exceed three times the width of the reinforced volume. Therefore, for brushlayering with 6–8 foot long cuttings, the slope height should not exceed 18–24 feet.
- Stabilization of slopes on the outside bends of streams will likely require vegetative, structural, or other armoring in addition to brushlayering, to handle the higher-flow velocities and sheer stresses encountered.

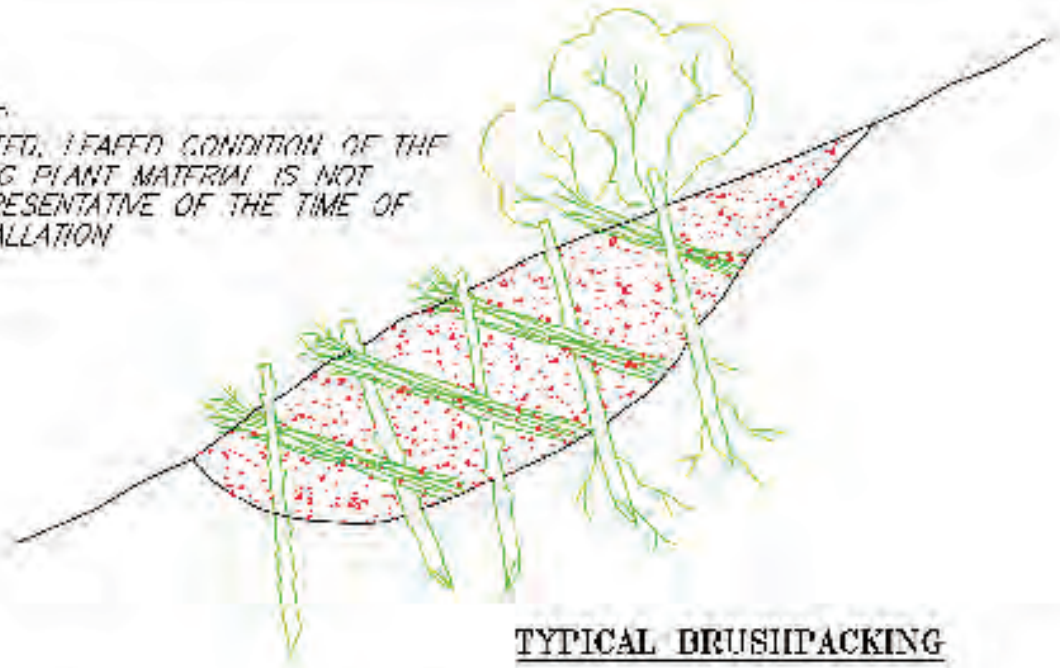
Construction Specifications

Cuttings must be harvested and planted when the willows, or other chosen species, are dormant. This period is generally from late fall to early spring. Choose plant materials that are adapted to the site conditions from species that root easily.

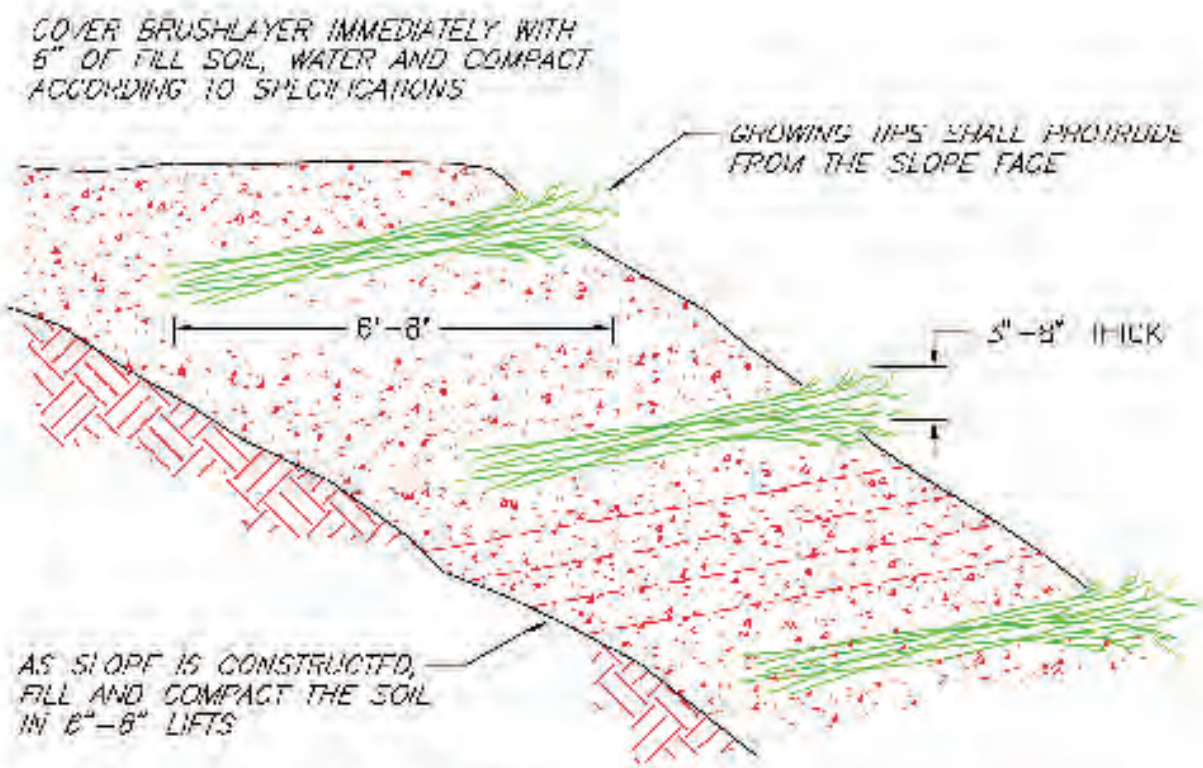
- Branch cuttings must be 4–8 feet long, 3/4–2 inches diameter. Presoak cuttings for a minimum of 24 hours before installing.
- Complete grading and other work on streambank slopes. Install rock or other toe protection if specified in construction plans. Prepare first (lowest elevation) bench, removing soil or using it to backfill toe protection zone. The surface of the bench must be sloped so the outside (near stream) edge is higher than the inside (bank) edge, so that the butt ends of the cuttings angle down slightly into the slope.
- Place branch cuttings, 3–8 inches thick, in a crisscross or over lapping configuration. The growing tips must protrude 6–12 inches from the slope face with the butt end dipping into the slope.
- Immediately cover brushlayer with 6 inches of fill soil and compact according to construction specifications. For ease of installation, use soil excavated from the bench immediately upslope to cover cuttings placed in the lower bench excavations. Water the soil cover immediately to wet the cuttings and achieve adequate compaction.
- Earth moving equipment must not travel directly over the cuttings. Six inches of soil must be maintained between the brushlayer and equipment at all times.
- Fill and compact the soil placed above the brushlayer in successive lifts, maximum 6–8 inches deep. Install the next brushlayer 3-8 feet above the previous row.
- Seed and mulch the slope, or install erosion control blanket or turf reinforcement mat as needed. Shallow slopes, generally 3:1 or flatter might be seeded and mulched by hand. Steeper slopes should have seed applied hydraulically, and the mulch must be anchored with tackifier or other approved methods of TRMs are not used.

Inspection and Maintenance

Regularly inspect and maintain bioengineering installations, particularly during the first year. To prevent major problems from developing, promptly correct any failures.



TYPICAL BRUSHPACKING



TYPICAL BRUSHLAYERING
WITH SLOPE CONSTRUCTION

SOURCE: SALIX APPLIED EARTHCARE -
EROSION DRAW 6.0

BRUSHLAYERING

4.9 Good Housekeeping and Other Runoff Controls

Good housekeeping practices are not typically entered on site maps or drawings but are described in the Stormwater Pollution Prevention Plan and standard notes. These practices are included as part of the construction operations and management process. Good housekeeping practices include plans, procedures, and activities designed to prevent or minimize the use or exposure of materials that could become pollutants.

Good housekeeping practices seek to reduce or eliminate pollutants being added to construction site runoff through analysis of pollutant sources, implementing proper handling and disposal practices, employee education, and other actions.

In general, good housekeeping focuses on keeping the work site clean and orderly, storing materials under roof or tarps whenever possible, and handling materials and wastes in manner that minimizes risk and potential pollutant runoff. A variety of good housekeeping practices have been developed to reduce or eliminate runoff pollutants. These practices—along with relevant application information—are summarized in the following sections.

Good housekeeping includes management of solid and sanitary wastes, hazardous materials, and other construction site materials that could contaminate runoff. Staff should be familiar with basic procedures for storing and managing site materials and how to respond in the event of a spill or other event that might threaten water resources.

These show poor housekeeping practices. Sloppy material storage and waste disposal practices are often indicative of inadequate stormwater management throughout the construction site. Inspectors often target sites like these for more detailed inspections.

4.9.1 Material Delivery, Storage, and Use

A wide variety of construction site materials—such as soil amendments, fertilizers, paint, and fuels—can contaminate stormwater runoff if not stored properly. In general, storing materials under roof or covering with a secure tarp provides good protection against polluting construction site runoff. Job site supervisors should check for leaching or spreading of contaminants from fuel storage areas, landscaping stockpiles, and other places where potentially hazardous materials are stored.

Definition

This is the practice of receiving, processing, storing, and using materials in a manner that minimizes the risk of spills and pollution of stormwater runoff.

Purpose

The purpose of material delivery, storage, and use is to prevent the material from being spilled or otherwise coming into contact with runoff.

Implementation

- Designate specific areas of the construction site for material delivery and storage
- Place material storage areas near the construction entrance and away from waterways and storm drain inlets
- Where possible, place materials designated for outside storage in locations that will be paved
- Install containment berms or rock check dams between stored materials (e.g., topsoil, fertilizer) and the site drainage system
- Minimize on-site storage of materials and schedule delivery of material for when it will be needed
- Minimize hazardous materials stored on-site
- Store hazardous or toxic materials in a covered area or indoors if possible
- Provide secondary storage for materials
- Keep materials in original containers and labeled
- Keep containers tightly sealed after use
- Train employees and subcontractors

Keep hazardous materials under cover and over collection pans to prevent problems.

Inspection and Maintenance

- Inspect material storage area weekly and after each rainfall greater than one-half inch
- Inspect material storage areas for cleanliness, spills, and leaks
- Clean up spills promptly; keep spill kits nearby

4.9.2 Spill Prevention and Control

Spill prevention and control measures require planning and monitoring to ensure that problems are minimized. Locate storage and handling areas for hazardous liquids away from waterways and culvert inlets. Clean up spills immediately, and report large spills to the KYDOW and Division of Waste Management.

Definition

Spill prevention and control are procedures that establish spill response and control actions by anticipating when and how spills might occur and instituting defined actions to contain and clean it up.

Purpose

Leaks and spills can significantly pollute runoff from a construction site. Prepare for potential spills by reducing the chance for spills to occur, stopping the source of spills, containing and cleaning up spills, properly disposing of spill material, and training employees. Planning and prevention can minimize spills at a construction site. Trained employees with the proper spill response equipment can also prevent spills from polluting runoff.

Implementation

- Store materials away from waterways and storm drain inlets.
- Store hazardous or toxic materials indoors if possible, or in other areas safe from vehicular traffic, vandals, and equipment movement.
- Place a stockpile of spill cleanup materials where it can be easily accessed.
- Train employees and subcontractors on the need to prevent spills.
- Train employees on spill prevention and response.
- Fix leaks and clean up spills immediately.
- Use dry methods to clean up spills—never hose down or bury spill materials.
- Dispose of absorbent material properly. For small quantities, place in double plastic bagging and discard with solid waste. For larger quantities, refer to material safety data sheets and KY Division of Waste Management (**502.564.6716** or **www.waste.ky.gov**) disposal requirements.
- For major spills or spills that enter a waterway or storm drain inlet, report the spill to the Kentucky Division of Water (**502.564.2380**). See list below for regional office phone numbers.

Emergency Numbers for Spills that Enter Waterways or Storm Drains

Location	Phone Number
Statewide	(800) 928-2380
Bowling Green	(270) 746-7475
Columbia	(270) 384-4734
Florence	(859) 525-4923
Frankfort	(502) 564-3358
Hazard	(606) 435-6022
London	(606) 330-2080
Louisville	(502) 429-7120
Madisonville	(270) 824-7529
Morehead	(606) 784-6634
Paducah	(270) 898-8468

Construction sites and other facilities that have aboveground storage capacity in excess of 1,320 gallons for petroleum products are required to comply with federal regulations posted at 40 CFR Part 112, which mandates the preparation and implementation of a Spill Prevention, Control, and Countermeasure (SPCC) Plan. The purpose of the SPCC Plan is to establish procedures, methods, and equipment to prevent or mitigate the discharge of oil from nontransportation-related onshore and offshore facilities into or upon the navigable waters of the United States. SPCC Plans must be prepared in accordance with sound engineering practices. The Kentucky Transportation Cabinet has a template for developing a SPCC Plan, posted at **www.kytc.state.ky.us/EnvAnalysis/Stormwaterquality/PDF/Appendix_1-6.pdf**.

Keep spill absorbants, containment dams, and other spill response materials close to the location of possible spills. Make sure employees know how to contain and report spills.

4.9.3 Vehicle and Equipment Maintenance

Service vehicles and equipment in locations where spills can be contained and cleaned up easily. Use sand, absorbants, and containment berming when changing oil or servicing hydraulic cylinders and lines. Clean up spills quickly and dispose of residue properly.

Definition

Vehicle and equipment maintenance are policies and procedures that specify how and where vehicles and equipment will be cleaned, fueled, and maintained in a manner that minimizes risks for spills and runoff of pollutants.

Purpose

Vehicle and equipment cleaning, fueling, and maintenance should ideally be conducted at an off-site facility. When cleaning, fueling, or maintenance must be conducted at the construction site, properly trained employees should do it in designated areas. Practices to properly clean, fuel, and maintain vehicles and equipment will help prevent and minimize spills from these activities. This practice will also minimize the exposure of oil and grease, hydrocarbons, and other pollutants in runoff from the construction site.

Implementation

- Use off-site repair and fueling shops as much as possible.
- If storing fuel on-site, specify double-containment systems and site fuel tanks on upland areas well away from stormwater drainage ditches, inlets, and streams.
- Use off-site facilities to wash vehicles and equipment as much as possible.
- If maintenance or fueling must occur on-site, designate an area away from waterways and storm drain inlets.
- Do not store batteries, oil, or other materials where they could be exposed to runoff.
- Use drip pans or absorbents under leaking vehicles or equipment.
- Properly dispose of used oil, lubricants, and grease.
- When washing vehicles or equipment, locate washing away from waterways or storm drain inlets, use phosphate-free, biodegradable soaps, and minimize the amount of water used.
- When fueling on-site, minimize mobile fueling; instead, designate a fueling location and bring vehicles and equipment to the designated fueling location.
- Protect on-site cleaning, fueling, and maintenance areas with berms or dikes.
- Train employees and subcontractors.
- Inspect vehicles and equipment daily for leaks. Check fueling area for any leaks or spills, and ensure that spill cleanup kits are available and fully stocked.

4.9.4 Debris and Trash Management

Use open containers for solid wastes with no potential for leaching contaminants, such as wood waste, packaging, and other inert material. For wastes with high leaching potential (e.g., paint containers, powders, granular material), use only covered containers and keep the lid closed.

Definition

Debris and trash management practices are policies and procedures designed to minimize the generation of waste and to handle and dispose of waste in a manner that minimizes risks to surface waters.

Purpose

Large volumes of debris and trash are often generated at construction sites including packaging, pallets, wood waste, concrete waste, soil, electrical wiring, cuttings, and a variety of other materials. There are several techniques and procedures to minimize the potential of stormwater contamination from solid waste through appropriate storage and disposal practices. Recycling construction debris also reduces the volume of material to be disposed of and the associated costs. Debris and trash management should be a part of all construction practices. By limiting the trash and debris on-site, stormwater quality is improved along with reduced cleanup requirements at the completion of the project.

Implementation

Solid waste management for construction sites is based on proper storage and disposal practices by construction workers and supervisors. Key elements of the program are education and modification of improper disposal habits. Supervisors and workers must cooperate and be vigilant to ensure that the recommendations and procedures are followed. Following are lists describing the targeted materials and recommended procedures.

Construction (and Demolition) Debris

- Dimensional lumber
- Miscellaneous wood (e.g., pallets, plywood)
- Copper (pipe and electrical wiring)
- Miscellaneous metal (e.g., studs, pipe, conduit, sheathing, nails)
- Insulation
- Concrete, brick, and mortar
- Shingles
- Roofing materials
- Gypsum board

Trash

- Paper and cardboard (packaging, containers, wrappers)
- Plastic (packaging, bottles, containers)
- Styrofoam (cups, packing, and forms)
- Food and beverage containers
- Food waste

Storage Procedures

- Stress to employees the importance of keeping the work site clean.
- Wherever possible, minimize production of debris and trash.
- Designate a foreman or supervisor to oversee and enforce proper debris and trash procedures.
- Instruct construction workers in proper debris and trash storage and handling procedures.
- Segregate potentially hazardous waste from nonhazardous construction site debris.
- Segregate recyclable construction debris from other nonrecyclable materials.
- Keep debris and trash under cover either in a closed dumpster or other enclosed trash container that limits contact with rain and runoff and prevents light materials from blowing out.
- Store waste materials away from drainage ditches, swales, and catch basins.
- Do not allow trash containers to overflow.
- Do not allow waste materials to accumulate on the ground.
- Prohibit littering by workers and visitors.
- Police the site daily for litter and debris.
- Enforce solid waste handling and storage procedures.

Disposal Procedures

- If feasible, recycle construction and demolition debris such as wood, metal, and concrete.
- General construction debris may be hauled to a licensed construction debris landfill (typically less expensive than a sanitary landfill).
- Use waste and recycling haulers or facilities approved by the local jurisdiction.

Education

- Educate all workers on solid waste storage and disposal procedures.
- Instruct workers in identification of solid waste and hazardous waste.
- Have regular meetings to discuss and reinforce disposal procedures (incorporate in regular safety seminars).
- Clearly mark on all debris and trash containers which materials are acceptable.

Quality Control

- The foreman or construction supervisor should monitor on-site solid waste storage and disposal procedures.
- Discipline workers who repeatedly violate procedures.

Performance Indicators

- No contaminated runoff from waste containers entering stormwater system.
- Jobsite waste handling and disposal education and awareness program.
- Compliance by workers with policies and procedures.
- Sufficient and appropriate waste storage containers.
- Timely removal of stored solid waste materials.
- Training workers and monitoring compliance.

Here is an example of poor waste management. Construction contractors should provide appropriate waste disposal containers, and employees should be instructed to use them.

Sites like this one are often the subject of public complaints to state and local planning and regulatory agencies. Good housekeeping practices keep complaints down, inspectors happy, and water clean.

Polluted runoff from construction sites can result in fines up to $27,500 per day per violation. Stop work orders can cause construction delays of days, weeks, or even months.

4.9.5 Hazardous Waste Management

Hazardous materials—such as paint, fuel, oil, fertilizers, and such—should be managed to prevent spills or runoff into storm drains and waterways.

Definition

Hazardous waste management practices are policies and procedures that address the problem of stormwater polluted with hazardous or chemical pollutants through spills or other forms of contact.

Purpose

The objective of hazardous materials management is to minimize the potential of stormwater contamination from construction chemicals through appropriate recognition, handling, storage, and disposal practices. Chemical management is not intended to supersede or replace normal site assessment and remediation procedures. Significant spills or contamination warrant immediate response by trained professionals. Suspected job-site contamination should be immediately reported to regulatory authorities and protective actions taken. These management practices, along with applicable Occupational Safety and Health Administration (OSHA) and EPA guidelines, should be incorporated at all construction sites that use or generate hazardous wastes. Many chemicals such as fuel, oil, grease, fertilizer, and pesticide are present at most construction sites.

Implementation

The chemical management techniques presented here are based on proper recognition, handling, and disposal practices by construction workers and supervisors. Key elements are education and proper disposal practices, as well as provisions for safe storage and disposal. Following are lists describing the targeted materials and recommended procedures.

Targeted Chemical Materials

- Paints
- Solvents
- Stains
- Wood preservatives
- Cutting oils
- Greases
- Roofing tar
- Pesticides, herbicides, and fertilizer
- Fuels and lube oils
- Antifreeze

Storage Procedures

- Wherever possible, minimize the use of hazardous materials.
- Minimize generation of hazardous wastes on the jobsite.
- Segregate potentially hazardous waste from nonhazardous construction site debris.
- Designate a foreman or supervisor to oversee hazardous materials handling procedures.
- Keep chemicals in appropriate containers (closed drums or similar) and under cover.
- Store chemicals away from drainage ditches, swales, and catch basins.
- Use containment berms in fueling and maintenance areas and where the potential for spills is high.

Waste Handling

- Minimize water usage during paint wash-up. Dispose of paint wash water with other liquid wastes, spread on graveled sites prepared for new concrete pouring, or areas being prepared for paving. Do not dispose of wash water in ditches or stormwater inlets.
- Retain and use all products such as paint, thinners, and so on until supplies are depleted. Do not dispose of liquid wastes on pavement or near ditches or stormwater inlets.
- Allow paint rollers, drop cloths, cans, and other wastes to dry thoroughly, then discard in solid waste containers.
- Recycle or dispose of all liquid wastes in accordance with material safety data sheets.
- Ensure that adequate hazardous waste storage volume is available.
- Ensure that hazardous waste collection containers are conveniently located.
- Do not allow potentially hazardous waste materials to accumulate.
- Enforce hazardous waste handling and disposal procedures.
- Clearly mark on all hazardous waste containers which materials are acceptable for the container.

Disposal Procedures

- Ensure that adequate cleanup and containment materials are available on-site.
- Regularly schedule hazardous waste removal to minimize on-site storage.
- Use only licensed hazardous waste haulers.

Education

- Instruct workers on safety procedures for construction site chemical storage.
- Instruct workers in identification of chemical pollutants.
- Ensure that workers are trained in procedures for spill prevention and response.
- Educate workers of potential dangers to humans and the environment from chemical pollutants.
- Educate all workers on chemical storage and disposal procedures.
- Have regular meetings to discuss and reinforce identification, handling, and disposal procedures (incorporate in regular safety seminars).
- Establish a continuing education program to train new employees.

Quality Assurance

- The foreman or construction supervisor must monitor on-site chemical storage and disposal procedures.

- Educate and, if necessary, discipline workers who violate procedures.
- Ensure that the hazardous waste disposal contractor is reputable and licensed.

Performance Indicators

- Jobsite chemical and hazardous waste handling and disposal education and awareness program.
- Commitment by management to implement chemical storage and hazardous waste management practices.
- Compliance by workers.
- Sufficient and appropriate chemical and hazardous waste storage containers.
- Timely removal of stored hazardous waste materials.

Store hazardous liquids like fuel, oil, and paint under roof and over spill pans. Keep spill cleanup supplies handy, and train staff in how to prevent and respond to spills.

Hazardous waste management involves caution, care, and common sense. This temporary fuel tank is sited on an unpaved area away from the drainage system. Note that rainwater has accumulated in the secondary containment box--clean stormwater should be drained regularly to ensure adequate volume in the event of a leak or overflow. Fill tanks in high-risk areas two-thirds full to avoid overfilling and spills.

4.9.6 Concrete Waste Management

Concrete washout structures or areas should be designated and used to prevent discharge of highly alkaline wash water to the storm sewer or surface streams. Use bermed areas created with hay bales, earthen dikes, or other material—do not dispose of concrete wastes in excavated holes in areas with high groundwater tables. The best place to discharge excess concrete and concrete wash water is into formed-up areas that have been prepared for the next pour. Make sure no material flows out of the concrete forms.

Definition

Concrete waste management is a set of policies and procedures that address the handling and disposal of (1) excess fresh concrete mix, including truck and equipment washing, and (2) concrete dust and concrete debris resulting from demolition.

Purpose

Concrete waste and wash water from trucks are present at most construction sites. Both forms of concrete waste have the potential to impact water quality through stormwater runoff contact with the waste. The purpose of good housekeeping practices associated with managing these wastes is to prevent stormwater contamination and impacts to receiving waters downstream.

Implementation

A number of water quality parameters can be affected by introduction of concrete, especially fresh concrete. Concrete contains hexavalent chromium and affects the pH of runoff, causing significant chemical changes in water bodies and harming aquatic life. Suspended solids in the form of both cement and aggregate dust are also generated from both fresh and demolished concrete waste.

Unacceptable Concrete and Wash Water Disposal Practices

- Dumping in unmanaged vacant areas on the job site.
- Illicit dumping away from the job site.
- Dumping into ditches, storm drains, or drainage facilities.
- Dumping wash water from trucks and chutes into storm drains

Recommended Disposal Practices

- Prevent runoff of wash water and concrete waste into storm drains, ditches, and waterways.
- If possible, dump waste and wash water into areas prepared for new concrete pouring.
- If no future pour site is available, develop other safe concrete disposal areas.
- Provide a washout area with a minimum of 6 cubic feet of containment area volume for every 10 cubic yards of concrete poured.
- Never dump waste concrete illicitly or without the property owner's knowledge and consent.
- Wash water must be handled in a manner that does not result in a violation of groundwater or surface water quality standards.

Education

- Drivers and equipment operators should be instructed on proper disposal and equipment washing practices (see above).
- Supervisors must be made aware of the potential environmental consequences of improperly handled concrete waste.

Enforcement

- The construction site manager or foreman must ensure that employees and pre-mix companies follow proper procedures for concrete disposal and equipment washing.
- Employees violating disposal or equipment cleaning directives must be reeducated or disciplined if necessary.

Demolition Practices

- Monitor weather and wind direction to ensure that concrete dust is not entering drainage structures and surface waters.
- Where appropriate, construct sediment traps or other types of sediment detention devices downstream of demolition activities.

Performance Indicators

- Use predetermined disposal sites for waste concrete.
- Prohibit dumping waste concrete anywhere but predetermined areas.
- Assign predetermined truck and equipment washing areas.
- Educate drivers and operators on proper disposal and equipment cleaning procedures.

This is a commercial concrete washout tank with fold-up ramp.

Shown here is a straw bale and plastic concrete washout structure. Place concrete washouts in convenient locations, make sure mixing truck drivers know where they are, and make sure they use them.

4.9.7 Sanitary Facilities

Provide sanitary waste facilities for construction site workers in convenient locations and have them serviced regularly. Do not site them near storm drain inlets.

Definition

Sanitary facilities practices provide facilities for collection and disposal of sanitary waste and ensure that they are properly managed to minimize the potential contamination of surface water with septic wastes. Location of portable facilities away from storm drain systems and surface waters or containment is necessary in case of spills.

Purpose

The purpose of this good housekeeping BMP is to prevent the contamination of stormwater with human waste and to provide for proper public health protection and employee safety.

Implementation

- Sanitary facilities must be provided on the site in close proximity to areas where people are working.
- Portable toilets must be provided if no permanent facilities are available.
- Locate portable toilets a minimum of 20 feet away from storm drain inlets, conveyance channels, or surface waters.
- If unable to meet the 20-foot distance requirement, provide containment for portable toilets.
- Portable toilets should be regularly serviced.

Relocate sanitary facilities as needed when the active work area changes. Make sure facilities are well away from vehicle and equipment traffic.

4.9.8 Employee Training

All employees should receive regular training and frequent updates on good housekeeping plans and practices. Murphy's Law postulates that the employee with the most training will be the farthest away when a spill or accident happens, so make sure your least-trained employee is ready to act!

Definition

Employee training includes workshops, meetings, and other structured interaction among managers and employees to distribute and discuss information regarding the control of erosion and the runoff of sediment or other pollutants from the construction site.

Purpose

Employee training ensures that both employees and subcontractors are aware of and follow appropriate practices to prevent polluted runoff from leaving construction sites. Education should be provided on basic requirements, water quality impacts, BMPs, and inspection or maintenance procedures at construction sites.

Implementation

- Use this *Kentucky BMP Planning and Technical Specifications Manual* as the training workbook
- Train both employees and subcontractors
- Integrate erosion and sediment control training with spill response training, safety training, or other training where appropriate.
- Reinforce training with frequent refreshers
- Consider posting information on BMPs for employees to read
- Consider sending employees to erosion and sediment control training courses

Training in the classroom and in the field are both necessary to keep employees up to date on how to control erosion, sediment, spills, and other pollutant runoff. Ask your workers frequently if they know what to do—and why—regarding stormwater management on the job site.

4.9.9 Groundwater Protection

Sampling runoff from construction and other sites is sometimes conducted to determine whether pollutants in the runoff can contaminate groundwater or surface water.

Groundwater protection is important throughout Kentucky because of the high numbers of residents depending on underground water supplies for drinking water. Groundwater protection plans are required for certain activities, such as storing and handling bulk quantities of fertilizers and pesticides, or applying fertilizers or pesticides for commercial purposes.

Definition

Construction site development often involves the storage or use of products that can contaminate groundwater. Groundwater Protection Plans (GPPs) are required for any operation that applies pesticides or fertilizers for commercial purposes, applies pesticides or fertilizers to maintain public rights-of-way, or stores or handles bulk quantities (i.e., 55 gallons or 100 lbs) of pesticides or fertilizers for commercial purposes.

Purpose

Groundwater protection measures are essential for ensuring that the storage, handling, or use of pesticides, fertilizers, or other hazardous products does not contaminate groundwater. These measures are particularly important when materials are transported, handled, or stored in areas with karst features (e.g., sinkholes, disappearing streams).

Implementation

The storage, handling, and use of pesticides or fertilizers at construction sites must be conducted in accordance with a GPP. For small construction sites, this can be accomplished under a Generic GPP, which is a GPP that can be applied to similar activities conducted at different locations. A template for preparing GPPs can be found on the KYDOW Web pages at **http://water.ky.gov/gw/gwprotection/gwplans**. The KYTC has a template for developing a GPP posted at **www.kytc.state.ky.us/EnvAnalysis/Stormwaterquality/PDF/Appendix_1-6.pdf**.

GPPs are documents that describe and establish a series of practices designed to prevent groundwater pollution. In general, GPPs should be in place before beginning to store, handle, or use pesticides, fertilizers, or other products that could contaminate groundwater. The plans should contain the following:

- General information regarding the facility and its operation, including the name of the facility, the address of the facility, and the name of the person responsible for implementing the plan.
- Identification of all pesticide and fertilizer storage, handling, and application activities.
- Identification of all practices chosen to protect groundwater from pollution, such as storing products indoors, under a roof, or other protected place (see the Material Delivery, Storage, and Use fact sheet in this section); following manufacturer's directions for handling and applying products, reporting of spills, and so on.

- An implementation schedule for the practices selected for the plan.
- A description of and implementation schedule for employee training necessary to ensure implementation of the plan (see the Employee Training fact sheet in this section).
- An inspection schedule requiring regular inspections as needed to ensure that all practices established are in place and properly functioning.
- A certification by the person responsible for implementing the plan or a duly authorized representative that the plan complies with the requirements of Kentucky laws and regulations, and that the person responsible for implementing the plan has reviewed the terms of the plan and will implement its provisions.

More information on Groundwater Protection Plans can be found on the Internet at **www.lrc.state.ky.us/kar/401/005/037.htm**. The groundwater protection practices chosen for a GPP can include but are not limited to equipment design, operational procedures, preventive maintenance techniques, construction techniques, personnel training, spill response capabilities, alternative materials or processes, implementation of new technology, modification of facility or equipment, spill prevention control and countermeasure plans, hazardous waste contingency plans, runoff or infiltration control systems, and siting considerations.

The nature of the pollutant and the hydrogeologic characteristics at or near the location of the activity must be considered in selecting practices to protect groundwater for the activities identified in the plan. At a minimum, the plan must require that

- Loading and unloading areas have spill prevention and control procedures and operation procedures designed to prevent groundwater pollution. Spill containment and cleanup equipment must be readily accessible.
- Any person using existing floor drains must evaluate those floor drains to determine if they discharge to an on-site sewage disposal system, to a closed-loop collection or recovery system, or to a waste treatment system permitted under the KPDES.

If drains are identified that do not discharge to an on-site sewage disposal system, a closed-loop collection or recovery system, or a waste treatment system permitted under the KPDES, that person must terminate the discharge or connect it to an on-site sewage disposal system, a closed-loop collection or recovery system, or a waste treatment system permitted under the KPDES. No person may install a floor drain unless it is connected to an on-site sewage disposal system, closed-loop collection or recovery system, or a waste treatment system permitted under the KPDES.

- Any person using a tank or sump must prepare and implement good housekeeping practices, operating procedures, operator training, and spill response procedures. In addition, any person using a tank or sump must consider leak control devices, secondary containment, integrity testing, mechanical inspections, and overfill protection devices. Additional containment is not required for sumps and tanks that are used solely to provide secondary containment.
- Any person who constructs a new surface impoundment, lagoon, pit, or ditch that will contain a pollutant must evaluate the site's hydrogeology and must design and operate it to minimize discharges to soil. However, soils may be used to construct liners under appropriate conditions. All necessary and appropriate measures must be taken to prevent groundwater pollution. The person must consider the use of liners, secondary containment, leak detection devices, and other appropriate and effective control systems. Additional containment is not required for new surface impoundments, lagoons, pits, and ditches that are used solely to provide secondary containment.

Appendix A

Example Stormwater Pollution Prevention Plan for a Construction Project in Kentucky

CONSTRUCTION SITE STORMWATER POLLUTION PREVENTION PLAN

This Stormwater Pollution Prevention Plan (SWPPP) narrative and the attached plan sheets address requirements of the Kentucky Division of Water's KPDES KYR10 permit.

Plan Preparer: Paul E. Planpreparer, P.E. 859.111.1121, pplanpreparer@planengineers.com

Date: January 1, 20XX

1. CONTACT INFORMATION AND SITE DESCRIPTION

Project Name and Location
Starshader Apartments
21 Broadview Avenue
Olympia Springs, KY 40000

Site Owner Name and Contact Information
Joe Pine, President
Pine Grove Development LLC
11 Main Street
Salt Lick KY 40000
606.111.1112
Joe.Pine@pinegrove.com

Construction Site SWPPP Manager and Contact Information
Mark Smith, General Contractor
DBA Smith Homebuilders
10 Main Street
Owingsville, KY 40360
859.111.1111
MSmith@Smithhomebuilders.com

Project Start and End Dates
Start: January 1, 20XX
End: December 31, 20XX

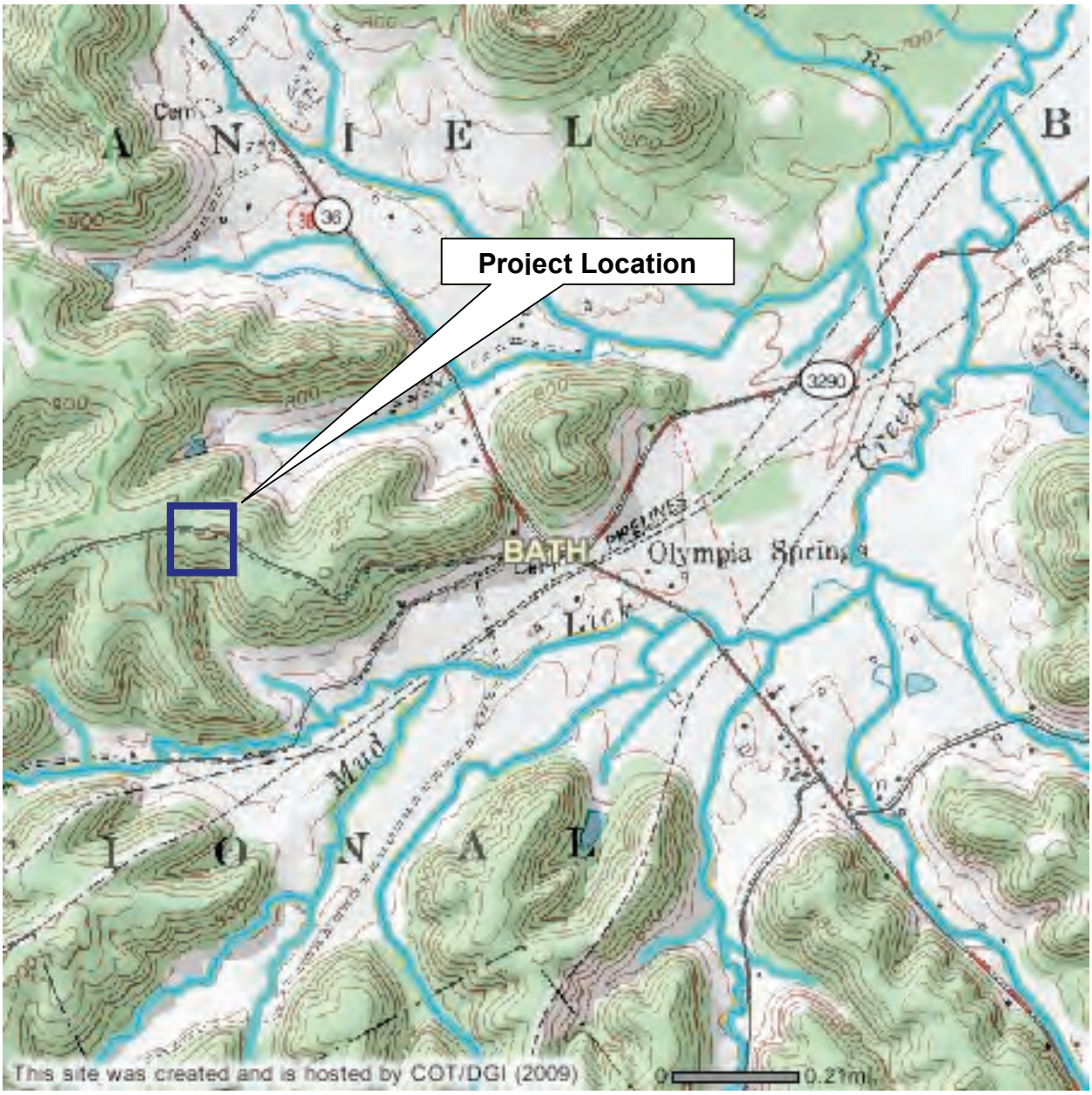
Description – Existing Site Conditions, Purpose, and Types of Soil Disturbing Activities
The site is near Olympia Springs in Bath County, KY. The existing site is grassed pasture with rolling slopes <5%, some cedars, and no mature trees in the area to be developed. Soils are sandy loam with good drainage. No streams are on the property. Rocky Creek is about 450 ft downgrade. It is not an impaired water body according to the Kentucky Division of Water. No threatened or endangered species or historical sites were found on the property. This project will consist of three low-rise, attached apartment buildings with adjacent parking facilities. Soil disturbing activities will include: installing a stabilized construction entrance, installing downgradient silt fencing, initial clearing and grubbing, installation of other erosion and sediment controls, general grading, excavation for the sediment pond, storm sewer, utilities, and building foundations; construction of roadside drainage swales, roads, and parking areas; and preparation for final seeding and landscaping.

Site Area and Disturbed Acreage
The site is approximately 11.0 acres, of which 9.8 acres will be disturbed by construction activities. No offsite borrow, fill, or cleared areas are associated with this project.

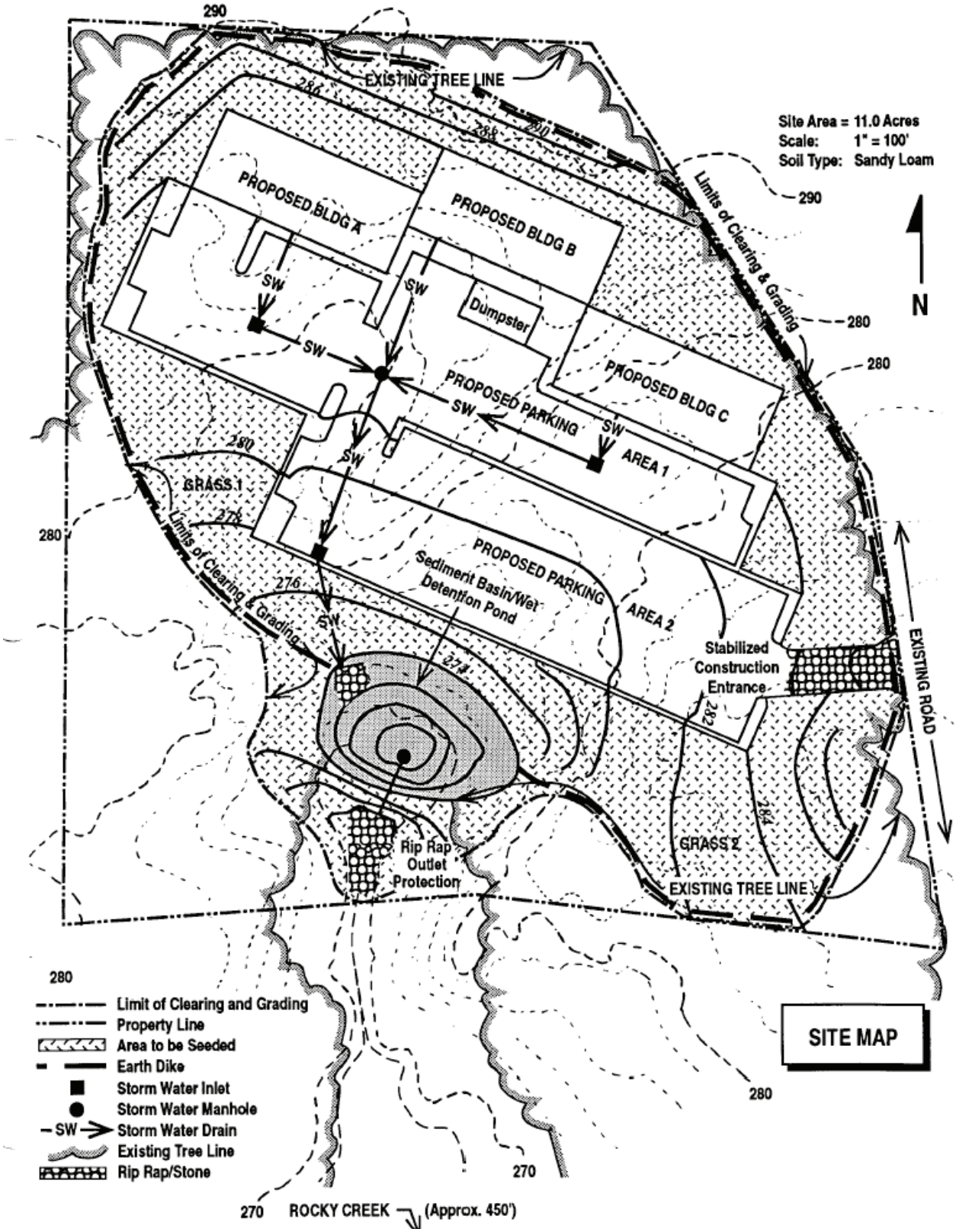
Sequence and Schedule of Major Project Activities

Construction Activity	Dates	Schedule Considerations
Work crew orientation	Jan 1 – 7	Pre-project briefing to review permits, plans, schedule, and staffing.
Construction access – install entrance to site, initial construction routes, initial areas designated for vehicle parking	Jan 8 – 15	This is the first land-disturbing activity. Minimal clearing/grading will be done to install stabilized #2 rock site exit with geotextile underliner, at least 50 ft long. Downgradient silt fences will be installed below areas to be cleared, grubbed, graded, or cut/filled. Do-not-disturb areas will be marked off.
Sediment traps and barriers – basins, traps, sediment fences, outlet protection	Jan 8 – 15	ID locations and install temporary sediment traps as needed to intercept flow. Build basins prior to upgradient work where possible, and seed/mulch/blanket slopes immediately. Relocate and reinstall silt fences as necessary prior to upgradient work. Maintain and remove sediment as necessary.
Runoff and run-on controls – diversion ditches or berms, perimeter dikes	Jan 8 – 15	Install controls as needed to divert clean flows around or through site. Key practices will be installed after the installation of principal sediment traps and before land grading. Additional runoff control measures may be installed during grading.
Land clearing and grading—site preparation (cutting, filling, and grading, sediment traps, barriers, diversions, drains, surface roughening)	Jan 16 – 31	Major clearing and grading will begin after installation of principal sediment and runoff control measures, and additional control measures will be installed as grading continues. Borrow and disposal areas will be cleared as needed. Trees and buffer areas around streams, sinkholes, and other protected areas will be marked for preservation.
Runoff conveyance system - storm drains, channels, inlet and outlet protection, slope drains	Feb 1 – 28	Inlet and outlet protection measures will be installed as needed. Drainage ditches will be stabilized immediately with sod or seed with erosion control blanket. Slope drains will be installed as indicated on site drawings. A minimum 25 ft vegetated buffer will be maintained around all streams and sinkholes.
Surface stabilization—temporary and permanent seeding, mulching, sodding, riprap	Mar 1 – 15	All disturbed areas will be graded and stabilized as soon as possible. Stabilization will begin within 14 days on areas of the site where construction has permanently or temporarily ceased. Temporary and permanent stabilization will comply with the Stormwater Manual. Erosion control blankets and turf reinforcement mats will be used on slopes in accordance with the Stormwater Manual.
Building construction—buildings, utilities, paving	Mar 1 – Jun 30	During construction, erosion and sedimentation control measures will be installed as needed, such as construction entrances and downgradient silt fences and sediment traps. Areas at final grade not in the immediate construction area will be seeded/mulched as soon as possible.
Landscaping and final stabilization—topsoiling, trees and shrubs, permanent seeding, mulching, sodding.	Jul 1 – 31	This is the last construction phase. All remaining disturbed areas will be stabilized, including borrow and spoil areas. Temporary control structures will be removed and the area will be seeded and mulched.

2. LOCATION AND SITE DESCRIPTION, MAPS, AND DRAWINGS (ALSO ATTACHED)



Starshader Apartments Project Location Map (NOTE: Pipeline has been retired from service, and removed)



Site Plan Showing Pre/Post Construction Topography, Construction, Drainage Features, and BMPs (See additional plan sheets for BMP design details, notes, and other stormwater management info)

Name of Receiving Waters
The entire site will drain into Rocky Creek, which is approximately 450 feet from the site. There are no sinkholes, wetlands, springs, or streams on the site.

Receiving Waters Classification and Status
Rocky Creek is designated as Warmwater Aquatic Habitat and Primary/Secondary Contact Recreation, and is not listed on the Kentucky impaired waters (303d) list. There is no TMDL for Rocky Creek. No threatened and endangered species are present on the site or downstream from the project discharge.

Potential Sources of Pollutants
Sediment from land clearing and grading; fertilizer; concrete washout water; paint wash water; oil/fuel/grease from equipment; sanitary waste; trash/debris.

3. EROSION PREVENTION AND SEDIMENT CONTROL MEASURES

Limits of Disturbance and Project Phasing
Approximately 9.8 acres will be disturbed during construction. Land disturbance activities will be phased to minimize the amount of soil exposed and the length of exposure time. The overall objective will be to achieve final grades as quickly as possible, and to stabilize all areas with seed, mulch or blankets/mats within 14 days after final grade is achieved, or after grading work has been suspended on that portion of the site.

Stabilization Practices
Temporary Stabilization – Top soil stockpiles and disturbed portions of the site where construction activity stops for 14 days or more will be stabilized with temporary seed or straw mulch no later than 14 days from the last construction activity in that area (portion) of the site. Seeding rates will be consistent with the Kentucky Erosion Prevention and Sediment Control Field Guide. Lime and fertilizer will be applied only when necessary, after soil testing. After seeding, each area shall be mulched with at least 4,000 pounds per acre of blown or hand-scattered straw. The straw will be netted down or crimped into place by a disk harrow with the blades set straight. Slopes will be covered with blankets or mats consistent with the Kentucky Construction BMP Planning andTechnical Specifications Manual. Areas of the site which are to be paved will be temporarily stabilized by applying geotextile and stone sub-base until bituminous pavement can be applied. Dust will be controlled by water sprayed from a tanker truck as needed during dry weather.

Permanent Stabilization – Disturbed portions of the site where construction activities are completed will be stabilized with permanent seed no later than 14 days after completion of grading in that area. Seed and mulch will be applied consistent with the Kentucky Erosion Protection and Sediment Control Field Guide. Lime and fertilizer will be applied only if needed. After seeding, each area will be mulched with 4,000 pounds per acre of straw. The straw mulch will be netted down or crimped into place by a disk harrow with blades set straight. Slopes will be covered with erosion control blankets or turf reinforcement mats consistent with the Kentucky Construction BMP Planning and Technical Specifications Manual. Ditches will be triple-seeded and lined with erosion control blanket or turf reinforcement matting.

Structural Practices (See Attached Plan Sheets for Additional Details and Drawings)
Earthen Berm – will be constructed along the uphill perimeter (north) of the site. This berm will divert clean run-on water around the construction site. Another berm on the east side will collect runoff from the disturbed area and direct the runoff to the sediment basin. Berms will be seeded and mulched immediately after construction. Erosion control blankets will be used on top of seed in berm ditches with slopes of 5-10 percent. Turf reinforcement mats will be used in berm ditches with slopes exceeding 10 percent. Blankets or mats will be used on slopes in accordance with the Kentucky Construction BMP Planning and Technical Specifications Manual.

Sediment Traps – will be sited and constructed as needed, according to the attached drawings and through field adaptations to changing grades and emergence of gullies that need to be controlled. Traps will consist of rock or rock bag berms across concentrated flow areas and be designed to intercept, detain, and settle out these flows. Traps installed as field adaptations will be logged on SWPPP & plans.

Sediment Basin – will be constructed at the common drainage location on the south side of the construction site. The basin will be formed by constructing an embankment across an existing gully and excavating a storage pond with a volume of 134 cubic yards for each upgradient disturbed acre. The basin will drain through a perforated corrugated metal riser and outlet pipe to a riprap outlet apron. The riser will have ½ inch holes 3-6 inches apart, with no large holes or slots in the lower two-thirds of the riser. Sediment will be removed before the basin is one-third full. Also, once construction activities are nearly complete, the accumulated sediment will be removed from the basin. The sediment basin and surrounding area will be seeded and mulched immediately after construction. Blankets or mats will be used on slopes in accordance with the Kentucky Construction BMP Planning and Technical Specifications Manual. Basin outlet will be protected with a rock berm during construction, to pond up and detain incoming flow.

Inlet Protection Measures – will be used to detain, pond, and settle (or filter) out sheet and concentrated flows moving toward curb, drop, or other inlets. Inlet protection structures will consist of rock bags, #2 rock berms, trenched in silt fence on framing, or commercial devices.

Outlet Protection Measures – will be used where culverts discharge to ditches or channels, and consist of turf reinforcement matting over triple seeding, erosion control blanket over triple seeding, or channel lining, depending on the scour flows and consistent with the Kentucky Division of Water's BMP Technical Specifications Manual.

Ditch Check Dams – will be installed as needed to control ditch downcutting, trap sediment, and stabilize ditches. Check dam installation will be consistent with the Kentucky Erosion Protection and Sediment Control Field Guide and BMP Technical Specifications Manual.

Site Runoff Management
Sediment will be prevented from leaving the site to the maximum extent practicable. Storm water drainage will be provided mostly by grassed swales, with sheet runoff from parking lots and building drains leading to a permanent stormwater pond on the south side of the site. The pond will be modified for sediment retention during the construction phase. Runoff will be diverted onto undisturbed vegetated areas and revegetated areas where possible for infiltration. Landscaped areas with no buildings or roads will be brought to grade and planted/seeded/mulched within 14 days. Two acres of the site, along existing drainage areas and some slopes, will be flagged off-limits to equipment and remain in its current natural state. When construction is complete the entire site will drain to the south side detention basin (the detention basin will be in the location of the temporary sediment basin). The areas on the sides of the basin will be seeded and mulched after construction. The detention pond is designed with a permanent pool volume of 1,333 cubic yards. This is equivalent to one inch of runoff for the drainage area. It is expected that this detention pond design – along with other site controls – will remove 80 percent removal of total suspended solids in the site runoff for the 2-year, 24-hour storm (see attached plan sheets for design details and calculations). The pond has been designed by a professional engineer to keep peak flow rates from the two and ten year 24-hour storms at pre-development rates. The outlet of the detention basin will be stabilized by a riprap apron. The inlet will be modified during construction by installation of a 3 ft high rock berm around the inlet to increase detention time and sediment removal. The berm will be removed after the entire site is stabilized.

4. OTHER CONTROL MEASURES

Offsite Vehicle Tracking
A stabilized #2 and larger rock construction exit with geotextile underliner will be installed to help reduce vehicle tracking of sediments at all exits onto paved roads. The stabilized exit will be 100 ft where

possible, and at least 50 ft in length. The paved street adjacent to the site entrance will be swept/cleaned daily if necessary to remove any excess mud, dirt, or rock tracked from the site. The rock exit will be grubbed lightly or otherwise maintained as needed to clear (shake down) dry mud. Dump trucks hauling material from the construction site will be covered with a tarpaulin.

Waste Disposal
Waste Materials – All waste materials that may leach pollutants (paint and paint containers, caulk tubes, oil/grease containers, liquids of any kind, soluble materials, etc.) will be collected and stored in a covered metal dumpster rented from the ABC Waste Management Company, which is a licensed solid waste management company. The dumpster will meet all local and state solid waste management regulations. Construction debris and other wastes that do not leach pollutants will be recycled or deposited in a covered or open-topped dumpster. The dumpster will be emptied when full, and the contents will be hauled to an approved site. No construction waste materials will be buried onsite. All personnel will be instructed regarding the correct procedure for waste disposal. Notices stating these practices will be posted in the office trailer and Mark Smith, the individual who manages the day-to-day site operations, will be responsible for seeing that these procedures are followed.

Hazardous Waste – All waste materials will be disposed of in the manner specified by local or state regulation or by the manufacturer. Site personnel will be instructed in these practices and Mark Smith, the individual who manages day-to-day site operations, will be responsible for seeing that these practices are followed

Sanitary Waste – Portable toilets will be used on site for sanitary wastes. All sanitary waste will be collected from the portable units as needed to prevent excessive odors and overflows by the TIDEE Company, a licensed sanitary waste management contractor, as required by local regulation. Portable units will be placed away from storm drain inlets, ditches, creeks, and other water bodies

Timing of Control Measures
As indicated in the Sequence of Major Activities, the stabilized construction exit, earthen diversion berm, silt fences / sediment barriers, and sediment basin will be constructed prior to clearing or grading of any other portions of the site. Sediment traps will be constructed as needed in areas where gullying occurs. Ditches will be built and triple seeded/mulched (or blanketed) after construction. Areas where construction activity temporarily ceases for more than 14 days will be stabilized with temporary seed and/or mulch within 14 days of the last disturbance. Once construction activity ceases permanently in an area, that area will be seeded and mulched within 14 days. Temporary controls in permanently stabilized areas, such as silt fences, sediment barriers, ditch checks, temporary sediment traps, etc., will be removed. Controls will remain in place until all vegetation is established and ditches are stable.

5. OTHER STATE AND LOCAL PLANS

Certification of Compliance with Federal, State, and Local Regulations
This Stormwater Pollution Prevention Plan reflects Kentucky Division of Water requirements for stormwater management and erosion and sediment control. To ensure compliance, this plan was prepared in accordance with the Kentucky BMP Planning and Technical Specifications Manual. There are no other local, state, or federal permits (e.g., Clean Water Act Section 404 dredge/fill permit, KY DOW Section 401 Water Quality Certification, KY DOW Floodplain Permit, etc.) needed for this project.

6. MAINTENANCE PROCEDURES

Stormwater, Erosion, and Sediment Control Maintenance Practices
Maintenance of all BMPs at the site will be handled by Mark Smith of Smith Homebuilders, who has been trained on construction site BMPs at workshops sponsored by the KY DOW and the Kentucky Erosion Protection and Sediment Control (KEPSC) Program. Other workers on-site will be trained in BMP

installation, maintenance, and good housekeeping by Mr. Smith. These are the inspection and maintenance practices that will be used to maintain erosion and sediment controls:

- Less than ½ of the site will be cleared of vegetation at one time; areas at final grade will be seeded and mulched within 14 days.
- All measures will be maintained in good working order; if a repair is necessary, it will be initiated within 24 hours of being reported. This information will be logged on the SWPPP/BMP Plan
- Silt fences will be inspected for bypassing, overtopping, undercutting, depth of sediment, tears, and to ensure attachment to secure posts. Bypasses will be repaired immediately.
- Built-up sediment will be removed from behind the silt fence before it has reached halfway up the height of the fence.
- The sediment basin will be inspected for depth of sediment, and built-up sediment will be removed when it reaches 30 percent of the design capacity and at the end of the job.
- Diversion dikes and berms will be inspected and any breaches promptly repaired. Areas that are eroding or scouring will be repaired and re-seeded / mulched as needed.
- Temporary and permanent seeding and mulching will be inspected for bare spots, washouts, and healthy growth. Bare or eroded areas will be repaired as needed.

7. INSPECTION PROCEDURES

Stormwater, Erosion, and Sediment Control Inspection Practices
Inspection of all BMPs at the site will be handled by Mark Smith of Smith Homebuilders, who has been trained on inspecting construction site BMPs at workshops sponsored by the KY DOW and the Kentucky Erosion Protection and Sediment Control (KEPSC) Program.

- All erosion prevention and sediment control measures will be inspected at least once every two weeks and within 24 hours following any rain of one-half inch or more.
- Inspections will be conducted by Mark Smith, who has been trained by the KY DOW and KEPSC. Mr. Smith will train three people who will be responsible for assisting in the inspections and installing, maintaining, and repairing the controls on the site.
- Inspection reports will be written, signed, dated, and kept on file for two years. They will be kept on file at the site office trailer, along with this Stormwater Pollution Prevention Plan.

8. NON-STORMWATER DISCHARGES

It is expected that the following non-storm water discharges will occur from the site during construction:

- Water from water line flushings.
- Pavement wash waters (where no spills or leaks of toxic or hazardous materials have occurred).
- Uncontaminated groundwater and rain water (from dewatering during excavation).

All non-storm water discharges will be directed to a sediment basin, filter bag, or filter fence enclosure in a flat vegetated infiltration area prior to discharge, to remove sediment and other contaminants.

The materials or substances listed below are expected to be present onsite during construction:

- Concrete
- Detergents
- Paints (enamel and latex)
- Metal Studs
- Concrete
- Tar
- Fertilizers
- Petroleum Based Products
- Cleaning Solvents
- Wood
- Masonry Block
- Roofing Shingles

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- Tar
- Fertilizers
- Petroleum Based Products
- Cleaning Solvents
- Wood
- Masonry Block
- Roofing Shingles

- Materials and equipment necessary for spill cleanup will be kept in the material storage area. Equipment and materials will include but not limited to brooms, dust pans, mops, rags, gloves, kitty litter, sand, sawdust, and plastic and metal trash containers.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contract with a hazardous substance.
- Spills of toxic or hazardous material will be reported to the appropriate state/local agency.
- The spill prevention plan will be adjusted as needed to prevent spills from reoccurring and improve spill response and cleanup.
- Mark, Smith, the site superintendent responsible for the day-to-day site operations, will be the spill prevention and cleanup coordinator. He will designate at least three other people onsite to receive spill prevention/cleanup training and assist in cleanups. Their names will be posted in the material storage area and in the office trailer outside.

9. PERMITTEE CERTIFICATIONS

SWPPP Files, Updates, and Amendments
This SWPP Plan and related documents (e.g., NOI, inspection reports) will be kept on file at the construction site by Mark Smith, the Site Manager. The SWPPP will be updated by the Owner and/or Site Manager to reflect any and all significant changes in site conditions, selection of BMPs, the presence of any unlisted potential pollutants on site, or changes in the Site Manager, contractor, subcontractors, or other key information. Updates and amendments will be made in writing within 7 days and will be appended to the original SWPPP and available for review.

Stormwater Pollution Prevention Plan Certification
I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____ Date: _____
Joe Pine, President
Pine Grove Development LLC

Kentucky Construction Site Stormwater Inspection Report

General Information			
Project Name			
KPDES Tracking No.		**Location**	
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Info			
Inspector's Qualifications			
Describe present work phase			

Type of Inspection:
❑Regular Weekly ❑Regular Bi-Weekly ❑Pre-Storm Event ❑During Storm ❑Post-Storm Event

Weather Information

Has there been a storm event since the last inspection? ❑Yes ❑No
If yes, provide: Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):

Weather at time of this inspection?
❑Clear ❑Cloudy ❑Rain ❑Sleet ❑Fog ❑Snowing ❑High Winds ❑Other Temperature: _____

Have any discharges of sediment or other pollutants occurred since the last inspection? ❑Yes ❑No
If yes, describe:

Are there any discharges of sediment or pollutants at the time of inspection? ❑Yes ❑No
If yes, describe:

Site-specific BMPs
Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary. Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.

	BMP Type or Name	BMP Installed?	Maintenance Required?	Corrective Action Needed and Notes
1		❑Yes ❑No	❑Yes ❑No	
2		❑Yes ❑No	❑Yes ❑No	
3		❑Yes ❑No	❑Yes ❑No	
4		❑Yes ❑No	❑Yes ❑No	
5		❑Yes ❑No	❑Yes ❑No	
6		❑Yes ❑No	❑Yes ❑No	
7		❑Yes ❑No	❑Yes ❑No	
8		❑Yes ❑No	❑Yes ❑No	
9		❑Yes ❑No	❑Yes ❑No	
10		❑Yes ❑No	❑Yes ❑No	
11		❑Yes ❑No	❑Yes ❑No	
12		❑Yes ❑No	❑Yes ❑No	
13		❑Yes ❑No	❑Yes ❑No	
14		❑Yes ❑No	❑Yes ❑No	
15		❑Yes ❑No	❑Yes ❑No	
16		❑Yes ❑No	❑Yes ❑No	
17		❑Yes ❑No	❑Yes ❑No	
18		❑Yes ❑No	❑Yes ❑No	
19		❑Yes ❑No	❑Yes ❑No	
20		❑Yes ❑No	❑Yes ❑No	

Overall Site Issues: Note BMPs, Implementation, Maintenance and Corrective Action Needs.

BMP/activity	Installed?	Maintenance Required?	Corrective Action Needed and Notes
Are all slopes and disturbed areas not being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
Are streams, wetlands, mature trees, etc. protected with barriers or BMPs?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
Are storm drain inlets properly protected?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
Is trash/litter from work areas collected and placed in covered waste containers?	❑Yes ❑No	❑Yes ❑No	
Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other material?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Other management practices inspected or needed (explain):			

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

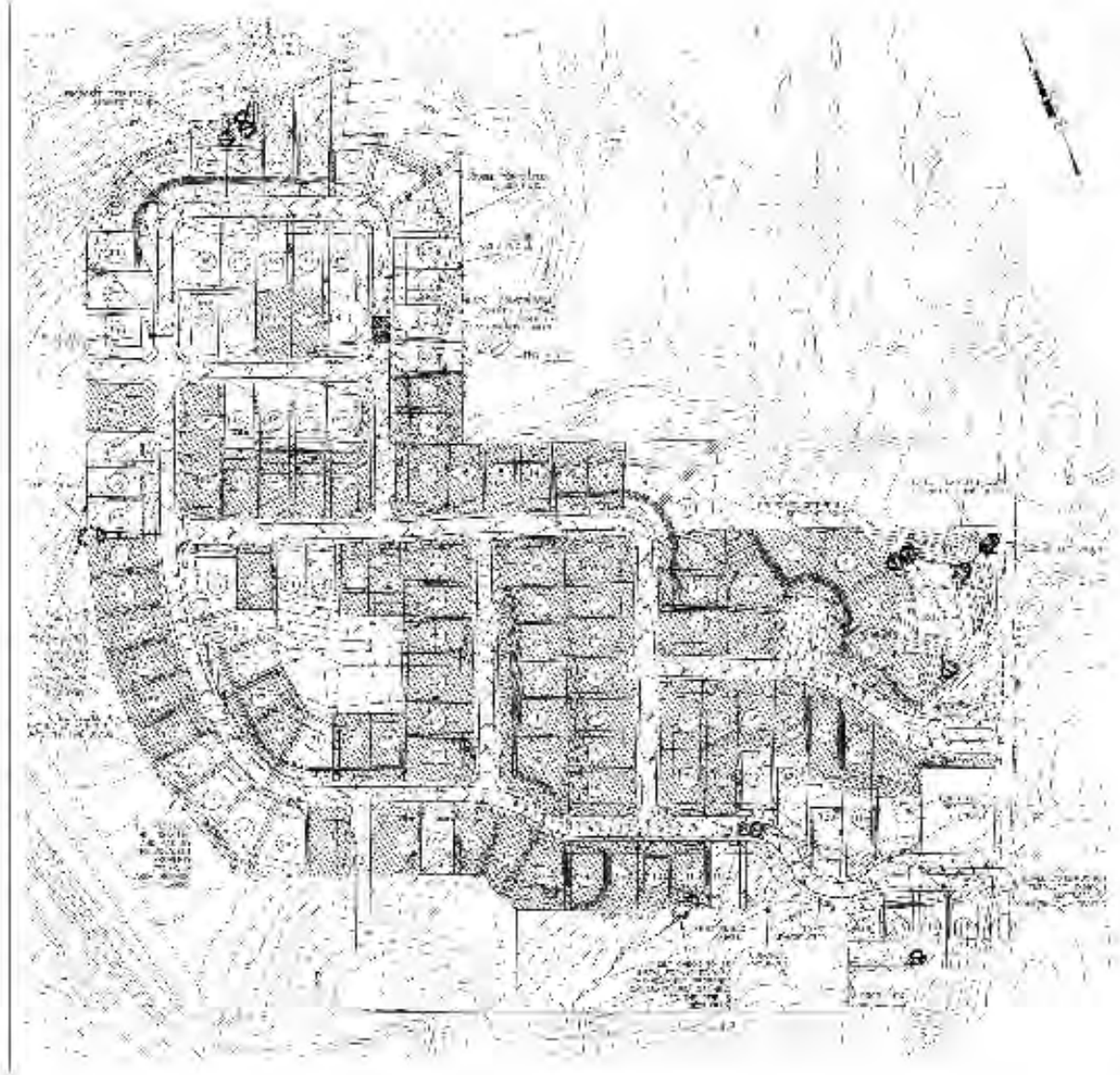
"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

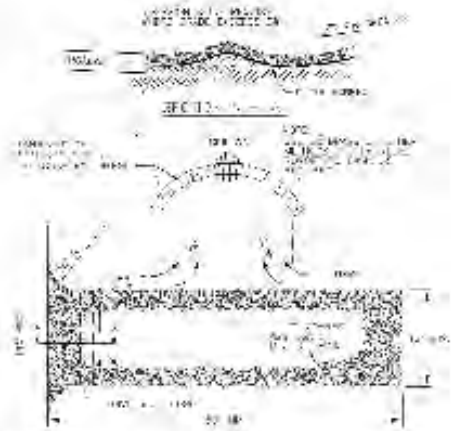
Signature:_____ **Date:**_____

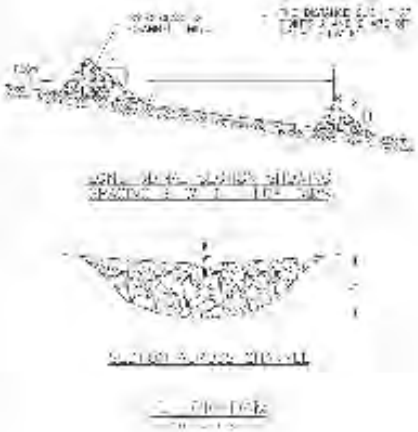
Appendix B

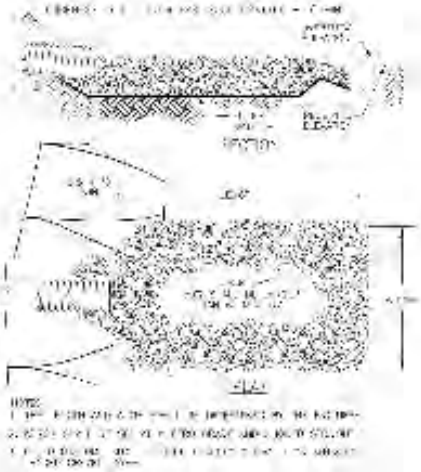
Example Site Plan Drawings

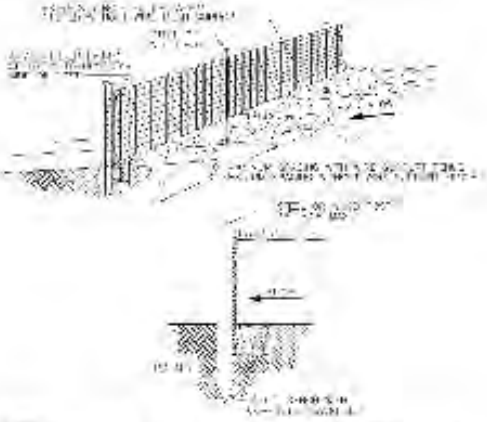


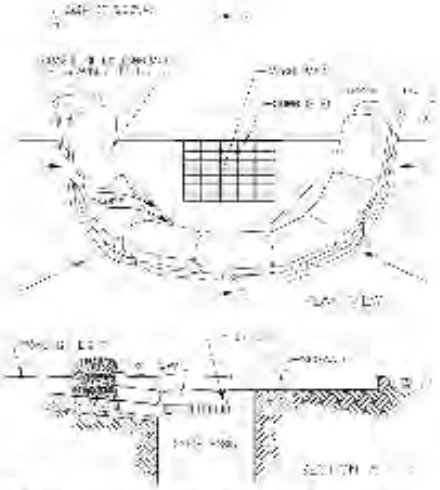
SWPPP
PLAN SHEET











SWPPP
DETAIL SHEET

Appendix C

Site Runoff Calculations

General Information

The Universal Soil Loss Equation (USLE) has been used extensively as an acceptable method of computing sheet erosion from farmlands. Modifications have been made in the USLE for determining construction site erosion. The revisions are referred to as RUSLE and are accomplished mainly through adjustments of "urban" vegetation conditions ("C" factors) and the urban best management factors ("P" factors). Soil erosion from rills and gullies is not included in this equation. If gullies are present or a potential problem, further computations may be made to determine additional soil erosion. This is an "estimation" of sheet soil erosion and is not interchangeable with sediment delivery or sediment yield.

The rate of sheet erosion depends on several factors:

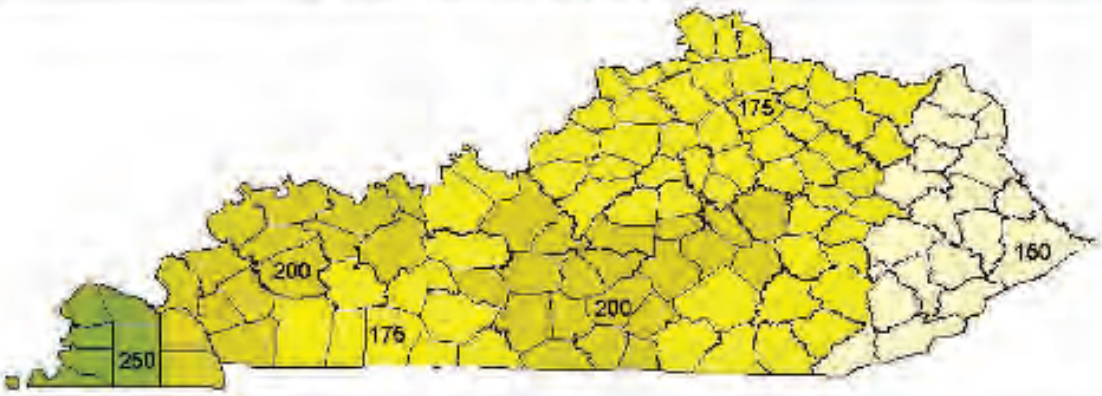
- Rainfall energy and intensity
- Soil erodibility
- Land slope and length of slope
- Condition of the soil surface and best management practices in use
- Surface cover involved, such as grass, woodlands, crops, pavement, or no cover at all

These factors are assigned quantitative values to be used for computing soil loss and are found in the following tables.

The Universal Soil Loss Equation equation is A = R x K x (LS) x C x P, where

- A = The computed annual soil loss expressed in tons per acre
- R = The rainfall factor is the number of erosion index units in a normal year's rain. The average annual erosive rainfall factors (R values) for Kentucky are shown in **Table 1006-1-A.**
- K = The soil erodibility factor for selected soils of Kentucky is shown in **Table 1006-1-B.** K is the erosion rate per unit of erosion index for a specific soil.
- LS = The slope length factor is the ratio of soil loss from a specific slope length to a 72.6-foot slope of the same soil on a 9 percent gradient. Refer to **Table 1006-1-C** for values of LS.
- C = The cropping management factor is the ratio of soil loss from a field with specified cropping management to that of the fallow condition on which the factor K is evaluated. Refer to **Table 1006-1-D** for crop management factors.
- P = The best management practice factor is the ratio of soil loss with certain conservation practices to that which results without such practices. Refer to **Table 1006-1-E** for best management practice factors. The annual soil loss in tons per acre may be reduced to cubic yards per acre by use of **Table 1006-1-F** and adjusted for the portion of the year that the soil is actually exposed to soil erosion by use of Table **1006-1-G.**

Table 1006-1-A
RAINFALL FACTOR, R by COUNTY



Counties with 150 R Factor				
Bell	Elliott	Johnson	Letcher	Morgan
Boyd	Floyd	Knott	Magoffin	Perry
Breathitt	Greenup	Lawrence	Martin	Pike
Carter	Harlan	Leslie		
Counties with 175 R Factor				
Allen	Clay	Kenton	Nelson	Shelby
Anderson	Estill	Knox	Nicholas	Simpson
Bath	Fayette	Laurel	Ohio	Spencer
Boone	Fleming	Lee	Oldham	Todd
Bourbon	Franklin	Lewis	Owen	Trimble
Bracken	Gallatin	Logan	Owsley	Warren
Breckinridge	Grant	Mason	Pendleton	Washington
Bullitt	Grayson	McCreary	Powell	Wayne
Butler	Harrison	Meade	Pulaski	Whitley
Campbell	Henry	Menifee	Robertson	Wolfe
Carroll	Jackson	Mercer	Rowan	Woodford
Christian	Jefferson	Montgomery	Scott	
Clark	Jessamine	Muhlenberg		
Counties with 200 R Factor				
Adair	Cumberland	Hart	Madison	Rockcastle
Barren	Daviess	Henderson	Marion	Russell
Boyle	Edmonson	Hopkins	Marshall	Taylor
Caldwell	Garrard	Larue	McLean	Trigg
Calloway	Green	Lincoln	Metcalfe	Union
Casey	Hancock	Livingston	Monroe	Webster
Clinton	Hardin	Lyon	Ohio	
Crittenden				
Counties with 250 R Factor				
Ballard	Fulton	Graves	Hickman	McCracken
Carlisle				

Table 1006-1-B
ERODIBILITY (K FACTORS) AND TEXTURES OF B AND C HORIZONS FOR SELECTED KENTUCKY SOIL SERIES

Soil Series	B Horizon		C Horizon	
	Tex.	K Value	Tex.	K Value
Armour	sicl	0.37	sicl	0.43
Ashton	sil	0.43	sil	0.43
Avonburg	sil	0.43	sic	0.32
Beasley	sic	0.28	c	0.28
Brandon	sicl	0.28	vgrsl	0.17
Brashear	sic	0.28	c	0.28
Braxton	sicl	0.28	sicl	0.28
Calloway	sic	0.43	sic	0.43
Crider	sicl	0.32	sic	0.28
Cynthiana	sic	0.28	rock	—
Donerail	sicl	0.28	c	0.28
Edon	flsic	0.28	vflsic	0.17
Elk	sicl	0.28	sicl	0.28
Fairmont	sic	0.28	rock	—
Faywood	sic	0.28	sic	0.28
Grenada	sicl	0.49	sil	0.64
Lakin	fsl	0.17	ls	0.17
Lanton	sic	0.43	c	0.32
Lax	sicl	0.43	grcl	0.32
Loradale	sic	0.28	c	0.28
Loring	sicl	0.49	sicl	0.43
Lowell	sic	0.28	c	0.28
Maury	sic	0.28	c	0.28
McAfee	sic	0.28	c	0.28
Memphis	sicl	0.49	sil	0.49
Mercer	sicl	0.43	c	0.28
Muskingum	sil	0.28	cnsil	0.17
Nicholson	sicl	0.43	c	0.37
Russellville	sicl	0.43	c	0.37
Shelbyville	sicl	0.28	sic	0.28
Wheeling	cl	0.24	fsl	0.24
Woolper	sic	0.28	c	0.28
Zanesville	sicl	0.28	l	0.28

(The K value may be increased or decreased as much as 20 percent to adjust for local soil series variations.) Abbreviations of Soil Textures are as follows:

c—clay
cl—clay loam
cnsil—channery silt loam
fsl—fine sandy loam
grsl—gravelly clay loam
ls—loamy sand
sic—silty clay
sicl—silty clay loam
sil—silt loam
vflsic—very flaggery silty clay
vgrsl—very gravelly sandy loam

Table 1006-1-C
Soil Loss, LS, Along a Slope

LS = $(\lambda / 72.6)^m * (430 * x^2 + 30 * x + 0.43) / 6.613$

Where λ = slope length (λ = horizontal length/cos θ or = fill height/sin θ)

θ = slope angle; $x = \sin \theta$

m = 0.3 for slope < 3%, 0.4 for slope = 4%, or 0.5 for slope > 5%

LS Based on Horizontal Length (feet)

Slope H : V	10	20	30	40	60	80	100
50 : 1	0.100	0.123	0.139	0.152	0.172	0.187	0.200
40 : 1	0.121	0.149	0.168	0.183	0.207	0.226	0.241
30 : 1	0.159	0.196	0.221	0.241	0.272	0.297	0.317
25 : 1	0.193	0.238	0.269	0.293	0.331	0.361	0.386
20 : 1	0.205	0.271	0.319	0.358	0.421	0.472	0.516
10 : 1	0.432	0.610	0.748	0.863	1.057	1.221	1.365
8 : 1	0.607	0.858	1.051	1.213	1.486	1.716	1.918
6 : 1	0.960	1.357	1.662	1.919	2.351	2.714	3.035
4 : 1	1.890	2.659	3.257	3.761	4.606	5.318	5.946

LS Based on Fill Height (feet)

Slope H : V	5	10	20	40	60	80	100
6 : 1	1.662	2.351	3.325	4.702	5.758	6.649	7.434
4 : 1	2.659	3.761	5.318	7.521	9.212	10.637	11.892
2 : 1	5.925	8.379	11.850	16.759	20.525	23.700	26.498
1 : 1	11.168	15.794	22.336	31.587	38.687	44.671	49.944

Table 1006-1-D
ESTIMATED C FACTORS FOR PROTECTIVE GROUND COVER ON CONSTRUCTION SITES

Type of Cover	Application Rate	C Factor
None (Fallow Ground)	-	1.0
Temporary Seeding (90% Stand):		
Ryegrass (Perennial Type)	-	0.05
Ryegrass (Annuals)		
Small Grain	-	0.05
Millet or Sudan Grass	-	0.05
Field Bromegrass	-	0.03
Permanent Seedings (90% Stand):	-	-
(Bluegrass, KY 31 Fescue, etc.)	-	0.01
Sod (Laid Immediately)	-	0.01
Mulches:		
Straw or Hay	2 Tons/acre	0.25
	4 Tons/acre	0.13
	6 Tons/acre	0.07
	10 Tons/acre	0.02
Wood Chips	30 Tons/acre	0.06
Wood Cellulose	9 Tons/acre	0.10
Fiberglass	2 Tons/acre	0.05
Asphalt Emulsion	40 Cubic Yards/acre	0.02
(Fiber matting, excelsior, gravel, and stone may also be used as protective ground cover with an estimated C factor of 0.02 to 0.10 depending upon the amount applied.)		

ESTIMATED C FACTORS FOR SURFACE CONDITIONS WITH NO COVER

Type of Cover	C Factor
Compact and smooth, scraped with bulldozer or scraper up and downhill	1.3
Same condition, except raked with bulldozer root rake up and downhill	1.2
Compact and smooth, scraped with bulldozer or scraper along the slope	1.2
Same condition, except raked with bulldozer root rake along the slope	0.9
Loose as a disked layer	1.0
Rough irregular surface equipment tracks in all directions	0.9
Loose with rough surface greater than 1 foot deep	0.8
Loose with smooth surface greater than 1 foot deep	0.9

Table 1006-1-E
ESTIMATED BEST MANAGEMENT PRACTICE P FACTORS FOR SEDIMENT BASINS AND SEDIMENT CONTROL SYSTEMS

Situation	P Factor
Sediment basin – small, on site	
- Receiving sediment from 70% of the site	0.50
- Receiving sediment from 100% of the site	0.20
Sediment basin – large, off site	
- Downstream below construction site	0.15
System of diversions and waterways	
- Seeded, sodded, riprap as needed	0.45

Table 1006-1-F
FACTORS FOR CONVERTING TONS PER ACRE TO CUBIC YARDS PER ACRE

Texture	Factor
Sands, loamy sands, sandy loams	0.70
Sandy clay loams, silt loams, loams, and silty clay loams	0.87
Clay loams, sandy clays, clay, and silty clays	1.02

Table 1006-1-G
RAINFALL DISTRIBUTION TABLE

Month	Western Half of Kentucky[1]		Eastern Half of Kentucky[1]	
	Per Month	Accumulative	Per Month	Accumulative
January	3	3	3	3
February	6	9	4	7
March	7	16	6	13
April	9	25	6	19
May	12	37	8	27
June	12	49	13	40
July	15	64	20	60
August	13	77	20	80
September	7	84	9	89
October	6	90	4	93
November	5	95	3	96
December	5	100	4	100
SUM	100		100	

[1] Division line is approximately a north/south line from Owenton to Albany.

Appendix D

Construction Site Inspection Checklist and Report Form

Kentucky Construction Site Stormwater Inspection Report

General Information			
Project Name			
KPDES Tracking No.		**Location**	
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Info			
Inspector's Qualifications			
Describe present work phase			
Type of Inspection: ❑Regular Weekly ❑Regular Bi-Weekly ❑Pre-Storm Event ❑During Storm ❑Post-Storm Event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑Clear ❑Cloudy ❑Rain ❑Sleet ❑Fog ❑Snowing ❑High Winds ❑Other Temperature: _____			
Have any discharges of sediment or other pollutants occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges of sediment or pollutants at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary. Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.

	BMP Type or Name	BMP Installed?	Maintenance Required?	Corrective Action Needed and Notes
1		❑Yes ❑No	❑Yes ❑No	
2		❑Yes ❑No	❑Yes ❑No	
3		❑Yes ❑No	❑Yes ❑No	
4		❑Yes ❑No	❑Yes ❑No	
5		❑Yes ❑No	❑Yes ❑No	
6		❑Yes ❑No	❑Yes ❑No	
7		❑Yes ❑No	❑Yes ❑No	
8		❑Yes ❑No	❑Yes ❑No	
9		❑Yes ❑No	❑Yes ❑No	
10		❑Yes ❑No	❑Yes ❑No	
11		❑Yes ❑No	❑Yes ❑No	
12		❑Yes ❑No	❑Yes ❑No	
13		❑Yes ❑No	❑Yes ❑No	
14		❑Yes ❑No	❑Yes ❑No	
15		❑Yes ❑No	❑Yes ❑No	
16		❑Yes ❑No	❑Yes ❑No	
17		❑Yes ❑No	❑Yes ❑No	
18		❑Yes ❑No	❑Yes ❑No	
19		❑Yes ❑No	❑Yes ❑No	
20		❑Yes ❑No	❑Yes ❑No	

Overall Site Issues: Note BMPs, Implementation, Maintenance and Corrective Action Needs.

BMP/activity	Installed?	Maintenance Required?	Corrective Action Needed and Notes
Are all slopes and disturbed areas not being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
Are streams, wetlands, mature trees, etc. protected with barriers or BMPs?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
Are storm drain inlets properly protected?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
Is trash/litter from work areas collected and placed in covered waste containers?	❑Yes ❑No	❑Yes ❑No	
Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other material?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No ❑N/A	❑Yes ❑No ❑N/A	
Other management practices inspected or needed (explain):			

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature:_____ Date:_____

Appendix E

US Army Corps of Engineers

Clean Water Act Section 404 Summary

U.S. Army Corps of Engineers

BACKGROUND ON DREDGE AND FILL/WETLANDS REQUIREMENTS FOR CONSTRUCTION ACTIVITIES

DEFINITIONS

Dredged Material: Material that is excavated or dredged from waters of the United States

Fill Material: Material placed in waters of the United States where the material has the effect of:

— Replacing any portion of a water of the United States with dry land, or
— Changing the bottom elevation of any portion of a water of the United States.

Examples of fill material include rock, sand, soil, clay, plastics, construction debris, wood chips, overburden from mining or other excavation activities, and materials used to create any structure or infrastructure in waters of the United States. The term "fill material" does not include trash or garbage.

Incidental Fallback. Redeposit of small volumes of dredged material that is incidental to excavation activity in waters of the United States when such material falls back to substantially the same place as the initial removal. Examples of incidental fallback include soil that is disturbed when dirt is shoveled and the backspill from a bucket falls into substantially the same place from which it was initially removed.

Waters of the United States (United States Waters). See 40 CFR Part 122.2 for the complete definition. Waters include, but are not limited to:

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

— All interstate waters including interstate wetlands, and

All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce.

Wetlands. Areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do

support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

ACRONYMS

USACE - United States Army Corps of Engineers

CWA - Clean Water Act

NWP - Nationwide Permit

PCN - Preconstruction Notification

APPLICABILITY

USACE defines discharges of dredged material at 33 CFR 323. These discharges, which require permits under Section 404 of the CWA, include:

> The addition of dredged material to a specified discharge site located in waters of the United States; the runoff or overflow from a contained land or water disposal area; and any addition, including redeposit other than incidental fallback, of dredged material, including excavated material, into waters of the United States that is incidental to any activity, including mechanized land clearing, ditching, channelization, or other excavation.

USACE also defines discharges of fill material at 33 CFR 323. These discharges, which require permits under Section 404 of the CWA, include: placement of fill necessary for the construction of any structure or infrastructure in a water of the United States; building of any structure, infrastructure, or impoundment in waters of the United States requiring rock, sand, dirt, or other material for its construction; site-development fills in waters of the United States for recreational, industrial, commercial, residential, or other uses; causeways or road fills, dams and dikes, artificial islands, beach nourishment, levees, and artificial reefs; property protection and/or reclamation devices such as rip rap, groins, seawalls, breakwaters, and revetments; fill for structures such as sewage treatment facilities; intake and outfall pipes associated with power plants and subaqueous utility lines; placement of fill material in waters of the United States for construction or maintenance of any liner, berm, or other infrastructure associated with solid waste landfills; and placement of overburden, slurry, or tailings or similar mining-related materials in waters of the United States. Contact the state environmental or permitting office and the USACE District Office to determine whether permits are required for the construction project.

SECTION 404 PERMIT PROCESS REQUIREMENTS

Section 404 requires that no discharge of dredged or fill material be permitted if a practicable alternative exists that is less damaging to the aquatic environment or if the nation's waters would be significantly degraded. When applying for a permit, a wetlands mitigation must be performed to show that the project: avoided wetland impacts where practicable; minimized potential impacts

to wetlands; and will provide compensation for any remaining, unavoidable impacts through activities to restore or create wetlands.

US ACE may issue permits, after notice and opportunity for public hearings, for the discharge of dredged or fill material into waters of the United States at specified disposal sites. Prior to issuing Section 404 permits, state approval must also be obtained (Section 401 certification). There are two types of Section 404 permits: general permits and individual permits. For discharges that have only minimal adverse effects, US ACE issues general permits. General permits may be issued on a nationwide, regional, or state basis for particular categories of activities. Attachment C includes a list of current Nationwide Permits (NWPs). Individual permits are usually required for activities with potentially significant impacts.

General Permit Process. An NWP may require that the US ACE District Engineer (DE) of the construction activity be notified in a "preconstruction notification (PCN). If required, the PCN should be submitted as early as possible. Within 30 days, the DE will determine whether the PCN is complete and may request additional information. The PCN review process will not begin until all required information is submitted. Construction activity may not begin until one of the following occurs:

(1) Notification that the activity may proceed is received from the DE. This notification may include special conditions imposed on the specific construction activity,
(2) Notification that an individual permit is required is received from the DE, and the individual permit is issued,
(3) Forty-five days have passed since the DE received the complete PCN and no written notice has been received from the DE.

The text of the NWPs should be reviewed to assess whether a particular NWP applies to the construction project (see 67 FRN 2020 or the on-line guide at http://www.usace.army.mil/CECW/Pages/nw_permits.aspx). Some items to check include:

NWP use limits (e.g., NWP 19 Minor Dredging only applies if the site dredges less than 25 cubic yards); and

Applicable waters (e.g., NWP 13 Bank Stabilization does not apply to special aquatic sites (i.e., sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes)).

If the construction activity is covered under an NWP, the site must comply with the general conditions listed for the permit. The US ACE District Office or state environmental department should be contacted for information on regional and state general permits.

Individual Permit Process. The following steps need to be completed to obtain an individual permit:

Application. To receive a Section 404 individual permit, operators must complete an Application for Department of Army Permit (available on line at: http://www.usace.army.mil/CECW/Pages/reg_permit.aspx). US ACE requires, among other things, that permit applicants describe the project and its purpose, the reasons for discharging dredged or fill material, types of material being discharged (and volume of each type in cubic yards), and the surface area of wetlands or other waters filled (in acres). Applicants must also submit one set of drawings showing location and character of proposed activity. The application is submitted to the DE having jurisdiction over the location of the proposed activity. (Note that states may contact the US ACE in conjunction with granting state approval for the project. The application process varies by state; contact the state and US ACE District Office for details.)

Public Notice. US ACE will issue a public notice once the complete permit application has been received. The notice includes the proposed activity, location, and potential environmental impacts.

Comment Period. The public comment period lasts between 15-30 days, depending on the proposed activity. The application and comments are reviewed by the US ACE and other interested federal and state agencies, organizations, and individuals. US ACE also determines whether an Environmental Impact Statement is necessary.

Public Hearing. Citizens may request that US ACE conduct a public hearing; however, public hearings are not usually held.

Permit Evaluation. COE, along with states and other federal agencies, evaluates the permit application, taking into account the comments received.

Permit Award or **Denial**. Based on the steps above, US ACE may either approve or deny the application.

Environmental Assessment and Statement of Findings. The *Statement of Finding* document explains how the permit decision was made. This document is made available to the public.

The above steps are a basic example of the requirements to obtain an individual permit. The process may require additional steps such as a pre-application meeting with the US ACE district engineer or state officials or negotiation of mitigation plans.

Notification Requirements for USACE and KDOW Section 404 Permits

Activity	USACE Permit #	Notification to USACE and KDOW Section 404 Permits	Application for a KDOW WQC is required if the following conditions occur:
Drift Removal	3 (ii)	■ Notification is required if the "One Step" method of drift removal cannot be used.	When the project does not qualify under the USACE nationwide permit.
Beaver Dam Removal	None	■ Notification is not required for this activity	Notification is not required for this activity.
Sediment Removal from Structures	3 (ii)	■ Work area extends further than 200 feet in any direction from the structure.	More than 200 feet of stream length will be affected.
	19	■ More than 25 cubic yards of material are removed.	When the project does not qualify under the USACE n nationwide permit.
Embankment Repair and/or Protection	13	■ Length of bank stabilization activity is more than 500 feet. ■ On average, more than one (1) cubic yard per foot of fill is placed below the ordinary high water mark.	Length of bank stabilization activity affects more than 500 feet of stream or using asphalt, creek rock or rip rap.
Scour/Erosion Repair to Bridge Elements	3 (ii)	■ Work area extends more than 200 feet in any direction rom the structure.	More than 200 feet of stream length will be affected.
	18	■ More than 25 cubic yards o material is placed below or removed from below the ordinary high water mark. ■ More than 1/10 acre of special aquatic site (i.e., wetlands, vegetated shallows, riffle/pool complex), is affected.	When the project does not qualify under the USACE nationwide permit or is more than 300 feet.
Bridge and Culvert Replacement	3 (i)	■ Notification is not required for this activity unless one or more of the General Conditions is not met.	More than 300 feet of stream length will be affected.
Temporary Construction, Access and Dewatering	33	■ A Notification is required for each project. ■ A Restoration Plan is required or each project.	If the project is more than 300 feet.
Minor Discharges	18	■ More than 25 cubic yards of material is placed below or removed from below the ordinary high water mark. ■ More than 1/10 acre of special aquatic site (i.e., wetlands, vegetated shallows, riffle/pool complex), is affected.	If the project is greater than 300 feet.
Minor Dredging	19	■ More than 25 cubic yards of material are removed.	When the project does not qualify under the USACE nationwide permit.
Residential Developments	29	■ More than 1/2 acre of wetland or other aquatic resource is affected. ■ Work extends more than 300 linear feet of stream bed.	Work extends or more than 300 linear feet of stream bed.
Reshaping Existing Drainage Ditches	41	■ Reshaping greater than 500 linear feet of drainage ditch. ■ Reshaping drainage ditch increases capacity of ditch or drains additional waters of the U.S.	When the project does not qualify under the USACE nationwide permit.
Stormwater Management Facilities	43	■ More than 1/2 acre of wetland or other aquatic resource is affected. ■ Work extends for more than 300 linear feet of stream bed. ■ When expanding or constructing SWM facilities.	When the project does not qualify under the USACE nationwide permit.

Appendix F

Definitions

Unless specifically defined in this section, words or phrases are usually interpreted so as to give them the meaning they have in common usage.

1-year Frequency Storm - A storm event defined to be 2.5 inches in 24 hours.

2-year, 24-hour event - The maximum 24-hour precipitation event with a probable recurrence interval of once in two (2), years, respectively, as defined by the National Weather Service and Technical Paper No. 40, "Rainfall Frequency Atlas of the U.S., May 1961, or equivalent regional or rainfall probability information developed there from.

2-year Frequency Storm - A storm event with a fifty (50) percent chance of being equaled or exceeded in a given year. Defined in general to be 3.3 inches in 24 hours.

5-year Frequency Storm - A storm event with a twenty (20) percent chance of being equaled or exceeded in any given year. Defined in general to be 4.1 inches in 24 hours.

10-year Frequency Storm - A storm event with a ten (10) percent chance of being equaled or exceeded in any given year. Defined in general to be 4.8 inches in 24 hours.

25-year Frequency Storm - A storm event with a four (4) percent chance of being equaled or exceeded in any given year. Defined in general to be 5.5 inches in 24 hours.

100-year Flood Elevation - The elevation of the 100-year flood at any given location.

100-year Frequency Storm - A storm event with a one (1) percent chance of being equaled or exceeded in any given year. Defined in general to be 6.5 inches in 24 hours.

305 (b) Report - means the approved biennial Clean Water Act Integrated Water Quality Report to Congress, §305(b).

401 Water Quality Certification - means the certification issued by a state in response to a federally issued permit. In this case the certification DOW issues in response to a COE §404 permit.

404 Permit - means the permit issued by the United States Army Corps of Engineers (USACE) for activities that discharge dredged or fill material into navigable waters.

500-year Flood Elevation - The elevation of the 500-year flood at any given location.

500-year Frequency Storm - A storm event with a one-fifth (1/5) of one (1) percent chance of being equaled or exceeded in any given year. Defined in general to be 7.6 inches in 24 hours

Active Channel - The area of the stream that is most subject to water flow and that includes the portion of the channel below the top-of-bank.

As-Built Certification - As-built, field-verified plans signed and sealed by a registered professional engineer and/or a registered land surveyor, both licensed to practice in the State of Kentucky, showing contours, elevations, grades, locations, drainage and hydraulic structures, and detention basin volumes.

As Soon As Practical - for the purposes of this permit means at the earliest possible time when external factors such as inclement weather would not prevent completion of the task.

Bankfull Elevation - for the purposes of this permit means the water level, or stage, at which a stream, river, or lake is at the top of its banks and any further rise would result in water moving into the flood plain (NOAA Glossary).

Base Flood Elevation (BFE) - The 100-year flood elevation at any given location.

Best Management Practices (BMPs) - means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants to waters of the Commonwealth. BMPs also include treatment requirements, operating procedures, and practice to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. (EPA CGP)

Blue-Line Stream - Any stream that is shown on a 7.5 minute USGS quadrangle map, unless determined otherwise by the Kentucky Division of Water or US Army Corps of Engineers.

Channel - A natural watercourse of perceptible extent, with definite bed and banks to confine and conduct continuously or periodically flowing water (also, see Ditch).

Clearing - The removal of vegetation and/or disturbance of soil prior to grading or excavation in anticipation of construction or other activities. Clearing may also refer to wide area land disturbance in anticipation of non-construction activities; for instance, cleared forested land in order to convert forest land to pasture for wildlife management purposes.

Cold Water Aquatic Habitats or CAH - means those "waters of the Commonwealth" that meet the criterion of 401 KAR 10:031, Section 4(2) and have been listed in 401 KAR 10:026, Section 5.

Commencement of Construction Activities - means the initial disturbance of soils associated with clearing, grading, or excavating activities or other construction-related activities (e.g., stockpiling of fill material). (EPA CGP)

Common Plan of Development or Sale - for the purposes of this permit means any announcement or piece of documentation (e.g., sign, public notice, or hearing, sales pitch, advertisement, drawing, permit application, zoning request, computer design, etc.) or physical demarcation (e.g., boundary signs, lot stakes, surveyor markings, etc.) indicating construction activities may occur on a specific plot. Where discrete construction projects within a larger common plan of development or sale are located 0.25 mile or more apart and the area between the projects is not being disturbed, each individual project can be treated as a separate plan of development or sale provided any interconnecting road, pipeline or utility project that is part of the same "common plan" is not concurrently being disturbed.

Construction and Construction-related activities - include all clearing, grading, excavation, and stockpiling activities that will result in the disturbance of one or more acres of land area. Construction does not include routine earth disturbing activities that are part of the normal day-to-day operation of a completed facility (e.g., daily cover for landfills, maintenance of gravel roads or parking areas, landscape maintenance, etc). Also, it does not include activities under a State or Federal reclamation program to return an abandoned property into an agricultural or open land use.

Construction Related Wastes - Refuse or unused materials that can result from construction activities. Construction related wastes can include, but are not limited to, unused building and landscaping materials, chemicals, litter, sanitary waste, paint waste, and concrete truck washout.

Control Measure - as used in this permit, refers to any BMP or other method used to prevent or reduce the discharge of pollutants to waters of the Commonwealth. (modified EPA CGP)

Conveyance - The capacity of a channel, ditch, or pipe to carry stormwater.

Covenants for Permanent Maintenance of Stormwater Facilities and Best Management Practices - A legal document executed by the property owner, homeowners' association as owner of record, or other owner of real property which guarantees perpetual and proper maintenance of stormwater facilities and best management practices.

Co-permittees - means when two or more operators are required to jointly file a single Notice of Intent (NOI) to obtain joint authorization. Co-permittees may be found on larger common plans of development or sale

Critical Areas - for the purposes of this permit means areas within 25 feet as measured from the bankfull elevation of the channel, and on a positive slope toward a water of the Commonwealth.

Development - Any land change that alters the hydrologic or hydraulic conditions of any property. Often referred to as "site development." Development includes, but is not limited to, providing access to a site, clearing of vegetation, grading, earth moving, providing utilities, roads and other services such as parking facilities, stormwater management and erosion control systems, potable water and wastewater systems, altering land forms, or construction or demolition of a structure on the land.

Discharge - when used without qualification means the "discharge of a pollutant." (EPA CGP)

Discharge of Stormwater Associated with Construction Activity - as used in this permit refers to a discharge of pollutants in stormwater from areas where soil disturbing activities (e.g., clearing, grading, or excavation), construction materials or equipment storage or maintenance (e.g., fill piles, borrow area, concrete truck chute washdown, fueling), or other industrial stormwater directly related to the construction process (e.g., concrete or asphalt batch plants) are located. (EPA CGP)

Disturbed Area - Portion of any site that has been altered from existing conditions, including but not limited to the following: providing access to a site, clearing of vegetation, grading, earth moving, providing utilities and other services such as parking facilities, stormwater management and erosion control systems, potable water and wastewater systems, altering land forms, or construction or demolition of a structure on the land. Also called bare soil area.

Ditch - A man-made watercourse of perceptible extent, usually constructed for the purpose of draining surface water.

Drainage Basin - The area of land, buildings, roads, parking lots, and other surfaces contributing stormwater runoff to a single point.

Drainage System - The system of pipes, channels, culverts, and ditches that convey stormwater from and through public and private land.

Edge of the Receiving Water - for the purposes of this permit is defined as the bankfull elevation of a water of the Commonwealth.

Eligible - means qualified for authorization to discharge stormwater under this general permit. (EPA CGP)

Equivalent Analysis Waiver - means a waiver, available only to "small construction activities" which discharge to non-impaired waters only, that is based on the applicant performance of an equivalent analysis using existing instream concentrations, expected growth in pollutant concentrations from all sources, and a margin of safety.

Erosion - The removal of soil particles by the action of water, wind, ice or other geological agents, whether naturally occurring or acting in conjunction with or promoted by anthropogenic activities or effects.

Excavation - A cavity or hole in the land surface that is caused by the cutting, digging, or scooping and removal of soil, rock, or other materials.

Exceptional Waters or EW - means those "waters of the Commonwealth" that have been listed in Table 2 of 401 KAR 10:030, Section 1(2).

Facility or Activity - means any "point source" or other facility or activity (including land or appurtenances thereto) that is subject to regulation under the KPDES program. (EPA CGP)

Filling - Any deposit or stockpiling of dirt, rocks, stumps, or other natural or man-made solid material.

Final Stabilization - means that: 1. All soil disturbing activities at the site have been completed and either of the two following criteria are met: c. a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70 percent of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or d. equivalent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed. 2. For individual lots in residential construction, final stabilization means, that either: e. The homebuilder has completed final stabilization as specified above, or f. The homebuilder has established temporary stabilization including perimeter controls for an individual lot prior to occupation of the home by the homeowner and informing the homeowner of the need for, and benefits of, final stabilization. 3 For construction projects on land used for agricultural purposes (e.g., pipelines across crop or range land, staging area for highway construction, etc.) final stabilization may be accomplished by returning the disturbed land to its preconstruction agricultural uses. Areas disturbed that were not previously used for agricultural activities, such as buffer strips immediately adjacent to waters of the Commonwealth and areas which are not being returned to their preconstruction agricultural use must meet the final stabilization criteria in item 1. (modified EPA CGP)

Flood - Water from a river, stream, watercourse, lake or other body of standing water that temporarily overflows and inundates adjacent lands and which may affect other lands and activities through increased surface water levels, and/or increased groundwater level.

Floodplain - The relatively flat or lowland area adjoining a river, stream, watercourse, lake, or other body of standing water, which has been or may be covered temporarily by flood water. Floodplains are typically assigned a recurrence interval (i.e., the 100-year floodplain) which defines the magnitude of the flood event that causes the inundation. The 100-year floodplain is the area subject to flood for the 100-year flood.

Flood Proofing - A combination of structural provisions, changes, or adjustments to properties and structures subject to flooding primarily for the reduction or elimination of flood damages to properties, water and sanitary facilities, structures, and contents of buildings in a flood hazard area.

Floodway - That portion of the stream channel and adjacent floodplain required for the passage or conveyance of a 100-year flood discharge without cumulatively increasing the 100-year water surface elevation more than one (1) foot. The floodway is the portion of special flood hazard area characterized by significant depths and velocities.

Floodway Encroachment - Any obstruction, fill, construction, improvement or other alteration that changes the hydraulic characteristics of the regulatory floodway.

Grading - Any clearing, excavating, filling or other disturbance of terrain.

Grading Permit - A permit issued by a local government authorizing the commencement of land disturbing activities.

High Quality Waters or HQW - means those "waters of the Commonwealth" that have categorized by the Division of Water as high quality pursuant to the requirements of 401 KAR 10:030, Section 1(3).

Illicit Discharge - Any discharge to the stormwater system that is not composed entirely of stormwater and not specifically exempted by state or federal regulations. Specifically, floor drains, wastewater treatment system discharges, cesspool discharges, sink drains, and all other non-stormwater discharges to the stormwater system and surface streams are illicit discharges, whether discharged directly or through a pipe, ditch, swale, drain tile, rolling stock, or other man made conveyance.

Impaired Waters or IW - means those "waters of the Commonwealth" that have been categorized by the Division of Water as impaired for applicable designated uses and have been identified pursuant to 33 U.S.C. 1315(b) and listed in the most recently approved 305(b) report.

Impervious Area - Impermeable surfaces which prevent the percolation of water into the soil including, but not limited to, pavement, parking areas and driveways, packed gravel or soil, or rooftops.

Kentucky Pollutant Discharge Elimination System (NPDES) - The program administered by The Commonwealth of Kentucky for the United States Environmental Protection Agency to eliminate or reduce pollutant discharges to the waters of the United States. (See also National Pollutant Discharge Elimination System.)

Lake - An inland body of standing water, usually of considerable size.

Land Disturbing Activity - Any activity on a property that results in a change in the existing soil (both vegetative and non-vegetative) and/or the existing soil topography. Land disturbing activities include, but are not limited to, development, redevelopment, demolition, construction, reconstruction, clearing, grading, filling, logging and/or tree chipping operations, haul roads associated with the development, and excavation.

Large Construction Activity - is defined at 401 KAR 5:002, Section 1(292). A large construction activity includes clearing, grading, and excavating resulting in a land disturbance that will disturb equal to or greater than five acres of land or will disturb less than five acres of total land area but is part of a larger common plan of development or sale that will ultimately disturb equal to or greater than five acres. Large construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity or original purpose of the site. (modified EPA CGP)

Municipal Separate Storm Sewer System or MS4 - is defined at 401 KAR 5:002, Section 1(188). Means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains): 1. Owned and operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to waters of the Commonwealth; 2. Designed or used for collecting or conveying stormwater; 3. Which is not a combined sewer; and 4. Which is not part of Publicly Owned Treatment Works (POTW) as defined in 40 CFR § 122.2. (modified from EPA CGP)

National Pollutant Discharge Elimination System (NPDES) - The program administered by the United States Environmental Protection Agency to eliminate or reduce pollutant discharges to the waters of the United States. In Kentucky, known as the Kentucky Pollutant Discharge Elimination System.

Natural Resources Conservation Service (NRCS) - An organization within the U.S. Department of Agriculture that has published standard drainage procedures in the form of Technical Release No. 55. Formerly known as the Soil Conservation Service (SCS).

New Project - means the "commencement of construction activities" occurs after the effective date of this permit. (EPA CGP)

Ongoing Project - means the "commencement of construction activities" occurred before the effective date of this permit (modified EPA CGP)

Operator - means any party associated with a construction project that meets either of the following two criteria: 1. The party has operational control over either the construction plans and specifications, including the ability to make modifications to those plans and specifications; or 2. The party has day-to-day operational control of those activities at a project which are necessary to ensure compliance with a storm water pollution prevention plan (SWPPP) for the site or other permit conditions (e.g., they are authorized to direct workers at the site to carry out activities required by the SWPPP or comply with other permit conditions). (modified EPA CGP)

Outfall - The terminus of a stormwater system where the contents are released into a larger public or private stormwater management system, or into a stream or other water body.

Outstanding National Resource Waters or ONRW - means those "waters of the Commonwealth" that have been listed in Table 1 of 401 KAR 10:030,
Section 1(1).

Outstanding State Resource Waters or OSRW - means those "waters of the Commonwealth" that meet the criterion of 401 KAR 10:031, Section 8.

Owner or operator - means the owner or operator of any "facility or activity" subject to regulation under the KPDES program. (modified EPA CGP)

Peak Discharge - The maximum instantaneous rate of flow of water at a particular point resulting from a storm event. Also, the maximum discharge computed for a given design flood event.

Permittee - for the purpose of this permit means the operator who obtains authorization under this permit.

Person - means an individual, trust, firm, joint stock company, corporation (including a government corporation), partnership, association, federal agency, state agency, city, commission, political subdivision of the Commonwealth, or any interstate body. (KRS 244.01-010(17))

Point Source - means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or a agricultural stormwater runoff.(401 KAR 5:002 (222) & EPA CGP)

Pollutant - means and includes dredged spoil, solid waste, incinerator residue, sewage, sewage sludge, garbage, chemical, biological or radioactive materials, heat, wrecked or discarded equipment, rock, sand, soil, industrial, municipal or agricultural waste, and any substance resulting from the development, processing, or recovery of any natural resource which may be discharged into water. (KRS 244.01-010(35))

Pond - An inland body of standing water that is usually smaller than a lake.

Public Water - Stormwater runoff that originates in whole or part from or is conveyed by publicly owned facilities such as roads.

Rainfall Erosivity Factor or R Factor - means a measure of the erosive force and intensity of rain in a normal year. Two components of the factor are total energy and the maximum 30-min intensity of storms. The R-Factor is the sum of the product of these two components for all major storms in the area during an average year. (USDA Handbook 703)

Rainfall Erosivity Waiver - means a waiver, available only to "small construction activities", that is based on the "rainfall erosivity" factor for the project.

Receiving Water - means the "water of the Commonwealth" as defined in KRS 224.01-010 (33) into which the regulated stormwater discharges. (modified EPA CGP)

Redevelopment - The improvement of a lot or lots that have been previously developed.

Revised Universal Soil Loss Equation or RUSLE - means an equation used to predict soil loss in an area. (USDA Handbook 703)

Riprap - A combination of large stone, cobbles and boulders used to line channels, stabilize stream banks, and reduce runoff velocities

Runoff - The water resulting from precipitation that is not absorbed by the soil. Also can be referred to as stormwater runoff.

Runoff Coefficient - means the fraction of total rainfall that will appear at the conveyance as runoff. (EPA CGP)

Sanitary Sewer - A system of underground conduits that collects and delivers wastewater from toilets, sinks and other plumbing fixtures to a wastewater treatment plant.

Sediment - Solid material, either mineral or organic, that is in suspension, is being transported, or has been moved from its site of origin by erosion.

Sewage - Human wastes carried by water from residences, buildings, industrial establishments or other places, together with such industrial wastes, stormwater or other water as may be present; or any substance discharged from a sanitary sewer collection system.

Sinkhole - A depression in karst areas, often but not always characterized by closed contours on a topographic map. A sinkhole throat, or opening to the subsurface, may or may not be visible. Field verification may be required in areas where the depth of the depression is below the tolerance of currently available topographic mapping. The extent of the area considered to be a sinkhole includes an appropriate vegetated or other buffer zone to ensure filtration and protection from contamination by surface runoff.

Site - means the land or water area where any "facility or activity" is physically located or conducted, including adjacent land use in connection with the facility or activity. (EPA CGP)

Small Construction Activity - is defined at 401 KAR 5:002, Section 1(293). A small construction activity includes clearing, grading, and excavating resulting in a land disturbance that will disturb equal to or greater than one acre and less than five acres of land or will disturb less than one acre of total land area but is part of a larger common plan of development or sale that will ultimately disturb equal to or greater than one acre and less five acres. Small construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity or original purpose of the site. (modified EPA CGP)

Stormwater - means storm water run-off, snow melt run-off, and surface run-off and drainage. (EPA CGP)

Stormwater Discharge Related Activities - as used in this permit include: activities that cause, contribute to, or result in stormwater point source pollutant discharges, including but not limited to: excavation, site development, grading and other surface disturbance activities; and measures to control stormwater including the siting, construction and operation of BMPs to control, reduce or prevent stormwater pollution. (EPA CGP)

Stormwater System - The system of roadside drainage, roadside curbs and gutters, curb inlets, swales, catch basins, manholes, gutters, ditches, pipes, lakes, ponds, sinkholes, channels, creeks, streams, storm drains, water quality best management practices, and similar conveyances and facilities, both natural and manmade, which are designated or used for collecting, storing, or conveying stormwater, or through which stormwater is collected, treated, stored or conveyed.

Stormwater Management Facilities - Structures and constructed features designed for the collection, conveyance, storage, treatment and disposal of stormwater runoff into and through the stormwater system. Stormwater management facilities include vegetative or structural measures, or both, to control the increased volume, rate, and quality of stormwater runoff caused by manmade changes to the land.

Stormwater Pollutant Prevention Plan (SWPPP) - means a site-specific, written document that: (1) identifies potential sources of stormwater pollution at the construction site; (2) describes practices to reduce pollutants in stormwater discharges from the construction site; and identifies procedures the operator will implement to comply with the terms and conditions of a construction general permit. (modified EPA Developing Your Stormwater Pollution Prevention Plan Guide For Construction Sites [Interim] January 2007).

Stream - A linear surface water conveyance that can be characterized with either perennial or ephemeral base flow. Characterized as a blue line on a 7.5-minute USGS quadrangle, or as any natural surface water conveyance that has a defined bed and banks, which carries runoff water or base flow.

Structure - Anything constructed or erected such that the use of it requires a more or less permanent location on or in the ground. Such construction includes, but is not limited to, objects such as buildings, towers, smokestacks, overhead transmission lines, carports and walls.

TMDL Wavier - means a waiver, available only to "small construction activities", based on an EPA established or approved TMDL.

Top of Bank - The uppermost limit of the active channel of a stream containing normal flows, usually marked by a break in slope. Often referred as the elevation of flowing water during bankfull flows, which occur every 2-3 years.

Total Maximum Daily Load or TMDL - means the sum of the individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background. If a receiving water has only one point source discharger, the TMDL is the sum of that point source WLA plus the LAs for any nonpoint source pollution and natural background sources, tributaries, or adjacent segments. TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure. (EPA CGP)

Transporting - Any moving of earth materials from one place to another, other than such movement incidental to grading, as authorized on an approved plan.

USACE - United States Army Corps of Engineers.

Utility, public or private - Any agency which under public franchise or ownership, or under certification of convenience and necessity provides the public with electricity, natural gas, steam, communication, rail transportation, water, sewage collection, or other similar service.

Vegetation - Collection of plant life, including trees, shrubs, bushes, and grass.

Wastes, industrial/commercial - Liquid or other wastes resulting from any process of industry, manufacture, trade or business, or from the development of any natural resources.

Wastes, other - Decayed wood; sawdust; shavings; fallen bark; fallen leaves; lawn clippings; animal wastes; used or previously applied lime; garbage; trash; refuse, loose used paper, paper products, plastic containers, or metal containers; ashes, offal, discarded tar; discarded paint; discarded or uncontained solvents; used, discarded, or spilled petroleum products, antifreeze, motor vehicle fluids; used or discarded tires, gas tanks, or chemicals; or any other used, uncontained, or unpackaged, or disposed of materials which may discharge to or otherwise enter the stormwater system.

Water or Waters of the Commonwealth - as defined in KRS 224.01-010(33)means and includes any and all rivers, streams, creeks, lakes, ponds, impounding reservoirs, springs, wells, marshes, and all other bodies of surface or underground water, natural or artificial, situated wholly or partly within or bordering upon the Commonwealth or within its jurisdiction. (KRS 244.01-010(33))

Waters or Waters of the State - Any and all water, public or private, on or beneath the surface of the ground, which are contained within, flow through or border upon Kentucky or any portion thereof except those bodies of water confined to and retained within the limits of private property in single ownership which do not combine or effect a junction with natural surface or underground waters.

Water Pollution - means the alteration of the physical, thermal, chemical, biological, or radioactive properties of the waters of the Commonwealth in such a manner, condition, or quantity that will be detrimental to the public health or welfare, to animal or aquatic life or marine life, to the use of such waters as present or future sources of public water supply or to the use of such waters for recreational, commercial, industrial, agricultural, or other legitimate purposes. (KRS 244.01-010(34))

Water Quality Buffer - A use-restricted, vegetated area that is located along the perimeter of local waters, containing natural vegetation and grasses, enhanced or restored vegetation.

Watercourse - A channel, natural depression, gully, stream, creek, pond, reservoir or lake in which stormwater runoff and floodwater flows either regularly or infrequently. This includes major drainageways for carrying urban stormwater runoff.

Watershed - A region or area bounded peripherally by a divide and draining ultimately to a particular watercourse or body of water.

Wetlands - An area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation

Notes

Best Management Practices (BMPs) for Controlling Erosion, Sediment, and Pollutant Runoff from Construction Sites

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EXHIBIT EE

OWNER'S TRAINING PROGRAM REQUIREMENTS

1.0 GENERAL

CONTRACTOR shall conduct site-specific training for OWNER-assigned administrative, operations, technical, and maintenance personnel. The course shall be conducted during a standard 8-hour day. Classroom training will be augmented by field reinforcement of the instruction topics. All students shall be taught in a one-class session if possible. The training program will cover all related aspects of knowledge required by the individual disciplines to allow them to competently operate, troubleshoot, and maintain all plant processes and utility systems.

OWNER shall advise one month (30 calendar days) in advance the number of personnel attending each session. A training sign-up sheet shall document OWNER's personnel attendance and CONTRACTOR's instructor(s). CONTRACTOR shall submit proposed Training Schedule, Training Course Outline and Training Manual for OWNER's review at least fifteen (15) calendar days prior to the planned initial start of commissioning activities.

2.0 SITE-SPECIFIC TRAINING

This Program will encompass on-site training.

2.1 CONTRACTOR Responsibility

CONTRACTOR shall be responsible for:

2.1.1 Preparation of all classroom and training materials.

2.1.2 Scheduling and coordination of all classroom-training courses.

2.1.3 Provision of instructions, review, and on-the-job training of the students.

2.1.4 Coordination with OWNER of the training schedule to allow OWNER to conduct its own employee training.

2.1.5 Completion of training program scheduled close enough to the hands-on operating phase so that the material will remain fresh in the minds of the operating personnel.

2.1.6 Providing on-the-job training throughout the start-up and commissioning period. During this time, CONTRACTOR's personnel, as well as representatives from the equipment representatives, shall be available to advise, support, and coach the operating staff.

2.2 Types of Training

This Program will be based on the Plant Operating and Maintenance Manuals to be prepared by CONTRACTOR and equipment manuals to be furnished by equipment providers. Training sessions will be grouped into logically organized modules. A trainer experienced in the specific subject matter will present each of the training modules. Each trainee will be provided with a copy of the classroom materials and other training documentation. Larger drawings of the general arrangements and plot plans will be displayed for orientation and discussion.

2.2.1 Two types of training shall be provided:

2.2.1.1 PV System and SCADA System, performed by CONTRACTOR's engineering staff, or alternatively, a subcontractor selected by CONTRACTOR and approved by OWNER.

2.2.1.2 Vendor specific training during construction, system start-up or commissioning by the appropriate equipment supplier or his duly authorized factory representative.

Training will consist of classroom instruction, discussions, site walk downs and a procedure to verify that the learning objectives were accomplished.. CONTRACTOR's training instructors will discuss the overall photovoltaic power plant, while representatives from the equipment manufacturers will address their scope of work.

2.3 Training Topics

2.3.1 <u>PV Systems</u>

During this section, CONTRACTOR will describe the process and discuss the principles of operation for the photovoltaic power plant.

CONTRACTOR shall provide experienced instructors to conduct its training program, which shall consist of classroom sessions bolstered by system walk downs and examinations. The course curriculum shall include the PV system design. The following outline of topics shall typically be covered but not limited to:

A. Introduction
B. PV Systems
C. Utilities
D. Commissioning and Startup
E. SCADA Systems

2.4 Lesson Format

Each session shall typically include the following information:

- Lesson Objectives
- Design Basis and List of Resources
- System Overview with Drawings
- Component Description with Supporting Documentation (figures, tables, graphs, etc.)

2.5 Lesson Content

2.5.1 Lesson Objectives

The major information the student is expected to learn and retain from the lesson shall be presented. Referenced materials utilized in the training session shall be displayed. Listed references shall include page numbers in Manuals, diagram and/or drawing numbers, and related Specification section numbers. This amount of detail is necessary to document the regulatory requirements for training placed on OWNER. This shall include the need-to-know information, not the nice-to-know information. OWNER shall provide CONTRACTOR with all relevant regulatory requirements ninety (90) calendar days prior to the first PV energization date.

2.5.2 Design Basis and List of References

The design basis and reference documents shall be presented. The student is expected to learn and retain this information from the lesson.

2.5.3 System Overview with Drawings

This section shall include a brief description of the intended use of the system.

2.5.4 Component Description with Supporting Documentation

This section shall include information on the major components in the system. Tables, figures, drawings and design details shall also be provided.

2.5.5 Principles of Operation, Including Start-up and Shutdown Procedures

The various operational modes of the system and documents shall be presented, including.

- Operating Philosophy
- Start-up
- Normal Operation
- Normal and Emergency Shutdown

- Recognizing and Handling Abnormal Operating Conditions (Troubleshooting)

Trained OWNER's personnel will participate in the commissioning and start-up of OWNER's facility. Therefore, CONTRACTOR's training shall emphasize safety practices and precautions throughout the entire program with the associated "do's and don'ts".

2.5.6 Walk-downs

Walk-downs shall be conducted to familiarize the students with the physical location and appearance of equipment and to clarify equipment features, controls, and displays.

2.5.7 Examinations

Students shall be qualified on material presented in each session. All sessions shall be presented in an informal lecture style with each student having their own set of training material. Each student shall be encouraged to ask questions and to participate in group discussions. This shall be stated in the course objectives and expectations.

EXHIBIT FF

OWNER'S SAFETY POLICIES

See attached.

EAST KENTUCKY POWER COOPERATIVE

CONTRACTOR

SAFETY HANDBOOK

TARGET ZERO

Safety rules are your best tools

Rev Org 11/2013

EAST KENTUCKY POWER COOPERATIVE

To EKPC Contractors & Their Employees,

EKPC exists to serve its sixteen member-owner cooperatives by safely delivering reliable and affordable energy and related services. Those sixteen cooperatives serve 520,000 Kentucky homes, farms, businesses and industries across 87 counties. We appreciate the valuable support of our contractors and their employees in helping us to achieve our mission.

Several years ago EKPC embarked on a journey to create a culture of safety, a culture where everyone thinks about safety in everything they do. Safety is our number one priority. We care about the safety of our employees, our contractor's employees and the general public. It is our goal to be accident-free each and every day.

As part of safety initiatives EKPC created a "Contractor Safety Handbook" that contains important safety information relative to working at EKPC sites and facilities. Obviously, the information contained in the handbook is not all inclusive, nor is it intended to replace any legal obligations pertaining to our contractors or their employees. However, we do believe the information will assist you in successfully completing work at EKPC sites and facilities in a safe manner.

Should you have any questions or concerns with the information provided in our Contractor Safety Handbook, please contact your EKPC Project Coordinator, EKPC Safety Coordinator, or the EKPC Safety Manager.

Make working safely your choice, not a chance.

Sincerely,

Anthony L. Campbell

Anthony "Tony" Campbell
President & CEO

4775 Lexington Rd. 40391
P.O. Box 707, Winchester,
Kentucky 40392-0707

Tel. (859) 744-4812
Fax: (859) 744-6008
www.ekpc.coop

Table of Contents

1 General

1.1 EKPC Policy Statement *

At East Kentucky Power Cooperative (EKPC) safety is our number one priority. We want to make sure everyone working for EKPC is able to go home to their family at the end of the day in the same condition they arrived at work. To achieve our goal of an injury free workplace, everyone involved must do their part to keep themselves and those working around them safe. This manual is provided to help guide Contractors in working safely for EKPC.

Contractors working for EKPC must comply with all applicable federal, state, and local laws, codes, ordinances, administrative rules, court orders, permits or executable orders. This includes Kentucky and Federal OSHA, EPA, and DOT regulations.

The safety policies and rules set forth in this manual shall apply to all Contractors and Sub Contractors and their respective personnel engaged in performing construction, operation or maintenance activities for EKPC at EKPC sites and facilities.

The safety policies and rules set forth in this manual address potential hazards that may be encountered while working at or near EKPC facilities and establishes practices designed to eliminate or avoid those hazards.

The safety policies and rules set forth in this manual shall not replace the Contractor's own safety rules and policies. If there is a conflict between the two the most stringent shall apply.

The use of "will" and "shall" in this handbook are used interchangeably and signifies that the Contractor is required to abide by the policy.

Any questions or suggestions regarding this handbook should be directed to the EKPC Safety Manager.

1.2 EKPC's Five Safety Principles *

- Safety is our number one priority.
- EKPC will promote a safe, secure and healthy environment both at work and at home.
- EKPC will strive to create an environment empowering each individual to contribute toward an injury-free workplace.
- All employees are responsible for preventing safety incidents.
- All safety incidents are preventable and all hazards are controllable.

1.3 Alcohol and Drugs *

Unauthorized possession, use or sale of alcohol, licit or illicit drugs or controlled substances, or being under the influence of said substances, on EKPC premises, in EKPC vehicles, or while performing EKPC business is prohibited.

All Contractors are subject to random drug testing and subject to testing if drug use is suspected.

Any Contractor who refuses to participate in a drug test or who has a non-negative drug screen will be immediately removed from EKPC property. Drug possession will be reported to local authorities.

1.4 Smoking Policy *

It is the policy of EKPC to establish a work environment which will allow all persons to work free of tobacco smoke and its potentially harmful effects.

The smoking of tobacco products inside any enclosed EKPC facility or vehicle is prohibited.

Smoking shall only occur in areas designated by signage as an acceptable area.

Smoking or open flames are not permitted in areas such as oil, hydrogen, or acetylene storage areas, or similar areas where dangerous gases might be present. Smoking is not permitted in flammable liquid storage and use locations, or other areas where quantities of combustible materials are kept. The absence of "No Smoking" signs does not excuse smoking in dangerous places.

State, County and/or City ordinances that include more stringent rules than the ones listed in this document take precedence over this manual.

1.5 Weapons *

All persons coming onto EKPC's premises at any location are prohibited from personally carrying any concealed dangerous weapons of any sort. The term "weapon," as used in this policy, includes firearms, large knives, clubs, and other dangerous objects as defined in KRS ß§500.080 (4).

A Contractor may carry his/her weapon in his/her personal motor vehicle so long as the weapons are not removed from the vehicle or brandished while the vehicle is on the premises.

EKPC reserves the right to grant complete or partial exemptions from this policy if the circumstances warrant exception. Any exemptions will be at the sole discretion of EKPC. Any questions should be directed to the Contract Manager.

1.6 Access Cards / Badging *

At facilities that have badging systems, badges will be given to Contractors when they enter the site. Contractors at these sites are to have the badge in their possession and visible at all times. Badges are to be returned to EKPC when work is complete.

1.7 Personal Conduct *

Fighting, bickering, horseplay, sleeping on the job, failing to maintain acceptable personal appearance and hygiene, or committing any illegal act on EKPC premises is forbidden and may lead to disciplinary action including potential removal from the site. Illegal acts will be reported to the proper authorities.

1.8 House Keeping *

The Contractor is expected to maintain a clean work area at all times. Floors will be kept free of debris and fluids. Walkways will be kept clear. Floors, work stations, tools, materials and equipment will be clean, and free of debris, leaking fluid and graffiti. Materials and unused equipment will be stored neatly.

1.9 Material Disposal

All materials, both hazardous and not-hazardous shall be disposed of properly by the Contractor in compliance with all Federal, State and Local laws and regulations.

1.10 Use of Company Property *

EKPC property will not be used by a Contractor without the prior consent of EKPC. The Contractor must prove that they are experienced in the proper use of the tool or equipment before consent is given. The Contractor is responsible for any damages to or caused by the improper use of EKPC tools or equipment. For questions regarding use of EKPC property, please contact the Contract Manager.

1.11 Personal Protective Equipment *

The Contractor is responsible for using appropriate PPE per the work requirements.

1.12 Camera Use

All photography is prohibited without prior consent from EKPC.

1.13 Transport of Contractor Employees *

Vehicles will be operated within the legal speed limit and at lower speeds where conditions warrant. Drivers will obey posted traffic signs. Seat belts will be used when the vehicle is so equipped. Drivers will not permit anyone to ride on the running boards,

in the back of pickup trucks or hauling equipment, on fenders or any part of the vehicle except on the seats or inside the body walls. Passengers will not stand in moving vehicles. Contractors will not ride on trailers. Contractors will not jump on or off vehicles in motion. Any loose materials (trash, bottles, etc.) in the driver's compartment area should be secured or removed. Drivers will perform a visual inspection of the vehicle prior to operation of the vehicle.

1.14 Job Briefing

Before the start of each job the Contractor in charge will conduct and document a job briefing with their direct reports. The job briefing will at least cover hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements.

If the work or operations to be performed during the work day are repetitive and similar, at least one job briefing will be conducted before the start of the first job of each day or shift. Additional job briefings will be held if significant changes, which might affect the safety of the employees, occur during the course of the work.

A brief discussion is satisfactory if the work involved is routine and if the employee, by virtue of training and experience, can reasonably be expected to recognize and avoid the hazards involved in the job. A more extensive discussion will be conducted if the work is complicated or extremely hazardous, or the employee cannot be expected to recognize and avoid the hazards involved in the job.

A Contractor working alone need not conduct a job briefing. However, the Contractor will ensure that the tasks to be performed are planned as if a briefing were required.

Refer to OSHA Standards for required training.

1.15 Imminent Threat

Contractors will immediately notify the Cooperatives' System Operator of any issue that poses an imminent threat to an energized transmission line or any other EKPC facility.

The Contractor should first contact the system operator to report an imminent threat through use of a cell phone at **859-745-9300**. In the event that the System Operator cannot be contacted by cell phone, the Contractor may use the EKPC radio installed in all trucks. In the event that the Contractor is unable to communicate with the System Operator by cell phone or radio, the Contractor may contact the System Operator by satellite phone, if available, at the above number.

The Contractor will stand by and await further instruction from the System Operator pertaining to appropriate mitigation actions to be taken until the threat is relieved.

1.16 Incident Reporting *

Contractors shall promptly report in writing to EKPC all near misses, accidents or incidents, including property damage, arising out of or in connection with the work, giving full details and statements of any witnesses, pictures, and providing EKPC with a full and thorough investigation of the incident. Immediate notice shall be given to EKPC's Safety Manager at Headquarters or to the onsite Safety Coordinator for the specific facility.

1.17 Responding to Incidents & Medical Emergencies *

When an accident or medical emergency takes place, first take steps to isolate the hazard and provide First Aid if necessary. Only move those injured if there is an immediate danger. If no one is immediately available to administer First Aid, contact dispatch or the local control room to request assistance. Once any immediate medical concerns are addressed, contact dispatch or local control room (if you haven't already done so), so that they can call for an emergency response, notify appropriate personnel, and start the process of documenting the incident.

Dispatch	859-745-9300
Cooper Station	606-561-4138 x 220
Spurlock Station	606-883-3166 x 600
Smith Station	859-745-4157 x 310
Dale Station	859-527-3138 x 203

1.18 Hazardous Material Communications *

To reduce the risks of working with hazardous materials, manufacturers of hazardous materials are required to convey hazard information to the users of their products. This information is contained in Safety Data Sheets (SDS) and in container labeling. At EKPC, SDS information is maintained at the facility where the material is to be used. Dispatch will also maintain SDS information for materials in use in the system.

SDS information will be available to Contractors working at EKPC facilities. Also, Contractors will make SDS information available to EKPC within seven (7) days prior to commencing work at EKPC for chemicals or hazardous materials they plan to bring on EKPC facilities and sites.

Contractors will not use and/or transfer materials in unlabeled containers. Contractors will are to report unlabeled containers and containers with damaged labels to their supervisor/foreman. Contractors should never mix hazardous substances unless it is explicitly required for use. Contractors will take special precautions when working on or around unlabeled pipes. Hazardous material spills shall be immediately reported to the

Contractor's Supervisor/Foreman and appropriate EKPC personnel. Contracted employees are not to engage in clean up or control of the spill unless properly trained and wearing the proper personal protective equipment.

Additional information concerning the requirements, refer to handling hazardous materials contained in OSHA standards 29 CFR 1910, Subpart Z, and 29 CFR 1910.120.

1.19 OSHA Inspection Procedures

A representative from EKPC must accompany OSHA personnel during inspections of the work site. Also, as required by OSHA, each Contractor will select a representative(s) to accompany the OSHA compliance officer during site inspections.

The EKPC representative must examine the OSHA officer's credentials prior to the start of any onsite inspection. At all times while onsite, OSHA representatives shall be treated in a courteous and cooperative manner.

1.20 Assurance of Training

Contractors will be trained and competent in the skills and techniques necessary to properly and safely perform their job assignments.

1.21 Energized Work

Only qualified Contractors may work on or with exposed energized lines or parts of equipment. Only qualified Contractors may work in areas containing unguarded, un-insulated energized lines or parts of equipment operating at 50 volts or more.

1.22 Ground Fault Protection

Tools connected to a central power supply, including portable and vehicle-mounted generators (not isolated) and are not double-insulated will be protected by a Ground Fault Interrupter (GFI) or by an "assured grounding system." For more information, refer to current OSHA GFI standards.

1.23 Confined Space Entry

Contractors who enter confined spaces or who serve as attendants will be trained in the hazards of confined space entry, confined space entry procedures, and confined space rescue procedures.

1.24 Power Equipment

Power equipment includes motorized, electrical or battery powered tools, equipment, and vehicles. The Contractor will follow equipment manufacturer's rules, specifications, and requirements including the use of any necessary PPE. Contractors will be trained in the proper use of the equipment.

1.25 Hot Work

Any activity that creates sparks or involves an open flame, such as welding, cutting or grinding requires that a Hot Work Permit be filled out and posted at the job site. The Contractor will abide by the guidelines listed as part of the permit. Hot work Permits can be obtained from Maintenance Supervisors.

1.26 Excavating & Trenching

The Contractor will call 811 at least two days prior to digging and have underground utilities marked. Refer to OSHA standards 29 CFR 1926.650, 29 CFR 1926.651, and 29 CFR 1926.652.

1.27 Flammable Liquids

When pouring or pumping gasoline and or other flammable liquids from one container to another; metallic contact (grounding) will be maintained between the pouring and receiving containers.

All flammable solvents will be kept in UL listed approved safety cans. Make sure all cans are properly labeled per 1910.1200 the Hazard Communication standard. Refer to OSHA standards 29 CFR 1926.152

1.28 Explosives

Explosives will not be used without prior consent from the EKPC area manager. Explosives will only be handled and used by a qualified and licensed person as specified in OSHA, Part1926, Subpart U, Blasting and Use of Explosives.

1.29 Asbestos

All building insulating materials will be treated as PACM (Presumed Asbestos Containing Material) unless it has been replaced and marked as Non-Asbestos Containing Material or the material has been sampled, tested, analyzed and marked as Non-Asbestos Containing Material.

Refer to OSHA standards 29 CFR 1926.1101

1.30 Lead

All paint is to be treated as lead containing paint unless documentation has been obtained stating that the paint is non-lead based or it has been sampled, tested, analyzed and deemed to be non-lead based.

Permissible exposure limits will not be exceeded. Monitoring for lead levels will be conducted in compliance with existing regulations.

Engineering and work practice controls will be used to minimize lead exposure. The Contractor will use respiratory protective equipment or other personal protective equipment in accordance with existing regulations.

1.31 Blood-Borne Pathogens

If an injury creates a potential exposure to blood, the blood should be treated as infected and steps taken to protect others from the exposure. This includes use of proper PPE such as gloves, protective eyewear, and a one-way ventilation device or rescue bag.

Steps will be taken to properly clean up and properly dispose of any blood contaminated items. Dispose of all contaminated items in a "hazard waste" receptacle.

Contractors shall contact the local EKPC safety coordinator for appropriate response.

1.32 Signs & Labels *

Contractors will be responsible for posting and removing signs at prominent points to alert persons of work zones or specific hazards that may lead to accidental injury or workers or the public, or both, or to property damage. Contractors will be aware of posted danger and warning signs and obey all posted safety instructions.

All signs will be designed with rounded or blunt corners and be free from sharp edges, burrs, splinters, or other sharp projections.

Danger signs indicate immediate danger and special precautions are necessary. Danger signs will consist of opaque glossy colors of red, black, and white.

Caution signs indicate a possible hazard against which proper precaution will be taken. All signs will be posted in accordance with ANSI standards.

1.33 Ladders

The Contractor will make sure that ladders being used meet OSHA requirements. Ladders will be inspected regularly by Contractor. Damaged ladders will not be used and should be tagged "CAUTION – DO NOT USE" until repairs are made and inspected by an authorized person.

Refer to OSHA standards 29 CFR 1917 119.

1.34 Scaffolding

Scaffolding shall be constructed and inspected by qualified persons per State, Federal, and local regulations.

Refer to OSHA standards 29 CFR 1910.28.

1.35 Barricades

Work areas shall be “roped off” at locations where hazardous work is being performed or dangerous conditions exist. This is especially important in substations, switching structures or in power plants where there is a possibility of confusion from arrangement of similar pieces of equipment. Yellow and black tape, rope with tags or signs, or snow fence shall be used for this purpose.

Mark or tag barricades with the company name, foreman’s name and cell phone number. An unauthorized Contractor will not enter a barricaded area without first contacting the foreman who roped off the area to determine the hazards in the area and to receive permission to enter the roped off area.

1.36 Hoisting Equipment & Rigging

All rigging equipment will be sufficient strength, proper type, and safe for its intended use. Make sure rigging equipment is not loaded beyond its rated capacity. Before each use, all slings, fastenings, and attachments will be inspected for damage or defects by a qualified person. Damaged or defective equipment will be immediately removed from service.

1.37 Hand Tools

All tools used by Contractor, will be of an approved type and maintained in good condition. Tools are subject to inspection at any time. EKPC has the authority to condemn unserviceable tools, regardless of ownership.

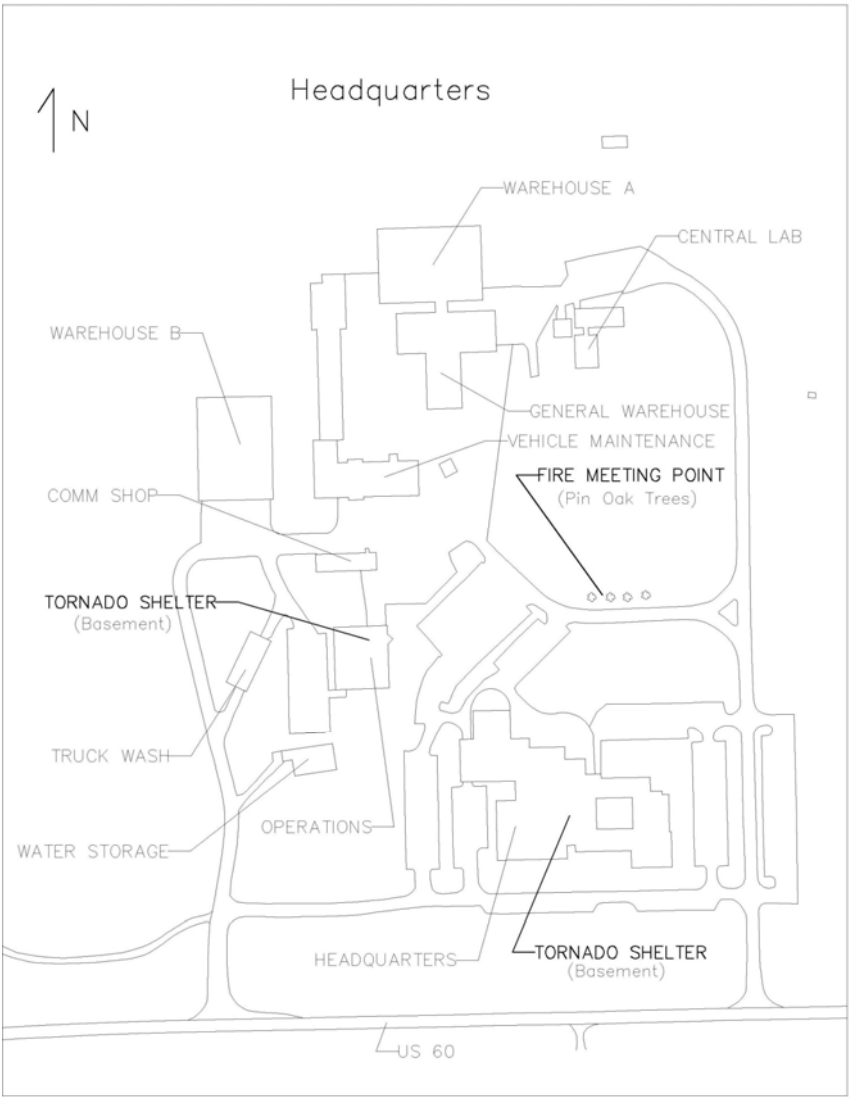
Defective tools will be tagged to prevent their use or will be removed from the jobsite. Always use the proper tool for the job being performed.

1.38 Language Requirements

The Forman or lead for each work crew will be English speaking. The English speaking person must be able to speak the language of the other non-English speaking persons in the crew and be able to act as a translator for the non-English speaking persons.

2 Headquarters

2.1 Site Map



2.2 Responding to Emergencies/Incidents

For any emergency, please call Dispatch and report the emergency – **1-859-745-9300**

2.3 Fire/Evacuation

EKPC has an automatic alarm system that is activated if fire or abnormal conditions are detected. In the event a fire is observed and the fire alarm system has not sounded, pull the handle down on the closest fire alarm station. When the alarm system is activated the Fire Department will automatically be notified.

At the sound of the building alarm, all Contractors shall adhere to the color-coded evacuation plan posted by all exterior doors in a quick and orderly manner. During required periodic testing of system, the incident will be announced over the PA system and no evacuation will be necessary.

In case an alarm is sounded, the following actions will provide a safe exit:

1. **DO NOT USE THE ELEVATOR! DO NOT CALL THE RECEPTIONIST**!
2. Thoroughly familiarize yourself with the color-coded evacuation plan and use the evacuation route for your particular area.
3. Leave the building in a quiet, orderly fashion as quickly as possible. **DO NOT RUN!** Proceed at least 150 feet from the building (walking trail). **Follow walking trail (use caution when crossing roads) to the area around the pin oak trees between the Headquarters Building and Central Lab.** Project Managers will account for each Contractor during this process.
4. Generally, do not attempt to determine the location, cause or severity of the fire. However, if the fire is small in nature in your area and can be extinguished by nearby extinguishers, you can attempt to do so. Report use of any fire extinguisher to the HQ Facilities Supervisor.
5. **DO NOT ENTER** the enclosed courtyard area in the center of the building.
6. Close all vault doors before leaving areas where vaults are located.
7. **Efforts should be made to provide assistance for Contractors, employees, and visitors with disabilities.**
8. Allow fire doors to close as they are designed to do. **DO NOT BLOCK OPEN.**
9. Allow outside doors to close as they are designed to do. **DO NOT BLOCK OPEN.**
10. The HQ Facilities Supervisor or designee will ensure that no persons are trapped in the elevator, and if so, will take necessary steps to extricate persons that may be on the elevator. The elevator will then be de-activated.
11. No person is to re-enter the building until a member of the Facilities Team gives the all-clear signal.

2.4 Tornado Procedures

In the event of a tornado warning, move to the center of an interior room on the lowest level (closet, interior hallway) away from corners, windows, doors, and outside walls.

Put as many walls as possible between you and the outside. Get under a sturdy table and use your arms to protect your head and neck.

If in a vehicle, try to reach sturdy shelter. If your vehicle is hit by flying debris while you are driving, pull over and park. Stay in the car with the seat belt on. Put your head down below the windows; cover your head with your hands and a blanket, coat or other cushion if possible. If you can safely get lower than the level of the roadway, leave your car and lie in that area, covering your head with your hands. Watch out for flying debris. Flying debris from tornadoes causes most fatalities and injuries.

2.5 Earthquake Procedures

If indoors, take cover under sturdy furniture and stay near the center of the building. Stay away from glass windows, doors, display cabinets, bookcases, etc. Do not run for the exit as the stairs may be broken or jammed with people. Do not use the elevators.

If outdoors, move to an open area away from building, utility wires, trees, etc.

If driving a vehicle, stop as quickly as safety permits while avoiding overpasses and power lines. Remain in the vehicle until the shaking stops.

2.6 Emergency Medical

1. Provide first aid and medical care:

   The most important and immediate tasks are rescue operations, medical treatment for the injured, and prevention of further injuries. Assist the injured parties or obtain help if needed. Follow the appropriate emergency response notification procedures or call 911.

2. Isolate the area to prevent more injuries or to avoid increasing the hazard:
   It may be necessary to isolate the location of the injury to prevent other injuries. For example, if a machine or device was involved in the accident, this item should be evaluated and/or examined prior to resuming work. It may be necessary to "lock-out" or "tag-out" the item until it can be evaluated.

3. Notify the Project Manager:
   The Contractor will immediately notify the Project Manager.

2.7 Fire Prevention/Protection

Contractors will familiarize themselves with the emergency exits, alarm signals, and escape procedures when working inside a building or structure.

In buildings or structures, all fire exits and escape routes will be visibly marked and be kept free of obstructions. Fire exits or doors will not be locked, chained, or barricaded at any time.

Combustible materials such as oil soaked rags, waste, and shavings will be kept in an approved metal container with a metal lid. These containers will be emptied daily.

Flammable liquids will not be used for general cleaning purposes.

When pouring or pumping gasoline and or other flammable liquids from one container to another; metallic contact (grounding) will be maintained between the pouring and receiving containers.

All flammable solvents will be kept in UL listed approved safety cans. All cans will be properly labeled per 1910.1200 the Hazard Communication standard.

2.8 Lockout/Tagout

The Contractor will follow EKPC procedures and will always coordinate equipment emergency source isolation through EKPC contract coordinator. **Failure to follow LOTO procedures may result in immediate dismissal from EKPC property.**

2.9 Security

EKPC HQ has perimeter fencing and 2 marked entrances. EKPC grounds are patrolled by security guards. Video cameras are installed throughout various locations on EKPC grounds. Contractors are subject to search and/or seizure at the request of EKPC.

2.10 Traffic Rules and Parking

All local traffic rules will be obeyed. Follow speed limit and stop signs as posted.

2.11 Sanitary Facilities

Use of restrooms is to be determined by the Project Manager, according to the type of work being performed (inside, outside, etc…).

2.12 Air Contaminates (Asbestos and Lead)

Asbestos - All building insulating materials shall be treated as PACM (Presumed Asbestos Containing Material) unless it has been replaced and marked as Non-Asbestos Containing Material or the material has been sampled, tested, analyzed and marked as Non-Asbestos Containing Material.

Only those Contractors who have been properly trained and equipped with the necessary personal protective equipment shall handle asbestos.

For additional information concerning asbestos requirements, refer to OSHA standard 29 CFR 1910.1001 and the Environmental Protection Agency's Worker Protection Rule 40 CFR 763.

Lead - All paint is to be treated as lead containing paint unless documentation has been obtained stating that the paint is non-lead based or it has been sampled, tested, analyzed and deemed to be non-lead based.

Refer to OSHA standards 29 CFR 1910.1025 and 29 CFR 1926 for more information on lead exposure.

2.13 Monitoring

Contractors will be responsible for monitoring individual work areas which have the potential for air contaminants.

2.14 Medical Examinations

Contractors exposed to contaminants while working on EKPC sites will have a medical exam. Contractor will coordinate with Project Manager for details.

2.15 Compressed Gases

Procedures and instructions outlined in this section are intended to provide a general knowledge of safe, effective methods of handling, storing, and using compressed gases and their containers. This section is covered by OSHA standards CFR 1910.101 - 105, .110 and .111. For additional information, refer to 29 CFR 1926.350 - .354

This section also deals with electric welding, gas welding, and cutting operations common to each process.

These procedures are covered by OSHA standards 29 CFR 1910.251, .252, .253, .254, and .255. Refer to 29 CFR 1926.350 - .354

3 Transmission Line and Right of Way

3.1 Working On or Near Exposed Energized Lines and Equipment

Only qualified Contractors as defined by OSHA may work on or near exposed energized conductors or other electrical equipment.

All non-qualified Contractors as defined by OSHA working near energized conductors shall maintain the following minimum clearances from energized conductors and equipment (numbers expressed are phase to ground):

1) For lines and equipment energized at 50kV or less, the minimum clearance distance is 10 feet.
2) For lines and equipment energized at more than 50 kV, the minimum clearance is 10 feet plus 4 inches for every 10 kV over 50 kV.

3.2 Dispatching and Clearances

Contact dispatch to have EKPC perform all actions necessary to obtain the appropriate clearances and Hold Carding of Transmission Line Facilities. A Hold Card shall be attached to each switch that is providing clearance on a cleared line or apparatus.

Contractors shall ensure that the handles of switches providing clearances for working on lines or apparatus shall be locked open or closed in addition to being Hold Carded.

Contractor shall ensure that under no circumstances shall Hold Cards be removed or the line or apparatus put in service until so ordered by the person for which the Hold Card was placed.

3.3 Emergency Procedure

Be sure you know your location (City or County and can describe your exact location for EMS/Fire or Police).

Use 911 in areas where it exists, or call the operator outside of 911 areas for emergencies.

4 Substation

4.1 Working On or Near Exposed Energized Lines and Equipment

Only qualified Contractors as defined by OSHA may work on or near exposed energized conductors or other electrical equipment.

All non-qualified Contractors as defined by OSHA working near energized conductors shall maintain the following minimum clearances from energized conductors and equipment (numbers expressed are phase to ground):

1) For lines and equipment energized at 50kV or less, the minimum clearance distance is 10 feet.
2) For lines and equipment energized at more than 50 kV, the minimum clearance is 10 feet plus 4 inches for every 10 kV over 50 kV.

4.2 Working in Substations

Non-authorized personnel shall not enter substations, electrical equipment rooms or enclosures unless they have been authorized by EKPC.

Electric equipment, lines, and circuits shall be considered energized until locked and tagged per EKPC LOTO procedures.

Metal ladders shall not be used in substations.

When carrying long, conductive material, tools or equipment in energized areas of substations, they shall be held by at least two individuals, one at each end and carried below shoulder height.

Steel tapes and rulers shall not be used in the energized areas of a substation. Fish tapes and steel tapes may be used on or below ground. Extreme caution shall be used when working in areas of energized underground cables.

Before driving a vehicle into a substation, the driver shall check the overhead clearance of the vehicle (e.g. radio antenna, boom, and basket) to prevent contact with low lines or other structures, or any energized equipment.

Movement and operation of mechanical equipment within hazardous areas must be controlled by a qualified person and at all times shall maintain safe clearances to energized bus and equipment.

4.3 Gate Entrance Procedures

When entering a substation, and before leaving, all entrants shall notify the EKPC system operator (859-745-9300) of their entrance into the station and their departure.

When entering a substation where work is in progress, you must report your presence to the person(s) in charge for a job briefing.

Gates to substations shall be kept closed and locked when authorized personnel are not in the substation.

When authorized personnel are working in the substation and the gate is not in view of the authorized personnel, the gate shall be kept closed and latched.

Doors to enclosures (other than control cabinets) containing exposed energized electrical equipment shall be kept closed and locked, or equipment shall be barricaded.

Contractor must make arrangements with their EKPC contact for entrance to the substation. Substations are normally unattended. Before entering in a substation, all Contractors must satisfactorily complete EKPC's substation orientation program.

4.4 Substation Barriers and Barricades

All barriers, barricades and warnings signs shall be heeded. No one shall enter a barricaded area without permission.

4.5 Emergency Procedure

Be sure you know your location (City or County and can describe your exact location for EMS/Fire or Police).

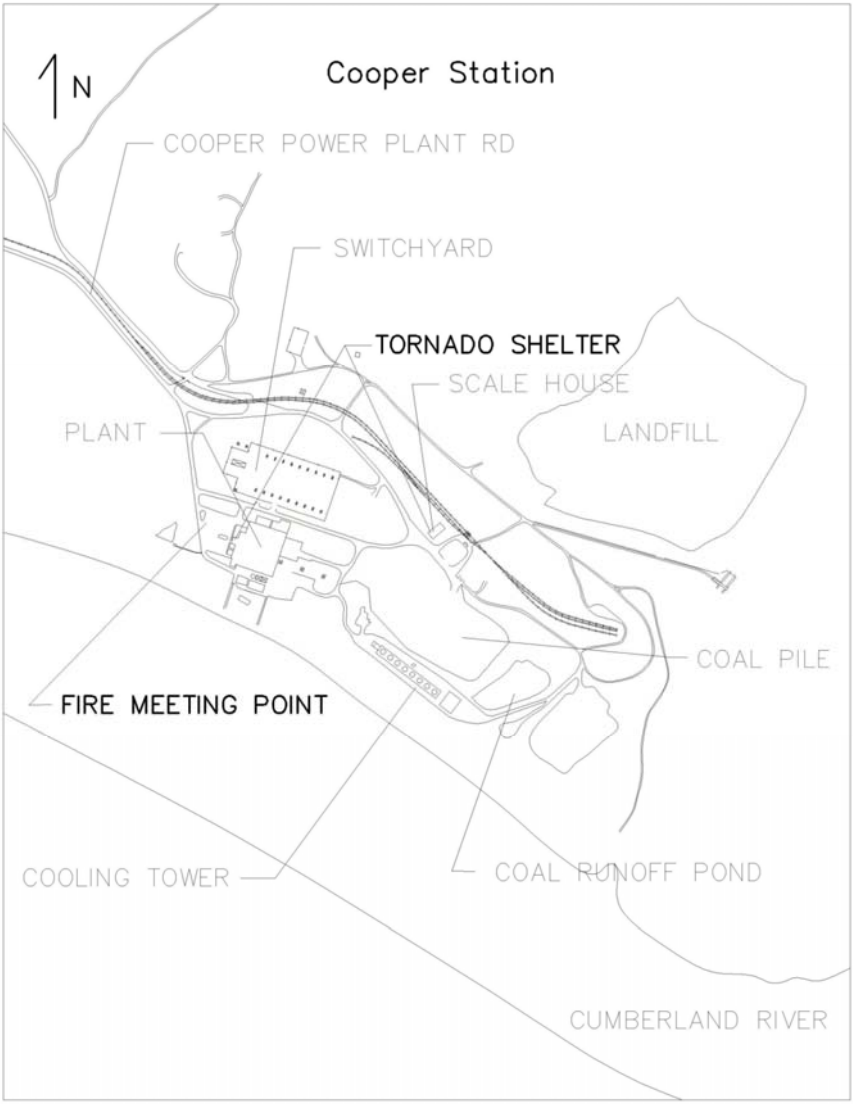
Use 911 in areas where it exists, or call the operator outside of 911 areas for emergencies.

4.6 No Smoking Policy

Smoking is not permitted in EKPC substation control buildings.

5 Cooper Power Plant

5.1 Site map



5.2 Responding to Incidents & Medical Emergencies

When reporting an emergency, call the Control Room,

- **Dial Number: (606) 561-4138 or ext. 220**

When an incident or medical emergency takes place, first take steps to isolate the hazard and provide First Aid if necessary. Only move those injured if there is immediate danger. If no one is immediately available to administer First Aid, contact the Control Room at **(606) 561-4138 or ext. 220** to request assistance. Once any immediate medical concerns are addressed, contact the Control Room so they can call for an emergency response, notify appropriate personnel, and start the process of documenting the incident.

Emergency Phone Numbers (dial 9 to get an outside line):

- **Dial Number:** 9-1-1 Dispatch Center (E.M.S., Fire Dept., Law Enforcement Agency)
- **Dial Number:** (606) 679-7441 Lake Cumberland Regional Hospital
- **Dial Number:** (606) 878-6622 Kentucky State Police (London Post)

5.3 Fire Procedures

When reporting an emergency, call the Control Room,

- **Dial Number: (606) 561-4138 or ext. 220**

If a fire is discovered try to contain the fire if possible. In the fire cannot be contained or the smoke alarm sounds exit the building. If smoke or fire is blocking your way find a second way out. If you must escape though smoke, get low and go under the smoke. Before opening a door, feel the doorknob and door. If either is hot, leave the door closed and use your second way out. If there is smoke coming around the door, leave the door closed and use your second way out. If you open a door, open it slowly. Be ready to shut it quickly if heavy smoke or fire is present.

Once outside, contact EKPC Control Room at **(606) 561-4138 or ext. 220.** Tell the emergency operator where the fire is located especially if calling from a cell phone.

If you can't get out, close the door and cover vents and cracks around doors with cloth or tape to keep smoke out. If your clothes catch fire, stop, drop, and roll – stop immediately, drop to the ground, and cover your face with your hands. Roll over and over or back and forth until the fire is out. If you or someone else cannot stop, drop, and roll, smothers the flames with a blanket or towel. Use cool water to treat the burn immediately for 3 to 5 minutes. Cover with a clean, dry cloth. Get medical help right away by calling 9-1-1 or the fire department.

5.4 Tornado Procedures

In the event of a tornado warning move to the center of an interior room on the lowest level (closet, interior hallway) away from corners, windows, doors, and outside walls. Put as many walls as possible between you and the outside. Get under a sturdy table and use your arms to protect your head and neck. If you are working outside and in the event of a tornado warning you will be directed to go to the coal yard maintenance building, coal yard coal tunnel or the plant lunch room and adjoining rooms depending on your location.

If in a vehicle, try to reach sturdy shelter. If your vehicle is hit by flying debris while you are driving, pull over and park. Stay in the car with the seat belt on. Put your head down below the windows; cover your head with your hands and a blanket, coat or other cushion if possible. If you can safely get lower than the level of the roadway, leave your car and lie in that area, covering your head with your hands. Watch out for flying debris. Flying debris from tornadoes causes most fatalities and injuries.

5.5 Earthquake Procedures

If indoors take cover under sturdy furniture and stay near the center of the building. Stay away from glass windows, doors, display cabinets, bookcases, etc. Do not run for the exit as the stairs may be broken or jammed with people. Do not use the elevators. If outdoors move to an open area away from building, utility wires, trees, etc. If driving a vehicle, stop as quickly as safety permits while avoiding overpasses and power lines. Remain in the vehicle until the shaking stops.

5.6 Emergency Evacuation Procedure

Control Room Operator will sound the Emergency Alarm. Follow the nearest and best exit out and away from the hazard or structure. Each Supervisor on duty shall be responsible for the accounting of his/her personnel. Move away from the structure, look at the wind to determine wind direction and evacuate accordingly - primary evacuation point is the construction parking lot; if wind is blowing in that direction, go up wind or 90 degrees from that.) Report a **"HEAD COUNT"** to your supervisor. Do not block roadway or driveway. Stay at the assembly area until instructed otherwise. When the **"ALL CLEAR ALARM"** is sounded, you may return to your work station.

5.7 Aqueous Ammonia

In the event of spill, evacuate the immediate area, move upwind of the spill, and contact the Control Room.

- **Dial Number: (606) 561-4138 or ext. 220**

5.8 Fire Prevention/Protection

Contractors will familiarize themselves with the emergency exits, alarm signals, and escape procedures when working inside a building or structure. In buildings or structures, all fire exits and escape routes will be visibly marked and be kept free of obstructions. Fire exits or doors will not be locked, chained, or barricaded at any time. Combustible materials such as oil soaked rags, waste, and shavings will be kept in an approved metal container with a metal lid. Flammable liquids will not be used for general cleaning purposes. When pouring or pumping gasoline, or other flammable liquids from one container to another, metallic contact (grounding) will be maintained between the pouring and receiving containers. All flammable solvents will be kept in UL listed approved safety cans. All cans will be properly labeled per Hazard Communication Standard KY OSHA 29 CFR 1910.1200.

5.9 Lockout Tagout

Each EKPC facility will ensure that all Contractors are trained and informed on the procedures for Lock Out / Tag Out. A copy of the lock out / tag out procedure is located in the Standard Operating Procedures Manual for Cooper Station or with the Lock Out - Tag Out Authority / Shift Supervisor.

5.10 Security

EKPC's power plant sites have perimeter fencing and a controlled entrance manned by security guards. EKPC's power plant sites are patrolled by security guards as well as EKPC plant operators. Video cameras are installed throughout various locations on EKPC grounds.

5.11 Traffic Rules and Parking

A designated parking lot is provided for Contractor employee parking. The only vehicles allowed beyond this lot are those required for work, deliveries, and the superintendent's vehicle. These vehicles are required to have a pass issued by the EKPC office. Vehicles and equipment are subject to inspection upon departure from the plant grounds.

5.12 Sanitary Facilities

A wash sink will be provided by EKPC in the main building. Potable water is available at the cooler fill stations and drinking fountains. Any additional facilities required will be the Contractor's responsibility. Use of EKPC facilities will be strictly prohibited.

5.13 Respiratory Requirements

The following standards outline the requirements for our Respiratory Protection Program. It delineates the proper responsibilities and provides selection criteria in

determining respiratory protection. The pertinent standards 29 CFR 1910.134, CFR 1926.103 and Z88.2 require that respirators be provided by the vendor or employer (Contractor). The requirements for a minimal program that is acceptable must comply with these standards. EKPC requires all companies to furnish the proper PPE and ensure that their employees have been tested, trained, and are physically able to wear the proper respirators while performing work.

5.14 Air Contaminants and Exposure Limits

Some air contaminants have been shown to be a cancer risk. Exposure to airborne concentrations above the established Permissible Exposure Limit's (PEL) without appropriate respiratory protection may cause lung cancer and be a skin irritant. They may also affect other body parts if swallowed. Arsenic, cadmium, and lead, as well as other hazardous contaminates may be found in the plant. Follow the appropriate OSHA standards relating to air contaminate when the potential of exposure is possible.

Regulated Areas are areas above the PEL, or of unknown concentration for any known contaminants. Contractors are responsible for working with EKPC safety personnel to identify affected areas. Contractor shall indicate and regulate entry into affected areas with appropriate signage.

5.15 Monitoring

Contractors will be responsible for monitoring individual work areas which have the potential for air contaminants.

5.16 Crane Operations

EKPC requires that only designated, qualified and trained operator shall be permitted to operate cranes.

Weather conditions must be taken into consideration during any lift. Wind speed and lightning are two conditions that must always be considered. Other conditions include extreme cold weather and visibility. When weather conditions for making a lift put employees or facilities at risk, the work must be suspended.

Wind conditions: When wind speed approaches 20 mph consideration must be given to either halt the operations or reduce the crane capacity (refer to crane operating manual). Load weight, in relation to crane capacity, the physical shape of the load, and the length of the boom, are all factors that must be taken into consideration. The operator and supervisor must use sound judgment when wind speed approaches 20 mph and above.

Lightning Conditions: Lightning is potentially hazardous to persons in the area of crane operations. Whenever thunder is heard, the potential for a lightning strike exists. The operator and supervisor must use sound judgment when an electrical storm

approaches. Grounding of the crane may reduce but will not eliminate the danger to personnel should a lightning strike occur.

Operating parameter will include but are not limited to the regulations contained in the ASME B.30.5 Standard, OSHA Construction Standards (1926.550). OSHA general Industry (1910.180, manufacture instructions, and company safety regulations.

5.17 Compressed Gases

Do not let cylinders come in contact with energized conductors or ground wires from electrical equipment. Never tamper with safety relief devices designed as part of the cylinder. Never force connections that do not fit. Never use damaged, defective or leaking cylinders. Move such cylinders outdoors and away from sources of ignition and notify the supervisor or foreman immediately. Never use a flame to detect flammable gas leaks. Never mix gases in a cylinder or transfer gas from one cylinder to another.

Take care in handing gas cylinders. Do not drop, jar or use cylinders as rollers to move objects. Do not hoist cylinders with a sling or electric magnet and do not lift cylinders by the protection cap. Use a lifting cradle, boat or platform for hoisting cylinders. Use a truck, cart, chain or other holding device to keep cylinders from falling over while in use. Cylinders must have their contents properly identified.

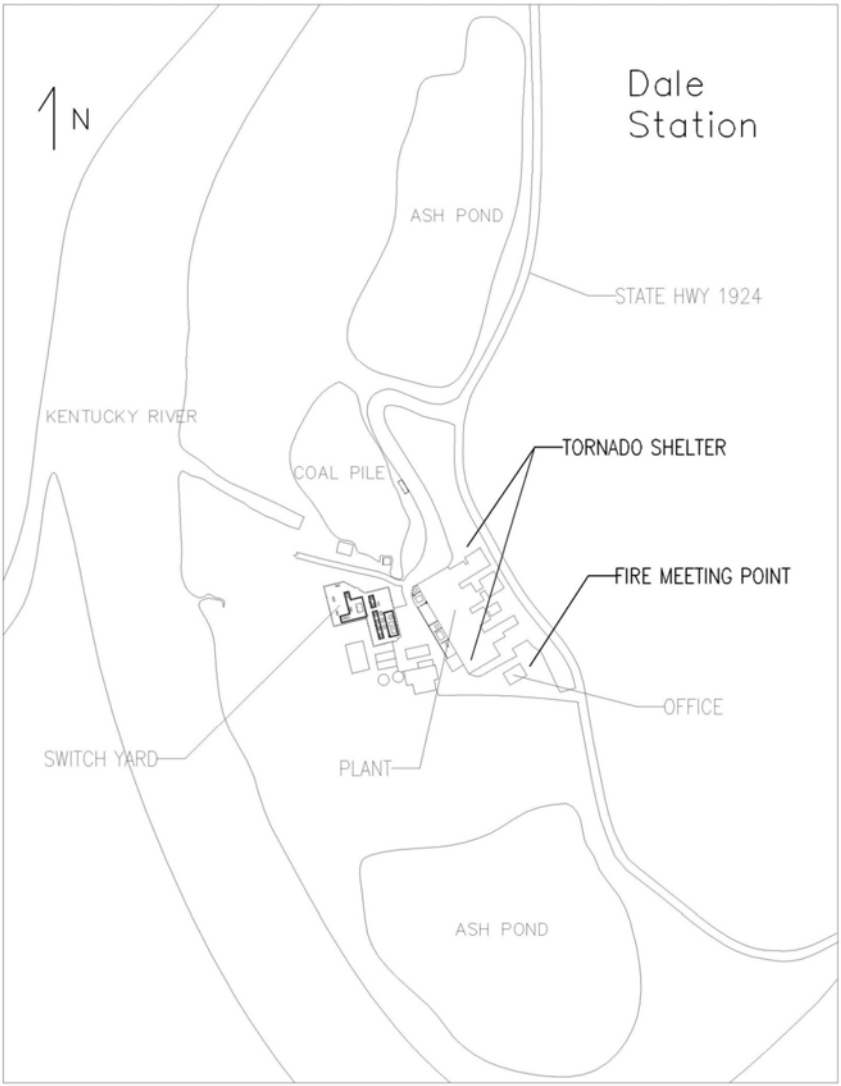
Store compressed gas cylinders, including empty cylinders, in an upright secured position. Valve protection caps should be kept in place except while regulators and hoses are attached. Caps should only be installed hand tight. Store gas cylinders away from heat, welding, and cutting operations where sparks will not reach them. Do not store oxygen cylinders near highly combustible materials like gasoline, oil, and grease. Store cylinders containing chlorine, propane and/or hydrogen; in isolated, well ventilated, fire-proof areas. Empty cylinders must be marked “Empty” or “MT”, and segregated from full cylinders with all valves closed and protection caps in place. Protect cylinders from the ground to prevent rusting. Hydrogen storage area should be marked as “Hydrogen – Flammable Gas – No Smoking – No open Flames” or equivalent and a sign with “Danger – No Smoking, Matches, or Open Lights” should be used in work areas where fuel gas is used or stored.

5.18 Minimum Approach Distance

Contractors will follow applicable OSHA, NESC and any other regulations specific to the Work relating to approach distances to unguarded or exposed energized parts.

6 Dale Power Plant

6.1 Site map



6.2 Responding to Incidents and Medical Emergencies

When reporting an emergency, call the Control Room,

- **Dial Number: (859) 527-3138 ext. 203**

When an incident or medical emergency takes place, first take steps to isolate the hazard and provide First Aid if necessary. Only move those injured if there is immediate danger. If no one is immediately available to administer First Aid, contact the control room at **(859) 527-3138 ext. 203** to request assistance. Once any immediate medical concerns are addressed, contact local control room so they can call for an emergency response, notify appropriate personnel, and start the process of documenting the incident.

Emergency Phone Numbers (Dial 9 to get an outside line):

- **Dial Number:** 9-1-1 Dispatch Center (E.M.S., Fire Dept., Law Enforcement Agency)
- **Dial Number:** (859) 745-3500 Clark Regional Hospital
- **Dial Number:** (859) 623-2404 Kentucky State Police (Richmond Post)

6.3 Fire Procedures

When reporting an emergency, call the Control Room,

- **Dial Number: (859) 527-3138 ext. 203**

If a fire is discovered try to contain the fire if possible. In the fire cannot be contained or the smoke alarm sounds exit the building. If smoke or fire is blocking your way find a second way out. If you must escape though smoke, get low and go under the smoke. Before opening a door, feel the doorknob and door. If either is hot, leave the door closed and use your second way out. If there is smoke coming around the door, leave the door closed and use your second way out. If you open a door, open it slowly. Be ready to shut it quickly if heavy smoke or fire is present.

Once outside, call the control room at **(859) 527-3138 ext. 203**. Tell the emergency operator where the fire is located especially if calling from a cell phone.

If you can't get out, close the door and cover vents and cracks around doors with cloth or tape to keep smoke out.
If your clothes catch fire, stop, drop, and roll – stop immediately, drop to the ground, and cover your face with your hands. Roll over and over or back and forth until the fire is out. If you or someone else cannot stop, drop, and roll, smothers the flames with a blanket or towel. Use cool water to treat the burn immediately for 3 to 5 minutes. Cover with a clean, dry cloth.

6.4 Tornado Procedures

In the event a tornado warning alarm is sounded move to the center of an interior room on the lowest level (closet, interior hallway) away from corners, windows, doors, and outside walls. Put as many walls as possible between you and the outside. Get under a sturdy table and use your arms to protect your head and neck.

If you are inside the plant, move to the basement of the plant on the southeast end of the building. If you are in the coal yard when the alarm is sounded go to the underground conveyor tunnels. If you are in the Filter Plant, move to that basement.

If in a vehicle, try to reach sturdy shelter. If your vehicle is hit by flying debris while you are driving, pull over and park. Stay in the car with the seat belt on. Put your head down below the windows; cover your head with your hands and a blanket, coat or other cushion if possible. If you can safely get lower than the level of the roadway, leave your car and lie in that area, covering your head with your hands. Watch out for flying debris. Flying debris from tornadoes causes most fatalities and injuries.

6.5 Earthquake Procedures

If indoors take cover under sturdy furniture and stay near the center of the building. Stay away from glass windows, doors, display cabinets, bookcases, etc. Do not run for the exit as the stairs may be broken or jammed with people. Do not use the elevators. If outdoors more to an open area away from building, utility wires, trees, etc. If driving a vehicle stop as quickly as safety permits while avoiding overpasses and power lines. Remain in the vehicle until the shaking stops.

6.6 Emergency Evacuation Procedure

Control Room Operator will sound the Emergency Alarm. Follow the nearest and best exit out and away from the hazard or structure. Each Supervisor on duty shall be responsible for the accounting of his/her personnel. Move away from the structure, look at the wind to determine wind direction and evacuate accordingly - primary evacuation point is the office parking lot and the coal yard parking lot; if wind is blowing in that direction, go up wind or 90 degrees from that.) Report a **"HEAD COUNT"** to your supervisor. Do not block roadway or driveway. Stay at the assembly area until instructed otherwise. When the **"ALL CLEAR"** is sounded, you may return to your work station.

6.7 Fire Prevention/Protection

Contractors will familiarize themselves with the emergency exits, alarm signals, and escape procedures when working inside a building or structure. In buildings or structures, all fire exits and escape routes will be visibly marked and be kept free of obstructions. Fire exits or doors will not be locked, chained, or barricaded at any time. Combustible materials such as oil soaked rags, waste, and shavings will be kept in an approved metal container with a metal lid. Contractor is responsible to ensure that

these containers are emptied daily. Flammable liquids will not be used for general cleaning purposes. When pouring or pumping gasoline, or other flammable liquids from one container to another, metallic contact (grounding) will be maintained between the pouring and receiving containers. All flammable solvents will be kept in UL listed approved safety cans. All cans will be properly labeled per Hazard Communication Standard KY OSHA 29 CFR 1910.1200.

6.8 Lockout Tagout

Each EKPC facility will ensure that all Contractor employees are trained and informed on the procedures for Lock Out / Tag Out for Dale Station. A copy of the Lock Out / Tag Out procedure is located in the Standard Operating Procedures Manual or with the Lock Out / Tag Out Authority or Shift Supervisor.

6.9 Security

EKPC's power plant sites have perimeter fencing and a controlled entrance. Video cameras are installed throughout various locations on EKPC grounds.

6.10 Traffic Rules and Parking

A designated parking area is provided for Contractor employee parking. The only vehicles allowed beyond the parking area are those required for work, deliveries, and the superintendent's vehicle. These vehicles are required to have a pass issued by the EKPC office.

6.11 Sanitary Facilities

A wash sink will be provided by EKPC in the main building. Potable water is available at the cooler fill stations and drinking fountains. Any additional facilities required will be the Contractor's responsibility. Use of EKPC facilities will be strictly prohibited.

6.12 Respiratory Requirements

We at East Kentucky Power Cooperative are very concern with the health and safety of our employees and the employees of our Contractors. The following standards outline the requirements for our Respiratory Protection Program. It delineates the proper responsibilities and provides selection criteria in determining respiratory protection. The pertinent standards 29 CFR 1910.134, CFR 1926.103 and Z88.2 require that respirators be provided by the vendor or employer (Contractor). The requirements for a minimal program that is acceptable must comply with these standards. We expect all companies to furnish the proper PPE and ensure that their employees have been tested, trained, and are physically able to wear the proper respirators while performing work.

6.13 Air Contaminants and Exposure Limits

Some air contaminants have been shown to be a cancer risk. Exposure to airborne concentrations above the established Permissible Exposure Limit's (PEL) without appropriate respiratory protection may cause lung cancer and be a skin irritant. They may also affect other body parts if swallowed. Arsenic, cadmium, and lead, as well as other hazardous contaminates may be found in the plant. Follow the appropriate OSHA standard relating to air contaminates when the potential of exposure is possible.

Regulated Areas are areas above the PEL, or of unknown concentration for any known contaminants. Contractors are responsible for working with EKPC safety personnel to identify affected areas. Contractor shall indicate and regulate entry into affected areas with appropriate signage.

6.14 Monitoring

Contractors will be responsible for monitoring individual work areas which have the potential for air contaminants.

6.15 Crane Operations

EKPC requires that only designated, qualified and trained operator shall be permitted to operate cranes.

Weather conditions must be taken into consideration during any lift. Wind speed and lightning are two conditions that must always be considered. Other conditions include extreme cold weather and visibility. When weather conditions for making a lift put employees or facilities at risk, the work must be suspended.

Wind conditions: When wind speed approaches 20 mph consideration must be given to either halt the operations or reduce the crane capacity (refer to crane operating manual). Load weight, in relation to crane capacity, the physical shape of the load, and the length of the boom, are all factors that must be taken into consideration. The operator and supervisor must use sound judgment when wind speed approaches 20 mph and above.

Lightning Conditions: Lightning is potentially hazardous to persons in the area of crane operations. Whenever thunder is heard, the potential for a lightning strike exists. The operator and supervisor must use sound judgment when an electrical storm approaches. Grounding of the crane may reduce but will not eliminate the danger to personnel should a lightning strike occur.

Operating parameter will include but are not limited to the regulations contained in the ASME B.30.5 Standard, OSHA Construction Standards (1926.550). OSHA general Industry (1910.180, manufacture instructions, and company safety regulations.

6.16 Compressed Gases

Do not let cylinders come in contact with energized conductors or ground wires from electrical equipment. Never tamper with safety relief devices designed as part of the cylinder. Never force connections that do not fit. Never use damaged, defective or leaking cylinders. Move such cylinders outdoors and away from sources of ignition and notify the supervisor or foreman immediately. Never use a flame to detect flammable gas leaks. Never mix gases in a cylinder or transfer gas from one cylinder to another.

Take care in handing gas cylinders. Do not drop, jar or use cylinders as rollers to move objects. Do not hoist cylinders with a sling or electric magnet and do not lift cylinders by the protection cap. Use a lifting cradle, boat or platform for hoisting cylinders. Use a truck, cart, chain or other holding device to keep cylinders from falling over while in use. Cylinders must have their contents properly identified.

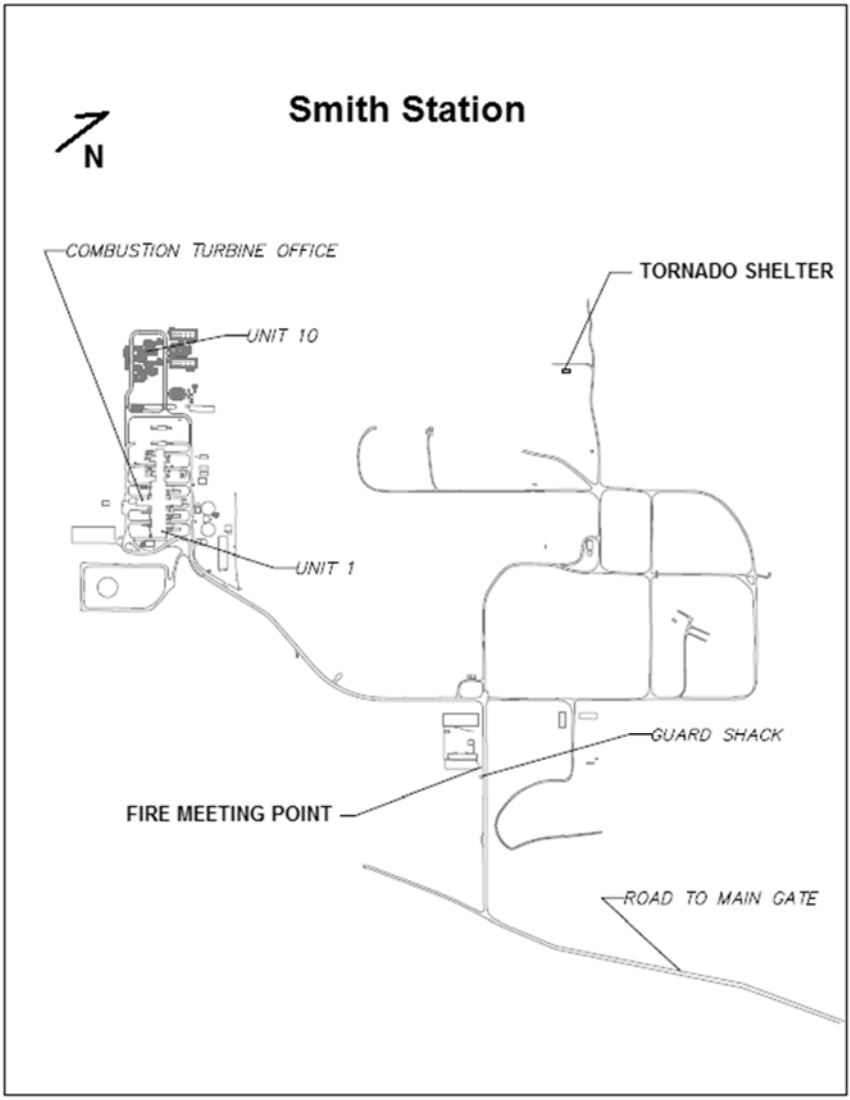
Store compressed gas cylinders, including empty cylinders, in an upright secured position. Valve protection caps should be kept in place except while regulators and hoses are attached. Caps should only be installed hand tight. Store gas cylinders away from heat, welding, and cutting operations where sparks will not reach them. Do not store oxygen cylinders near highly combustible materials like gasoline, oil, and grease. Store cylinders containing chlorine, propane and/or hydrogen; in isolated, well ventilated, fire-proof areas. Empty cylinders must be marked “Empty” or “MT”, and segregated from full cylinders with all valves closed and protection caps in place. Protect cylinders from the ground to prevent rusting. Hydrogen storage area should be marked as “Hydrogen – Flammable Gas – No Smoking – No open Flames” or equivalent and a sign with “Danger – No Smoking, Matches, or Open Lights” should be used in work areas where fuel gas is used or stored.

6.17 Minimum Approach Distance

Contractors will follow applicable OSHA and NESC regulations specific to their industry relating to approach distances to unguarded or exposed energized parts.

7 J.K. Smith Power Plant

7.1 Site map



7.2 Responding to Incidents & Medical Emergencies

When reporting an emergency, call the Control Room,

- **Dial Number: (859) 745-4157 ext. 310 or (859) 556-9460 (cell phone)**

When an incident or medical emergency takes place, first take steps to isolate the hazard and provide First Aid if necessary. Only move those injured if there is immediate danger. If no one is immediately available to administer First Aid, contact the Control Room at **(859) 745-4157 ext. 310** to request assistance. Once any immediate medical concerns are addressed, contact local control room so they can call for an emergency response, notify appropriate personnel, and start the process of documenting the incident.

Emergency Phone Numbers (Dial 9 to get an outside line):

- **Dial Number:** 9-1-1 Dispatch Center (E.M.S., Fire Dept., Law Enforcement Agency)
- **Dial Number:** (859) 745-3500 Clark Regional Hospital
- **Dial Number:** (859) 623-2404 Kentucky State Police (Richmond Post)

7.3 Fire Procedures

When reporting an emergency, call the Control Room,

- **Dial Number: (859) 745-4157 ext. 310**

If a fire is discovered try to contain the fire if possible. If the fire cannot be contained or the smoke alarm sounds exit the building. If smoke or fire is blocking your way find a second way out. If you must escape though smoke, get low and go under the smoke. Before opening a door, feel the doorknob and door. If either is hot, leave the door closed and use your second way out. If there is smoke coming around the door, leave the door closed and use your second way out. If you open a door, open it slowly. Be ready to shut it quickly if heavy smoke or fire is present.

Once outside, call 911 or the fire department and EKPC Control Room at **(859) 745-4157 ext. 310**. Tell the emergency operator where the fire is located especially if calling from a cell phone.

If you can't get out, close the door and cover vents and cracks around doors with cloth or tape to keep smoke out. Call 9-1-1 to reach emergency agencies. Say where you are and signal for help at the window with a light-colored cloth or a flashlight.
If your clothes catch fire, stop, drop, and roll – stop immediately, drop to the ground, and cover your face with your hands. Roll over and over or back and forth until the fire is out. If you or someone else cannot stop, drop, and roll, smothers the flames with a

blanket or towel. Use cool water to treat the burn immediately for 3 to 5 minutes. Cover with a clean, dry cloth.

7.4 Tornado Procedures

In the event of a tornado warning or the Weather Alarm is sounded move to the tornado shelter. If you don't have time to make it to the Tornado shelter move to the center of an interior room on the lowest level (closet, interior hallway) away from corners, windows, doors, and outside walls. Put as many walls as possible between you and the outside. Get under a sturdy table and use your arms to protect your head and neck.

Please use the underground coal tunnel on the old coal-fired site.

If in a vehicle, try to reach sturdy shelter. If your vehicle is hit by flying debris while you are driving, pull over and park. Stay in the car with the seat belt on. Put your head down below the windows; cover your head with your hands and a blanket, coat or other cushion if possible. If you can safely get lower than the level of the roadway, leave your car and lie in that area, covering your head with your hands. Watch out for flying debris. Flying debris from tornadoes causes most fatalities and injuries.

7.5 Earthquake Procedures

If indoors take cover under sturdy furniture and stay near the center of the building. Stay away from glass windows, doors, display cabinets, bookcases, etc. Do not run for the exit as the stairs may be broken or jammed with people. Do not use the elevators. If outdoors more to an open area away from building, utility wires, trees, etc. If driving a vehicle stop as quickly as safety permits while avoiding overpasses and power lines. Remain in the vehicle until the shaking stops.

7.6 Emergency Evacuation Procedure

Control Room Operator will sound the Emergency Alarm. Follow the nearest and best exit out and away from the hazard or structure. Each Supervisor on duty shall be responsible for accounting for his/her personnel. Move away from the structure, look at the wind to determine wind direction and evacuate accordingly - primary evacuation point is the Guard Shack parking lot; if wind is blowing in that direction, go up wind or 90 degrees from that.) Report a **"HEAD COUNT"** to your supervisor. Do not block roadway or driveway. Stay at the assembly area until instructed otherwise. When the **"ALL CLEAR"** is given, you may return to your work station.

7.7 Aqueous Ammonia

In the event of spill, evacuate the immediate area, move upwind of the spill and contact the Control Room.

- **Dial Number: (859) 745-4157 ext. 310**

7.8 Fire Prevention/Protection

Contractors will familiarize themselves with the emergency exits, alarm signals, and escape procedures when working inside a building or structure. In buildings or structures, all fire exits and escape routes will be visibly marked and be kept free of obstructions. Fire exits or doors will not be locked, chained, or barricaded at any time. Combustible materials such as oil soaked rags, waste, and shavings will be kept in an approved metal container with a metal lid. Contractor is responsible to ensure that these containers are emptied daily. Flammable liquids will not be used for general cleaning purposes. When pouring or pumping gasoline, or other flammable liquids from one container to another, metallic contact (grounding) will be maintained between the pouring and receiving containers. All flammable solvents will be kept in UL listed approved safety cans. All cans will be properly labeled per Hazard Communication Standard KY OSHA 29 CFR 1910.1200.

7.9 Lockout Tagout

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7.10 Security

EKPC's power plant sites have perimeter fencing and a controlled entrance manned by security guards. EKPC power plant sites are patrolled by security guards as well as EKPC plant operators. Video cameras are installed throughout various locations on EKPC grounds.

7.11 Traffic Rules / Parking

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Weather conditions must be taken into consideration during any lift. Wind speed and lightning are two conditions that must always be considered. Other conditions include extreme cold weather and visibility. When weather conditions for making a lift put employees or facilities at risk, the work must be suspended.

Wind conditions: When wind speed approaches 20 mph consideration must be given to either halt the operations or reduce the crane capacity (refer to crane operating manual). Load weight, in relation to crane capacity, the physical shape of the load, and the length of the boom, are all factors that must be taken into consideration. The

operator and supervisor must use sound judgment when wind speed approaches 20 mph and above.

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Do not let cylinders come in contact with energized conductors or ground wires from electrical equipment. Never tamper with safety relief devices designed as part of the cylinder. Never force connections that do not fit. Never use damaged, defective or leaking cylinders. Move these cylinders outdoors and away from sources of ignition, secure them, and notify the supervisor or foreman immediately. Never use a flame to detect flammable gas leaks. Never mix gases in a cylinder or transfer gas from one cylinder to another.

Take care in handing gas cylinders. Do not drop, jar or use cylinders as rollers to move objects. Do not hoist cylinders with a sling or electric magnet and do not lift cylinders by the protection cap. Use a lifting cradle, boat or platform for hoisting cylinders. Use a truck, cart, chain or other holding device to keep cylinders from falling over while in use. Cylinders must have their contents properly identified.

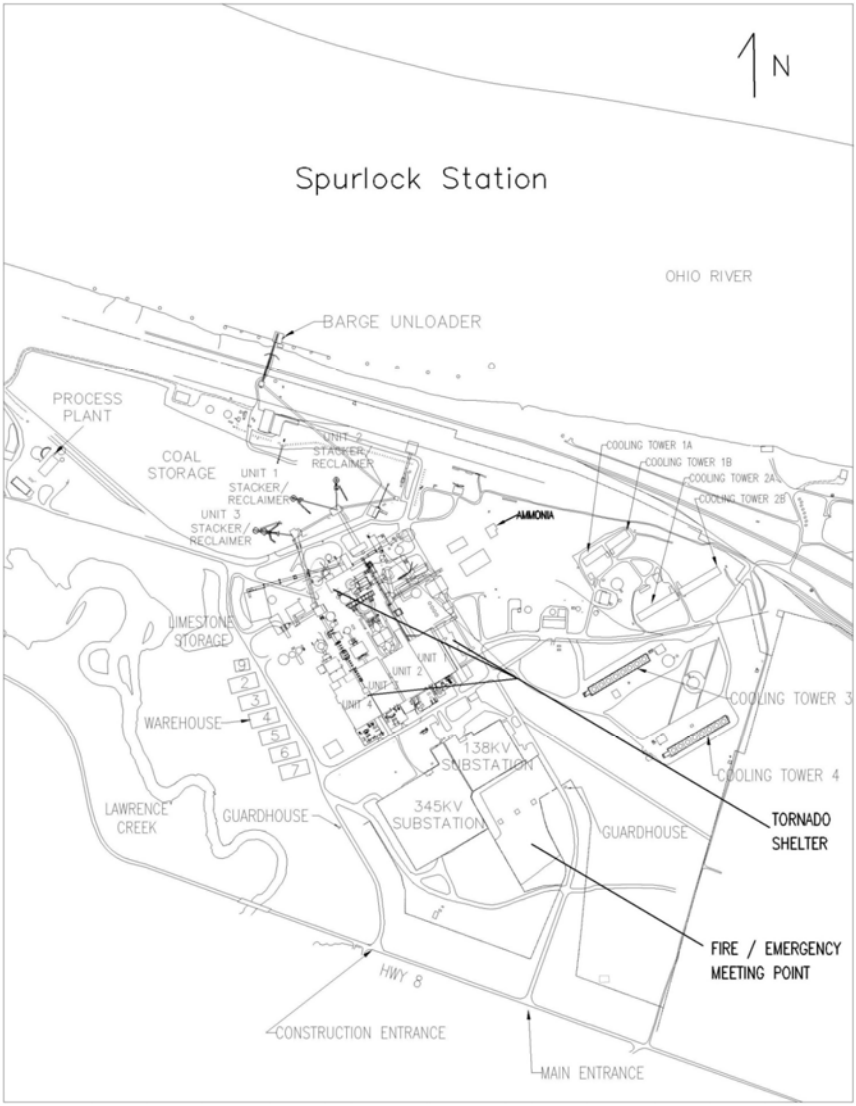
Store compressed gas cylinders, including empty cylinders, in an upright secured position. Valve protection caps should be kept in place except while regulators and hoses are attached. Caps should only be installed hand tight. Store gas cylinders away from heat, welding, and cutting operations where sparks will not reach them. Do not store oxygen cylinders near highly combustible materials like gasoline, oil, and grease. Store cylinders containing chlorine, propane and/or hydrogen; in isolated, well ventilated, fire-proof areas. Empty cylinders must be marked “Empty” or “MT”, and segregated from full cylinders with all valves closed and protection caps in place. Protect cylinders from the ground to prevent rusting. Hydrogen storage area should be marked as “Hydrogen – Flammable Gas – No Smoking – No open Flames” or equivalent and a sign with “Danger – No Smoking, Matches, or Open Lights” should be used in work areas where fuel gas is used or stored.

7.18 Minimum Approach Distance

Contractors will follow applicable OSHA and NESC regulations specific to their industry relating to approach distances to unguarded or exposed energized parts.

8 Spurlock Power Plant

8.1 Site map



8.2 Responding to Incidents and Medical Emergencies

When reporting an emergency, call the Control Room,

- **Dial Number: (606) 883- 3166 ext. 600**

When an incident or medical emergency takes place, first take steps to isolate the hazard and provide First Aid if necessary. Only move those injured if there is immediate danger. If no one is immediately available to administer First Aid, contact the Control Room at **(606) 883- 3166 ext. 600**. Once any immediate medical concerns are addressed, contact the local control room so they can call for an emergency response, notify appropriate personnel, and start the process of documenting the incident.

Emergency Phone Numbers (Dial 9 to get an outside line):

- **Dial Number:** 9-1-1 Dispatch Center (E.M.S., Fire Dept., Law Enforcement Agency)
- **Dial Number:** (606) 759-5311 Meadowview Regional Med Center
- **Dial Number:** (606) 784-4127 Kentucky State Police (Morehead Post)

8.3 Fire Procedures

When reporting an emergency, call the Control Room,

- **Dial Number: (606) 883- 3166 ext. 600**

If a fire is discovered try to contain the fire if possible. If the fire cannot be contained or the smoke alarm sounds exit the building. If smoke or fire is blocking your way find a second way out. If you must escape though smoke, get low and go under the smoke. Before opening a door, feel the doorknob and door. If either is hot, leave the door closed and use your second way out. If there is smoke coming around the door, leave the door closed and use your second way out. If you open a door, open it slowly. Be ready to shut it quickly if heavy smoke or fire is present.

Once outside; call the EKPC Control Room at **(606) 883- 3166 ext. 600.** Tell the emergency operator where the fire is located especially if calling from a cell phone.

If you can't get out, close the door and cover vents and cracks around doors with cloth or tape to keep smoke out.

If your clothes catch fire, stop, drop, and roll – stop immediately, drop to the ground, and cover your face with your hands. Roll over and over or back and forth until the fire is out. If you or someone else cannot stop, drop, and roll, smothers the flames with a blanket or towel. Use cool water to treat the burn immediately for 3 to 5 minutes. Cover with a clean, dry cloth.

8.4 Tornado Procedures

In the event of a tornado warning move to the center of an interior room on the lowest level (closet, interior hallway) away from corners, windows, doors, and outside walls. Put as many walls as possible between you and the outside. Get under a sturdy table and use your arms to protect your head and neck.

If in a vehicle, try to reach sturdy shelter. If your vehicle is hit by flying debris while you are driving, pull over and park. Stay in the car with the seat belt on. Put your head down below the windows; cover your head with your hands and a blanket, coat or other cushion if possible. If you can safely get lower than the level of the roadway, leave your car and lie in that area, covering your head with your hands. Watch out for flying debris. Flying debris from tornadoes causes most fatalities and injuries.

8.5 Earthquake Procedures

If indoors take cover under sturdy furniture and stay near the center of the building. Stay away from glass windows, doors, display cabinets, bookcases, etc. Do not run for the exit as the stairs may be broken or jammed with people. Do not use the elevators. If outdoors move to an open area away from building, utility wires, trees, etc. If driving a vehicle stop as quickly as safety permits while avoiding overpasses and power lines. Remain in the vehicle until the shaking stops.

8.6 Emergency Evacuation Procedure

Control Room Operator will sound the Emergency Alarm. Follow the nearest and best exit out and away from the hazard or structure. Each Supervisor on duty shall be responsible for the accounting of his/her personnel. Move away from the structure, look at the wind to determine wind direction and evacuate accordingly - primary evacuation point is the construction parking lot; if wind is blowing in that direction, go up wind or 90 degrees from that.) Report a **"HEAD COUNT"** to your supervisor. Do not block roadway or driveway. Stay at the assembly area until instructed otherwise. When the **"ALL CLEAR ALARM"** is sounded, you may return to your work station.

8.7 Anhydrous Ammonia

In the event of release, visual and audible alarms are triggered at the tank area and in the control room. In the event of a minor release an alarm will sound. Note the wind direction by checking a nearby windstock and move upwind. If the catastrophic release alert is given, leave Spurlock station and go to a predetermined offsite location.

- **Dial Number: (606) 883- 3166 ext. 600**

Contractors on site are to evacuate based on wind direction and the voice prompts from EKPC's emergency evacuation siren located throughout the plant.

8.8 Fire Prevention/Protection

Contractors will familiarize themselves with the emergency exits, alarm signals, and escape procedures when working inside a building or structure. In buildings or structures, all fire exits and escape routes will be visibly marked and be kept free of obstructions. Fire exits or doors will not be locked, chained, or barricaded at any time. Combustible materials such as oil soaked rags, waste, and shavings will be kept in an approved metal container with a metal lid. Contractor is responsible to ensure that these containers are emptied daily. Flammable liquids will not be used for general cleaning purposes. When pouring or pumping gasoline, or other flammable liquids from one container to another, metallic contact (grounding) will be maintained between the pouring and receiving containers. All flammable solvents will be kept in UL listed approved safety cans. All cans will be properly labeled per Hazard Communication Standard KY OSHA 29 CFR 1910.1200.

8.9 Lockout Tagout

Each EKPC facility will ensure that all Contractor employees are trained and informed on the procedures for Lock Out / Tag Out for Spurlock Station. A copy of the Lock Out / Tag Out procedure is located in the Standard Operating Procedures Manual or with the Lock Out / Tag Out Authority or Shift Supervisor.

8.10 Security

EKPC's power plant sites have perimeter fencing and a controlled entrance manned by security guards. EKPC's power plant sites are patrolled by security guards as well as EKPC plant operators. Video cameras are installed throughout various locations on EKPC grounds.

8.11 Traffic Rules and Parking

A designated parking lot is provided for Contractor employee parking. The only vehicles allowed beyond the designated parking lot are those required for work, deliveries, and the superintendent's vehicle. These vehicles are required to have a pass issued by the EKPC office.

The plant speed limit is 15mph. Failure to abide by this limit may result in loss of driving privileges.

8.12 Sanitary Facilities

A wash sink will be provided by EKPC in the main building. Potable water is available at the cooler fill stations and drinking fountains. Any additional facilities required will be the Contractor's responsibility. Use of EKPC facilities will be strictly prohibited.

8.13 Respiratory Requirements

We at East Kentucky Power Cooperative are very concern with the health and safety of our employees and the employees of our Contractors. The following standards outline the requirements for our Respiratory Protection Program. It delineates the proper responsibilities and provides selection criteria in determining respiratory protection. The pertinent standards 29 CFR 1910.134, CFR 1926.103 and Z88.2 require that respirators be provided by the vendor or employer (Contractor). The requirements for a minimal program that is acceptable must comply with these standards. We expect all companies to furnish the proper PPE and ensure that their employees have been tested, trained, and are physically able to wear the proper respirators while performing their work.

8.14 Air Contaminants and Exposure Limits

Some air contaminants have been shown to be a cancer risk. Exposure to airborne concentrations above the established Permissible Exposure Limit's (PEL) without appropriate respiratory protection may cause lung cancer and be a skin irritant. They may also affect other body parts if swallowed. Arsenic, cadmium, and lead, as well as other hazardous contaminates may be found in the plant. Follow the appropriate OSHA standard relating to air contaminates when the potential of exposure is possible.

Regulated Areas are areas above the PEL, or of unknown concentration for any known contaminants. Contractors are responsible for working with EKPC safety personnel to identify affected areas. Contractor shall indicate and regulate entry into affected areas with appropriate signage.

8.15 Monitoring

Contractors will be responsible for monitoring individual work areas which have the potential for air contaminants.

8.16 Crane Operations

EKPC requires that only designated, qualified and trained operator shall be permitted to operate cranes.

Weather conditions must be taken into consideration during any lift. Wind speed and lightning are two conditions that must always be considered. Other conditions include extreme cold weather and visibility. When weather conditions for making a lift put the employees or facilities at risk, the work must be suspended.

Wind conditions: When wind speed approaches 20 mph consideration must be given to either halt the operations or reduce the crane capacity (refer to crane operating manual). Load weight, in relation to crane capacity, the physical shape of the load, and the length of the boom, are all factors that must be taken into consideration. The

operator and supervisor must use sound judgment when wind speed approaches 20 mph and above.

Lightning Conditions: Lightning is potentially hazardous to persons in the area of crane operations. Whenever thunder is heard, the potential for a lightning strike exists. The operator and supervisor must use sound judgment when an electrical storm approaches. Grounding of the crane may reduce but will not eliminate the danger to personnel should a lightning strike occur.

Operating parameter will include but are not limited to the regulations contained in the ASME B.30.5 Standard, OSHA Construction Standards (1926.550). OSHA general Industry (1910.180, manufacture instructions, and company safety regulations.

8.17 Compressed Gases

Do not let cylinders come in contact with energized conductors or ground wires from electrical equipment. Never tamper with safety relief devices designed as part of the cylinder. Never force connections that do not fit. Never use damaged, defective or leaking cylinders. Move these cylinders outdoors and away from sources of ignition, secure them, and notify the supervisor or foreman immediately. Never use a flame to detect flammable gas leaks. Never mix gases in a cylinder or transfer gas from one cylinder to another.

Take care in handing gas cylinders. Do not drop, jar or use cylinders as rollers to move objects. Do not hoist cylinders with a sling or electric magnet and do not lift cylinders by the protection cap. Use a lifting cradle, boat or platform for hoisting cylinders. Use a truck, cart, chain or other holding device to keep cylinders from falling over while in use. Cylinders must have their contents properly identified.

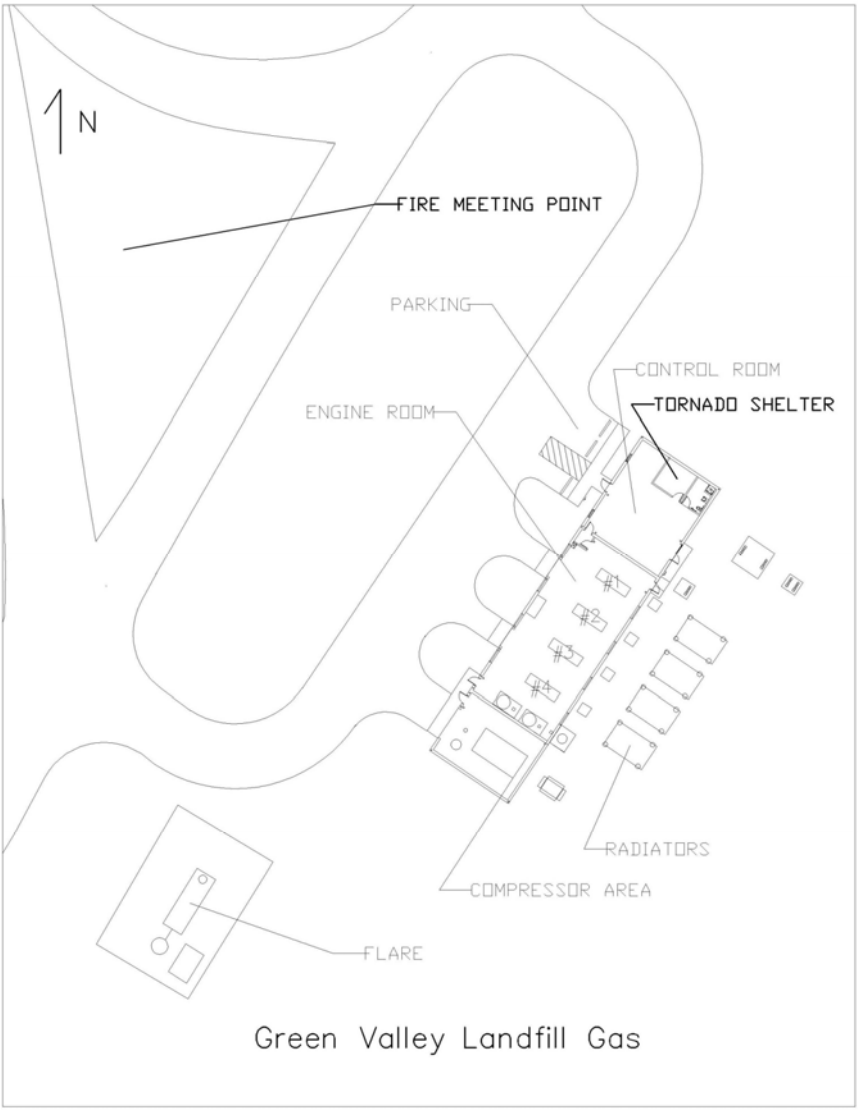
Store compressed gas cylinders, including empty cylinders, in an upright secured position. Valve protection caps should be kept in place except while regulators and hoses are attached. Caps should only be installed hand tight. Store gas cylinders away from heat, welding, and cutting operations where sparks will not reach them. Do not store oxygen cylinders near highly combustible materials like gasoline, oil, and grease. Store cylinders containing chlorine, propane and/or hydrogen; in isolated, well ventilated, fire-proof areas. Empty cylinders must be marked “Empty” or “MT”, and segregated from full cylinders with all valves closed and protection caps in place. Protect cylinders from the ground to prevent rusting. Hydrogen storage area should be marked as “Hydrogen – Flammable Gas – No Smoking – No open Flames” or equivalent and a sign with “Danger – No Smoking, Matches, or Open Lights” should be used in work areas where fuel gas is used or stored.

8.18 Minimum Approach Distance

Contractors will follow applicable OSHA and NESC regulations specific to their industry relating to approach distances to unguarded or exposed energized parts.

9 Landfill Gas Plants

9.1 Site Maps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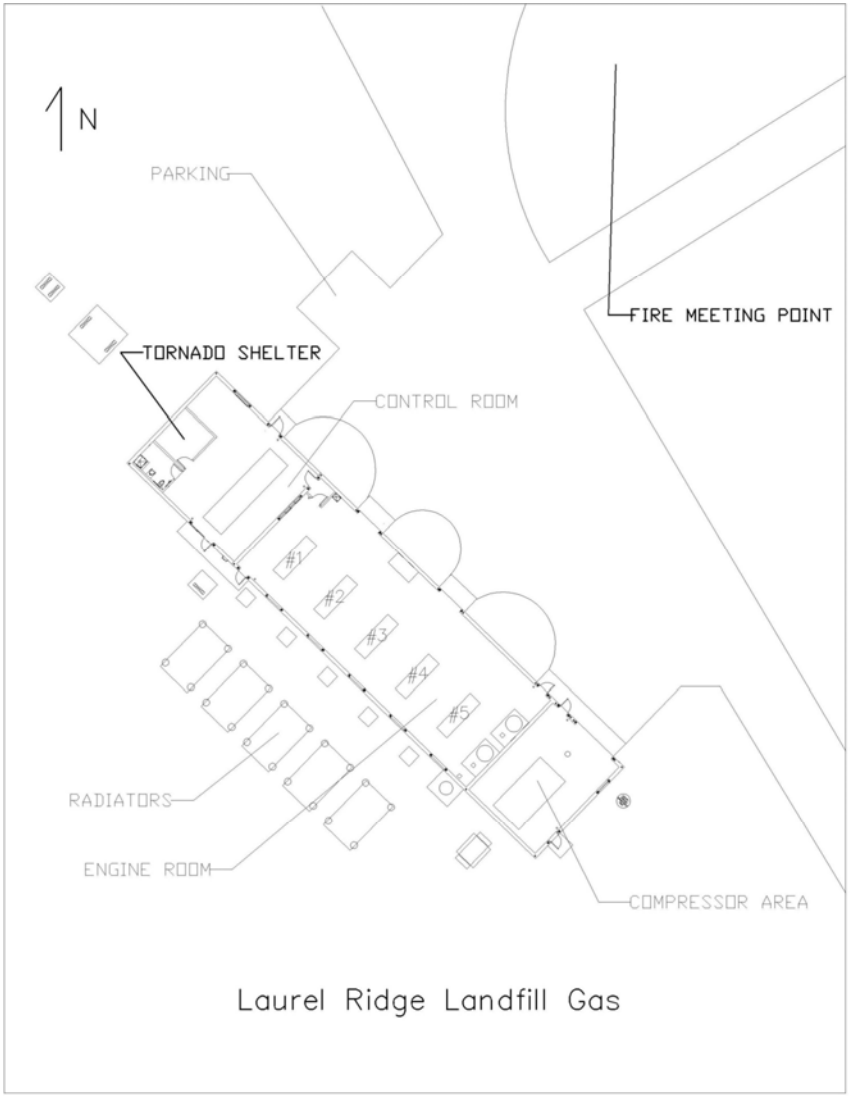
PARKING
CONTROL ROOM
TORNADO SHELTER
ENGINE ROOM
RADIATORS
COMPRESSOR AREA
FLARE
Green Valley Landfill Gas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CONTROL ROOM
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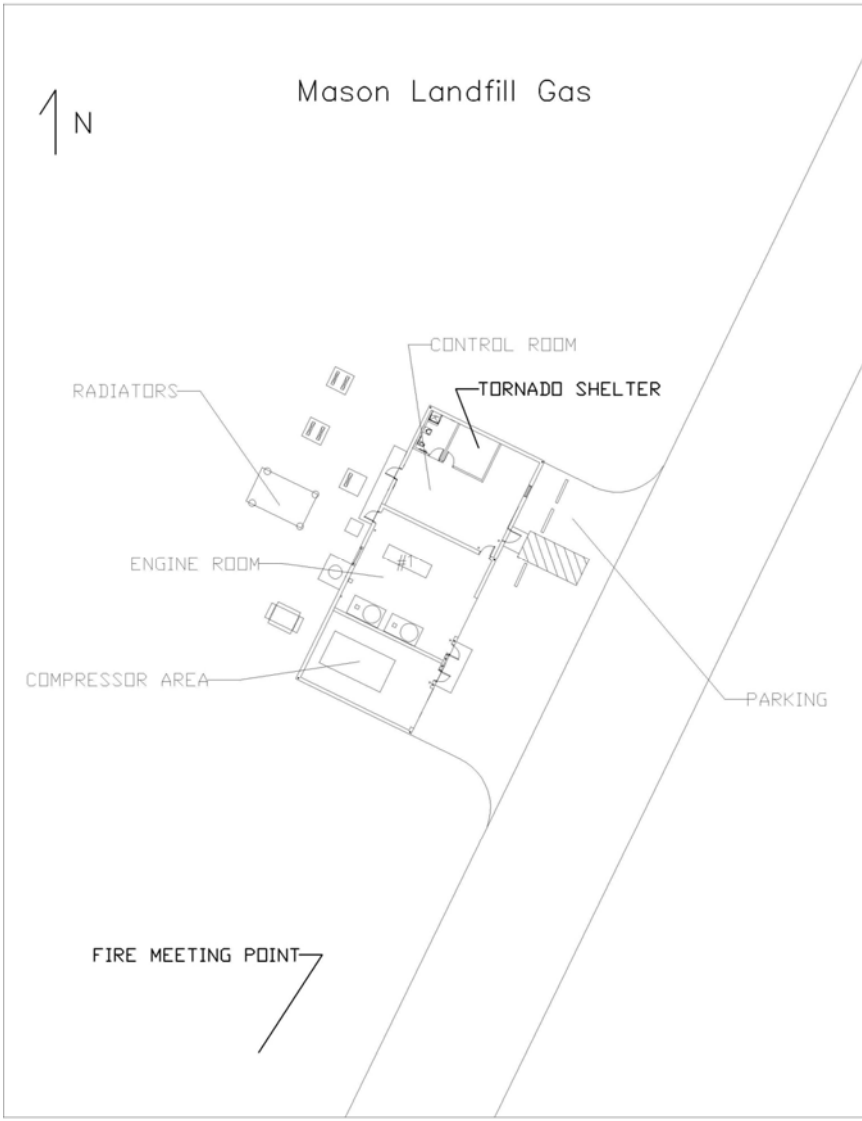
#5
RADIATORS
ENGINE ROOM
COMPRESSOR AREA
Laurel Ridge Landfill Gas


Mason Landfill Gas
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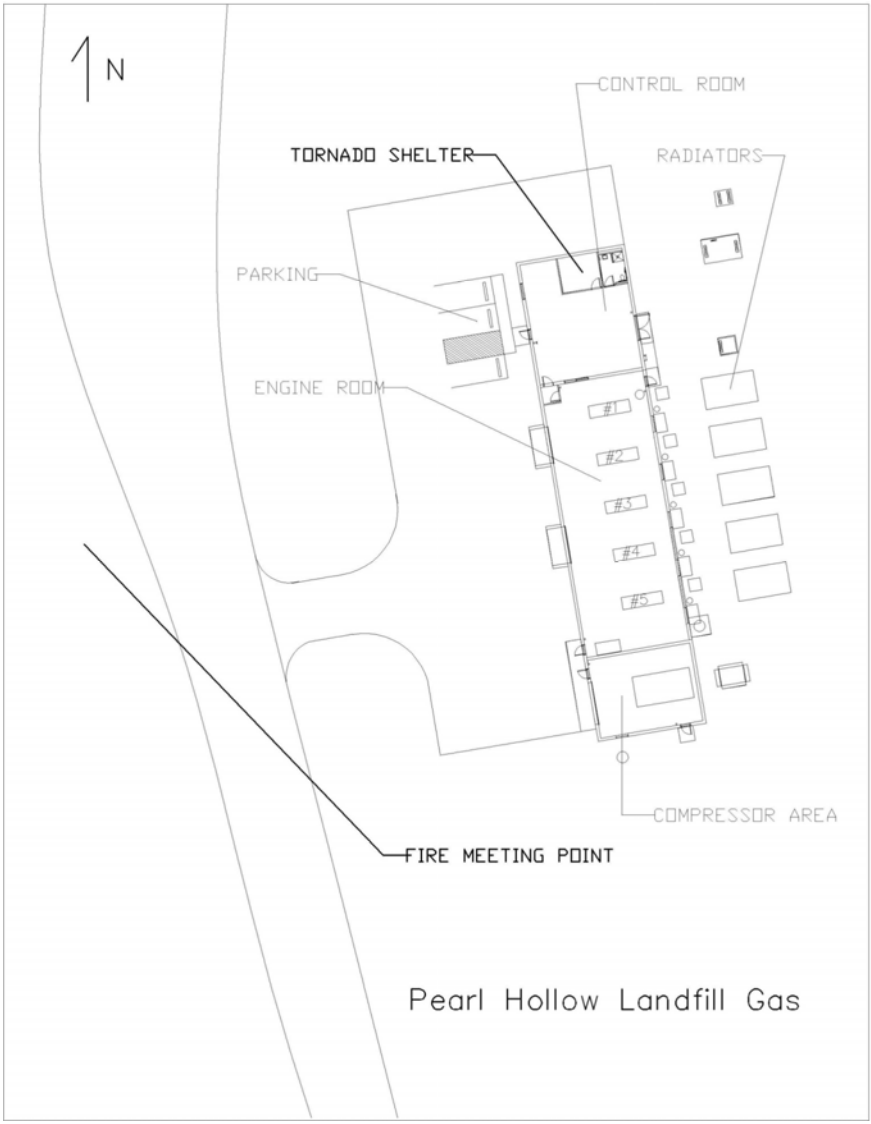
TORNADO SHELTER
RADIATORS
ENGINE ROOM
COMPRESSOR AREA
PARKING
FIRE MEETING POINT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CONTROL ROOM
TORNADO SHELTER
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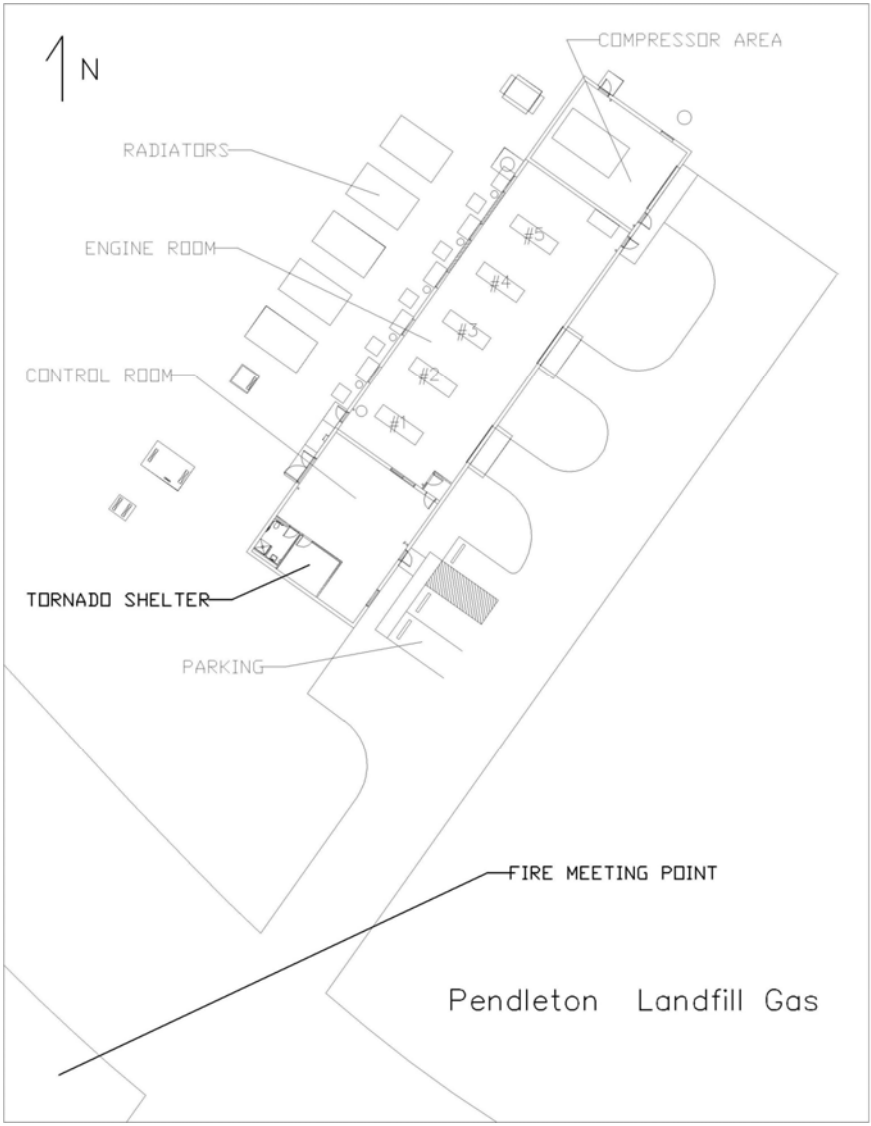
COMPRESSOR AREA
FIRE MEETING POINT
Pearl Hollow Landfill Gas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COMPRESSOR AREA
RADIATORS
ENGINE ROOM
CONTROL ROOM
#5
#4
#3
#2
#1
TORNADO SHELTER
PARKING
FIRE MEETING POINT
Pendleton Landfill Gas

9.2 Responding to Incidents & Medical Emergencies

When reporting an Emergency; contact EKPC dispatch at **859-745-9300** or the local control room to request assistance.

When an incident or medical emergency takes place, first take steps to isolate the hazard and provide First Aid if necessary. Only move those injured if there is immediate danger. If no one is immediately available to administer First Aid, contact EKPC dispatch at **859-745-9300** or the local control room to request assistance. Once any immediate medical concerns are addressed, contact dispatch or local control room so they can call for an emergency response, notify appropriate personnel, and start the process of documenting the incident.

9.3 Fire Procedures

If a fire is discovered try to contain the fire if possible. If the fire cannot be contained or the smoke alarm sounds exit the building. If smoke or fire is blocking your way find a second way out. If you must escape though smoke, get low and go under the smoke. Before opening a door, feel the doorknob and door. If either is hot, leave the door closed and use your second way out. If there is smoke coming around the door, leave the door closed and use your second way out. If you open a door, open it slowly. Be ready to shut it quickly if heavy smoke or fire is present.

Once outside, call 911 or the fire department and EKPC dispatch at **859-745-9300**. Tell the emergency operator where the fire is located especially if calling from a cell phone.

If you can't get out, close the door and cover vents and cracks around doors with cloth or tape to keep smoke out. Call 911 or the fire department. Say where you are and signal for help at the window with a light-colored cloth or a flashlight.

If your clothes catch fire, stop, drop, and roll – stop immediately, drop to the ground, and cover your face with your hands. Roll over and over or back and forth until the fire is out. If you or someone else cannot stop, drop; and roll, smother the flames with a blanket or towel. Use cool water to treat the burn immediately for 3 to 5 minutes. Cover with a clean, dry cloth. Get medical help right away by calling 9-1-1 or the fire department.

9.4 Tornado Procedures

In the event of a tornado warning move to the center of an interior room on the lowest level (closet, interior hallway) away from corners, windows, doors, and outside walls. Put as many walls as possible between you and the outside. Get under a sturdy table and use your arms to protect your head and neck.

If in a vehicle, try to reach sturdy shelter. If your vehicle is hit by flying debris while you are driving, pull over and park. Stay in the car with the seat belt on. Put your head down

below the windows; cover your head with your hands and a blanket, coat or other cushion if possible. If you can safely get lower than the level of the roadway, leave your car and lie in that area, covering your head with your hands. Watch out for flying debris. Flying debris from tornadoes causes most fatalities and injuries.

9.5 Earthquake Procedures

If indoors take cover under sturdy furniture and stay near the center of the building. Stay away from glass windows, doors, display cabinets, bookcases, etc. Do not run for the exit as the stairs may be broken or jammed with people. Do not use the elevators.

If outdoors move to an open area away from building, utility wires, trees, etc.

If driving a vehicle stop as quickly as safety permits while avoiding overpasses and power lines. Remain in the vehicle until the shaking stops.

9.6 Lockout Tagout

Each EKPC facility will ensure that all Contractor employees are trained and informed on the procedures for Lock Out / Tag Out. A copy of the Lock Out / Tag Out Procedure is located in the Standard Operating Procedures Manual or with the Lock Out / Tag Out Authority for the facility.

9.7 Security

Landfill gas plants are located on landfill sites that are not EKPC property. Some stations are unmanned and manned hours may vary at all sites. Generation buildings are kept locked. See the project manager to arrange access to the site.

9.8 Traffic Rules / Parking

Abide by all traffic signs posted by the landfill operator. Parking is available in front of all generation buildings. Take care not to block access to rollup doors.

9.9 Sanitary Facilities

A wash sink will be provided by EKPC in the main building. Any additional facilities required will be supplied by the Contractor. Use of EKPC facilities is strictly prohibited.

9.10 Crane Operations

EKPC requires that only designated, qualified and trained operator or operator trainees under the direct supervision of a qualified operator shall be permitted to operate cranes.

Weather conditions must be taken into consideration during any lift. Wind speed and lightning are two conditions that must always be considered. Other conditions include extreme cold weather and visibility. When weather conditions for making a lift put employees or facilities at risk the work must be suspended.

Wind conditions: When wind speed approaches 20 mph consideration must be given to either halt the operations or reduce the crane capacity (refer to crane operating manual). Load weight, in relation to crane capacity, the physical shape of the load, and the length of the boom, are all factors that must be taken into consideration. The operator and supervisor must use sound judgment when wind speed approaches 20 mph and above.

Lightning Conditions: Lightning is potentially hazardous to persons in the area of crane operations. Whenever thunder is heard, the potential for a lightning strike exists. The operator and supervisor must use sound judgment when an electrical storm approaches. Grounding of the crane may reduce but will not eliminate the danger to personnel should a lightning strike occur.

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from the ground to prevent rusting. Hydrogen storage area should be marked as "Hydrogen – Flammable Gas – No Smoking – No open Flames" or equivalent and a sign with "Danger – No Smoking, Matches, or Open Lights" should be used in work areas where fuel gas is used or stored.

9.12 Minimum Approach Distance

Contractors will follow applicable OSHA and NESC regulations specific to their industry relating to approach distances to unguarded or exposed energized parts.

EXHIBIT GG

WEEKLY CONSTRUCTION MEETING AGENDA AND MEETING PROTOCOLS

Form of Weekly Construction Meeting Agenda

1. Review of construction progress since previous meeting.
2. Field observations, interface requirements, conflicts.
3. Issues which may impede construction schedule.
4. Off-Site fabrication.
5. Delivery schedules.
6. Submittal schedules and status.
7. Site use; coordination with other contractors.
8. Temporary facilities, controls, and services.
9. Hours of Work.
10. Hazards and risks.
11. Housekeeping.
12. Quality and Work standards.
13. RFIs.
14. Status of Change Orders.
15. Documentation of information for payment requests.
16. Corrective measures and procedures to regain construction schedule if necessary.
17. Revisions to construction schedule.
18. Review of proposed activities for succeeding Work period.
19. Review proposed Contract modifications for:
    a) Effect on construction schedule and on completion date.
    b) Effect on other contracts of the Project.
20. Other business.

Meeting Protocols

1. Representatives of the Owner, Owner's Engineer, and Contractor shall be present at each meeting. With Owner's concurrence, Contractor may request attendance by representatives of Subcontractors or other entities concerned with the Project or involved with planning, coordination, or performance of future Work. All participants in the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.

2. Contractor and each Subcontractor represented shall be prepared to discuss the current construction progress report and any anticipated future changes to the Project Schedule. Each Subcontractor shall comment on the schedules of Contractor and other Subcontractors and advise if their current progress or anticipated activities are compatible with that Subcontractor's Work.

3. If one Subcontractor is delaying another, Contractor shall issue such directions as are necessary to resolve the situation and promote construction progress.

4. Location of Meetings: At EKPC HQ and / or teleconference.

EXHIBIT HH

DAVIS-BACON ACT REQUIREMENTS AND WAGE RATE DETERMINATION

(1) ***Minimum wages.***

(i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii)

(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(*1*) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(*2*) The classification is utilized in the area by the construction industry; and

(*3*) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) ***Withholding.*** The (write in name of Federal Agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any

subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) ***Payrolls and basic records.***

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)

(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency). The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (*e.g.*, the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the (write in

name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency), the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(*1*) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(*2*) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(*3*) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the (write the name of the agency) or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) ***Apprentices and trainees—***

(i) ***Apprentices.*** Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) ***Trainees.*** Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there

is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) ***Equal employment opportunity.*** The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) ***Compliance with Copeland Act requirements.*** The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) ***Subcontracts.*** The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the (write in the name of the Federal agency) may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) ***Contract termination: debarment.*** A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) ***Compliance with Davis-Bacon and Related Act requirements.*** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) ***Disputes concerning labor standards.*** Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) ***Certification of eligibility.***

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(b) ***Contract Work Hours and Safety Standards Act.*** The Agency Head shall cause or require the contracting officer to insert the following clauses set forth in paragraphs (b)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by § 5.5(a) or 4.6 of part 4 of this title. As used in this paragraph, the terms *laborers* and *mechanics* include watchmen and guards.

(1) ***Overtime requirements.*** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) ***Violation; liability for unpaid wages; liquidated damages.*** In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) ***Withholding for unpaid wages and liquidated damages.*** The (write in the name of the Federal agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) ***Subcontracts.*** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor

shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

Wage Rate Determinations

General Decision Number: KY160161 06/03/2016 KY161

Superseded General Decision Number: KY20150161

State: Kentucky

Construction Type: Heavy

Counties: Bourbon, Clark, Fayette, Jessamine, Scott and
Woodford Counties in Kentucky.

HEAVY CONSTRUCTION PROJECTS (including sewer/water construction).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.15 for calendar year 2016 applies to all contracts subject to the Davis-Bacon Act for which the solicitation was issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.15 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2016. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/08/2016
1	06/03/2016

ELEC0369-004 09/01/2014

	Rates	Fringes
LINE CONSTRUCTION		
Equipment Operator.....	$ 30.51	11.25
Groundman.....	$ 20.21	9.19
Lineman.....	$ 34.13	13.02

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* ELEC0369-008 06/01/2016

	Rates	Fringes
ELECTRICIAN.....	$ 30.56	16.10

ENGI0181-016 06/01/2014

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	$ 27.66	14.15

OPERATING ENGINEER CLASSIFICATIONS

GROUP 1 - Crane; Forklift

Operators on cranes with boom 150 feet and over, including jib, shall receive $0.75 above Group 1. All cranes with piling leads will receive $0.50 above Group 1 rate regardless of boom length. Combination rate shall mean $0.50 per hour above the basic hourly rate of pay.

Employees assigned to work below ground level are to be paid 10% above basic wage rate. This does not apply to open cut work.

ENGI0181-051 07/01/2015

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	$ 29.95	14.40
GROUP 2.....	$ 27.26	14.40
GROUP 4.....	$ 26.96	14.40

OPERATING ENGINEER CLASSIFICATIONS

GROUP 1 - Drill; Pumpcrete; Roller (Bituminous)

GROUP 2 - Bobcat/Skid Steer/Skid Loader; Concrete Pump; Roller (Rock)

GROUP 4 - Pump; Roller (Earth)

Operators on cranes with booms 150 feet and over (including jib) shall receive $1.00 above Group 1 rate; 250 feet and over including jib shall receive $1.50 above Class 1 rate. Combination Rate: All crane operators operating cranes, where the length of the boom in combination with the length of the piling leads equal or exceeds 150 feet, shall receive $1.00 above the Group 1 rate.

Employees assigned to work below ground level are to be paid 10% above basic wage rate. This does not apply to open cut work.

IRON0044-005 06/01/2015

	Rates	Fringes
IRONWORKER (STRUCTURAL AND REINFORCING).....	$ 26.40	19.15

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* IRON0070-011 06/01/2016

	Rates	Fringes
IRONWORKER, ORNAMENTAL.....	$ 27.91	21.11

LABO0189-020 07/01/2015

	Rates	Fringes
LABORER		
Concrete Worker.....	$ 22.30	12.46

LABO0265-014 05/01/2015

	Rates	Fringes
LABORER		
Concrete Saw (Hand Held/Walk Behind).....	$ 28.89	9.85
Flagger.....	$ 28.72	9.85

SUKY2011-038 06/25/2014

	Rates	Fringes
CARPENTER (Form Work Only)....	$ 24.80	8.76
LABORER: Common or General....	$ 22.17	9.64
LABORER: Concrete Finishing.....	$ 25.75	8.60
LABORER: Pipelayer.....	$ 19.66	10.85
OPERATOR:		

Backhoe/Excavator/Trackhoe.....	$ 22.56	12.10
OPERATOR: Bulldozer.....	$ 27.90	13.00
OPERATOR: Loader.....	$ 26.68	13.00
OPERATOR: Mechanic.....	$ 28.60	11.83
OPERATOR: Oiler.....	$ 24.34	13.00
OPERATOR: Trencher.....	$ 26.27	12.37
TRUCK DRIVER: Dump Truck.....	$ 17.82	3.26

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION