

The following list of pay items includes pay item numbers and the detailed measurement of payment relating to those items.

SIDE BANK FILTER (SBF) APPURTENANCES & DRA FENCING

Payment for these bid items shall be made at the contract price bid amount and shall constitute full compensation for:

SBF-01	Bold & Gold® CTS Biosorption Activated Media	CY
514	Filter Fabric GEOTEXTILE- SEPARATION	SF
948-09	30 mil PVC Liner	SF
440-1	18" HP Dual Wall Perforated Pipe	LF
DAF-1	Decorative Aluminum Fencing 6' x 8' panel	EA
DAG-1	Decorative Aluminum Swing Gate installed with 6" post	EA
DAG-W	Decorative Aluminum 6' x 4' Walkthrough Gate	EA
WA	Well Abandonment	EA

SBF-01: Bold & Gold CTS Biosorption Activated Media

Contractor will provide designated Bold & Gold® CTS Filtration media Biosorption Activated Media (BAM) for stormwater treatment in conjunction with other structural or non-structural stormwater BMPs.

Bold & Gold® (B&G) Filtration media is a patented product developed at the Stormwater Management Academy of the University of Central Florida. Environmental Conservation Solutions, LLC. (ECS) is the licensed manufacturer of the Bold & Gold® Filtration media.

The contractor shall be responsible for the satisfactory delivery, stockpiling, installation and maintenance of the Bold & Gold® CTS Filtration media during construction based on information provided in the Contract Documents and as provided by the supplier. The Bold & Gold® CTS Filtration media shall be purchased from an approved source.

Contact the local Ferguson Waterworks branch for pricing information. ECS will provide a Certificate of Authenticity to the Engineer of Record at the completion of the project. The Certificate of Authenticity includes the quantity of media delivered to the project site and certifies the Bold & Gold® media delivered meets the patent requirements of the University of Central Florida.

Composition: The Bold & Gold® CTS Filtration media is manufactured with mineral materials and no organic materials. The final product has more than 2% but less than 6% passing the US #200 (75 micron opening size) sieve. The mix is composed of 85% poorly graded clean sand (washed) and 15% sorption materials by volume. The sorption materials are composed of recycled tire crumb with no metal contents and mined kaolin clay that has no less than 99% clay content. Percentages shall be determined by in-place volume. Water passing through the media must not exhibit acute or chronic toxicity and not change the pH of the filtered water by more than 1.0 unit. The material will have a water holding capacity (amount of water that the media can hold for crop use) of at least 10% as measured by porosity, and total porosity of 32%. The permeability as measured in the laboratory for a media at 95 pounds per cubic feet must be greater than 10.0 inches per hour.

Storage and Handling: The Bold & Gold® CTS Filtration media may be delivered pre-mixed and ready to install or the material components delivered separately and mixed on site by a certified ECS representative. Pre-mixed material and/or the clay portion of the component material shall be stored in a covered and well-drained area. Material shall not be stockpiled longer than 30 days before installation and must be covered always, to prevent separation of the material due to adverse weather and environmental conditions such as, but not limited, to rainfall and wind.

Delivery of the Material: Bold & Gold® CTS Filtration media may be delivered to the jobsite premixed OR the component materials may be delivered for onsite mixing by a certified ECS representative.

Premixed Delivery: Bold & Gold® CTS Filtration media shall be mixed by

Environmental Conservation Solutions, LLC. and delivered to the jobsite ready for installation. The delivered material is certified to meet the patent requirements and a certificate shall be issued as stated in Section 1.2 of this specification.

Onsite Mixing Delivery: The mixing shall be done either in a pugmill or other mechanical mixing system that has the capability of uniformly mixing the component material to the requirements of Section 1.3.1 of this specification. An Environmental Conservation Solutions, LLC. representative shall mix the material on a predesignated location. Care shall be taken to avoid contaminating the component material with the existing ground in the stockpile area. The mixed material may be stockpiled, and covered always, for up to 30 days before installation.

Installation: Surface on which the Bold & Gold® CTS Filtration media is placed shall be reasonably levelled within ± 1 -inch of the elevations shown in the plans. Unless a slope grade is specified in the plans, a level surface is recommended for the subgrade soil to ensure even infiltration of filtered stormwater spread over the entire surface area.

The surface of the subgrade soil underneath the Bold & Gold® CTS Filtration media shall be compacted and/or scarified to meet the requirements as specified by the design engineer. All necessary construction practices shall be taken to minimize the compaction of the subgrade soil, above the specified subgrade density, to avoid the reduction of the infiltration rate at the soil-filter media interface. The contractor shall take all necessary measures needed to control the deposition of sediments on the surface of the subgrade soil prior to the placement of the Bold & Gold® CTS Filtration media.

The Bold & Gold® CTS Filtration media shall not be installed until all areas that drain to it have temporally/permanent erosion and sedimentation stabilization in place. No runoff shall be directed to the specified location of the Bold & Gold® CTS Filtration Media until all drainage area leading to the location are stabilized. If the installed Bold & Gold® CTS Filtration media becomes contaminated with sediment, prior to the placement of the cover material, it shall be removed and replaced at the contractor's expense.

The Bold & Gold® CTS Filtration media may be placed in one lift and compacted to the density specified in the plan by the design engineer. For traffic load-bearing BMP applications, the Bold & Gold® CTS Filtration media shall be installed, in number and depth of lifts, as specified by the design engineer to achieve target installation density. The maximum dry density of the Bold & Gold® CTS Filtration media ranges between 100 and 105 pounds per cubic feet. Unless specified by the design engineer; a) the suggested installation dry density of the Bold & Gold® CTS Filtration media shall not be greater than 95 pounds per cubic feet for all non-traffic bearing BMP applications; or b) no less than 100 pounds per cubic feet for all traffic bearing BMP applications. The final in-place thickness of the Bold & Gold® CTS Filtration media shall not be less than the thickness shown in the plans for the specific project.

Compaction of the Bold & Gold® CTS Filtration Media shall be achieved by using industry-standard compaction techniques. Water free of contaminants (sediments and nutrients) may be sprinkled on to the Bold & Gold® CTS Filtration media to achieve the compaction requirements. If the compacted Bold & Gold® CTS Filtration media has an in-place density greater than 105% of the required density, the material will be reworked to meet density requirements.

Unless specified by the design engineer, the surface of the Bold & Gold® CTS Filtration media shall have a slope of between zero and 0.5 percent in preparation for the placement of the top cover material. The top cover material shall serve as a spreader of runoff over the filter media and prefilter of gross pollutants from contaminating the Bold & Gold® CTS Filtration media. In the event of clogging, the top cover material shall be removed and replaced with clean top cover material, at the same depth, to rejuvenate flow into the filter media. The top cover shall be free-draining material that is free of organics, sediments and all other pollutants that negates the purpose for the installation of the Bold & Gold® CTS Filtration media. Top cover materials shall be, but not limited to clean sand, gravel, geotextile, grass and others that may be specified by the design engineer and does not hinder the performance of the Bold & Gold® CTS Filtration media.

If required by the design engineer, sod or seed shall be placed over the Bold & Gold® CTS Filtration media within two days of placement. The sod used as cover for the Bold & Gold® CTS Filtration media shall have been grown in a predominantly sandy site with less than 5% of the soil attached to the sod passing the #200 (75 micron opening size) sieve and have no added fertilizer.

After placement of the top soil over the Bold & Gold® CTS Filtration media, driving and parking on the installed Bold & Gold® CTS Filtration media maybe allowed, if the surface is intended for traffic loading. If rutting to the Bold & Gold® CTS Filtration media occurs due to vehicles or equipment during installation, the contractor shall repair it to the grades and elevations in the plans.

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514: FILTER FABRIC (GEOTEXTILE)

514-1 Description.

Under this Item, the Contractor shall furnish and install **FILTER FABRIC (GEOTEXTILE)** of the types and sizes shown on the plans, in accordance with the plans, specifications, and directions of the Engineer.

514-2 Material.

Meet the filter fabric requirements Mirafi® 160N a nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers that retain their relative position.

Mirafi® 160N has been specified due to its inert features to biological degradation and resists naturally encountered chemicals, alkalis, and acids.

Mirafi® 160N meets AASHTO M288-15 Class 2 for Elongation > 50%.
 TenCate Geosynthetics Americas Laboratories are accredited by Geosynthetic Accreditation Institute - Laboratory Accreditation Program (GAI-LAP). NTPEP Listed

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D4632	lbs. (N)	160(712)	160 (712)
Grab Tensile Elongation	ASTM D4632	%	50	50
Trapezoid Tear Strength	ASTM D4533	lbs. (N)	60 (267)	60 (267)
CBR Puncture Strength	ASTM D6241	lbs. (N)	410 (1825)	
			Maximum Opening Size	
Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve (mm)	70 (0.212)	
			Minimum Roll Value	
Permittivity	ASTM D4491	sec ⁻¹	1.5	
Flow Rate	ASTM D4491	gal/min/ft ² (l/min/m ²)	110(4481)	
			Minimum Test Value	
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70	

Physical Properties	Unit	Roll Size
Roll Dimensions (width x length)	ft (m)	15 x 300 (4.5 x 91)
Roll Area	yd ² (m ²)	500 (418)

514-3 Construction Methods.

514-3.1 General: Place the filter fabric (fabric) in the manner and locations as shown in the Plans, in accordance with the manufacturer's directions, and as specified in these Specifications.

Place the fabric on areas with a uniform slope that are reasonably smooth, free from mounds, windrows, and any debris or projections which might damage the fabric. Loosely lay the material.

Do not stretch the material. Replace or repair any fabric damaged or displaced before or during placement of overlying layers to the satisfaction of the Engineer and at no expense to the Department.

When overlapping is necessary, the Contractor may sew the seams to reduce overlaps as specified in 985-3.

Schedule work so that covering the fabric with the specified material does not exceed the manufacturer's recommendations for exposure to ultraviolet light or five days, whichever is less. If the Engineer determines the exposure time was exceeded, the Contractor shall replace the fabric at no expense to the Department.

514-3.2 Subsurface Drainage: When indicated in the Plans, place the fabric with the long dimension parallel to the trench. Place the fabric to provide a minimum 12-inch overlap for each joint. Do not drop the filter material from heights greater than 3 feet.

514-3.3 Stabilization and Reinforcement: Overlap adjacent strips of fabric a minimum of 36 inches.

514-3.4 Riprap Filter: Overlap adjacent strips of fabric a minimum of 24 inches, and anchor them with securing pins (as recommended by the manufacturer) inserted through both strips of fabric along a line through the midpoint of the overlap and to the extent necessary to prevent displacement of the fabric.

Place the fabric so that the upstream (upper) strip of fabric overlaps the downstream (lower) strip.

Stagger vertical laps a minimum of 5 feet. Use full rolls of fabric whenever possible to reduce the number of vertical laps.

Do not drop bedding stone or riprap from heights greater than 3 feet onto the fabric.

514-4 Basis of Payment.

No separate payment will be made for the work specified in this Section. The cost of furnishing, placing, and sewing or overlapping the fabric will be included in the Contract price for the items to which it is incidental.

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948-9 PVC Geomembrane Liner 30 Mil

948-9.1 General: PVC liners fabricated by Environmental Protection INC. are a single-ply construction with Polyvinyl Chloride as the principle polymer. Only first quality virgin resins are used, and all materials meet or exceed the requirements of ASTM D7176 Standard Specification for PVC geomembranes used in buried applications.

948-9.2 Folded Liner: Folded liner shall be manufactured in an out of form state, usually collapsed circumferentially and folded on the long axis. After installation in a host structure, the liner is formed by means of heat and pressure to fit the host structure. When installed, folded liner shall extend from one structure to the next in one continuous length with no intermediate joints.

948-9.2.1 Polyethylene: Folded polyethylene liner shall meet the requirements

- Thickness 5% ASTM D-5199 .030"
- Specific Gravity (min) ASTM D-792 1.20
- Tensile (lb/in-width, min) ASTM D-882 73
- Elongation at Break (% min) ASTM D-882 380
- Modulus (lb/in-width, min) ASTM D-882 30
- Tear Resistance (lb/in, min) ASTM D-1004 8
- Resistance to Soil Burial ASTM G-160 (% change, max)
 1. Breaking Factor 5
 2. Elongation at Break 20
 3. Modulus at 100% Elongation 20

Impact Cold Crack (°C) ASTM D-1790 -29, Dimensional Stability ASTM D-1204, (% change, max) (212°F/15 min.) 3 Water Extraction (% max) ASTM D-1239 0.15, Volatile Loss (% max) ASTM D-1203(A) 0.70, Hydrostatic Resistance ASTM D-751(A) 100(psi, min), Plasticizer Min Ave Molec Wt ASTM 2124 400 Factory Fabricated Seams: Peel Strength (lbs/in, min) ASTM D-882 15, Shear Strength (lbs/in, min) ASTM D-882 58.4.

948-9.3 Basis of Payment.

No separate payment will be made for the work specified in this Section. The cost of furnishing, placing, and overlapping the liner will be included in the

Contract price for the items to which it is incidental.

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440-1 - 18" HP Dual Wall Perforated Pipe

Perforated pipe plays an integral role in many applications of HDPE pipe. Generally, perforated pipe is used to accelerate the removal of subsurface water in soils or to allow storm water to percolate into the soil. Currently, two classifications of perforations are specified in the AASHTO material specifications for HDPE pipe: Class I, and Class II. The Class II perforation pattern comes standard when perforated pipe is ordered. Class One perforated pipe has limited availability. Please check with a local representative to determine availability. Both classes are explained in more detail in the AASHTO materials specifications (M294 and M252). AASHTO M252 covers pipe diameters 3- through 10-inch (75 - 250 mm) while M294 covers 12-inch through 60-inch (300 - 1500 mm).

Nominal I.D.		Perforation Type	Maximum Slot Length or Diameter		Maximum Slot Width		Minimum Inlet Area	
in	mm		in	mm	in	mm	in ² /ft	cm ² /m
4	100	Slot	0.875	22	0.125	3	1.0	21
6	150	Slot	0.875	22	0.125	3	1.0	21
8	200	Slot	1.18	30	0.125	3	1.0	21
10	250	Slot	1.18	30	0.125	3	1.0	21
12	300	Circular	0.313	8	-	-	1.5	32
15	375	Circular	0.313	8	-	-	1.5	32
18	450	Circular	0.313	8	-	-	1.5	32
24	600	Circular	0.313	8	-	-	2.0	42
30	750	Circular	0.375	9.5	-	-	2.0	42
36	900	Circular	0.375	9.5	-	-	2.0	42
42	1050	Circular	0.375	9.5	-	-	2.0	42
48	1200	Circular	0.375	9.5	-	-	2.0	42
54	1350	Circular	0.375	9.5	-	-	2.0	42

60	1500	Circular	0.375	9.5	-	-	2.0	42
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Standard**Perforation Patterns AASHTO Class II Perforation**

The following terminology for perforations is derived from the applicable AASHTO specification. Differences between the specifications are covered in the table below. Class II perforations shall be in the outside valleys of the corrugations, be circular and/or slotted and evenly spaced around the circumference and length of the pipe. The perforations shall be in the outside valleys of the corrugations. The water inlet area shall be no less than 0.945 in²/ft (20 cm²/m) for pipe diameters 4- through 10-inch (100 - 250mm), 1.42 in²/ft (30 cm²/m) for pipe diameters 12- through 18-inch (300 - 450 mm) and 1.89 in²/ft (40 cm²/m) for pipe diameters larger than and equal to 24 inches (600 mm). Table 1 below represents ADS standard perforation patterns for AASHTO Class II.

440-4 Laying Pipe.

440-4.1 General: Bed the pipe firmly on the bottom of the trench, with the perforations down and joints securely made.

440-5 Placing Filter Material and Backfilling.

440-5.1 Placing Material: After laying the pipe and obtaining the Engineer's approval, backfill the trench with filter material to the lines shown in the Plans.

440-5.2 Compaction of Filter Material and Protection of Pipe: Place and compact the filter material around the pipe and for the full width of the trench, in layers not exceeding 6 inches in thickness. Take special care to avoid displacement or damage to the pipe.

440-5.3 Backfill Above Filter Material: For all types of pipe, backfill the portion of the trench above the filter material with suitable pervious material. Place and compact the material in layers not exceeding 4 inches in thickness.

440-6 Type V Underdrain Construction.

To prevent clogging of Type V underdrain from construction sediments, initially excavate the associated stormwater facilities to rough grade. After

the contributing drainage area is stabilized, construct the underdrains and excavate the stormwater facilities to achieve the final elevation.

440-7 Method of Measurement.

The quantities to be paid for will be the length, in feet, of underdrain, which includes underdrain cleanout structures, measured in place, along the centerline and gradient of the underdrain, completed and accepted. The quantities to be paid for will be the length, in feet, of outlet pipe measured in place, along the centerline and gradient of the outlet pipe, completed and accepted. The quantity of underdrain inspection boxes to be paid for will be the number completed and accepted.

440-8 Basis of Payment.

Price and payment will be full compensation for all the work, including all materials and all excavation except the volume included in the items for the grading work. Payment will be made under:

Item No. 440- 1- Underdrain - per foot.

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DAF-1 Decorative Aluminum Fencing 6' x 8' panel with 6" post
DAG-1 Decorative Aluminum Swing Gate installed with Hardware
DAG-W Decorative Aluminum 6' x 4' Walkthrough Gate

Contractor will provide new fence installations and repairs for various stormwater drainage retention areas (DRA) throughout the City. The Contractor will provide all labor, materials and equipment necessary to complete this project per the scope of work.

WORK: Under this Item, the Contractor shall furnish, and erect **Decorative Aluminum Fencing** and **GATES** of the types and sizes shown on the plans, in accordance with the plans, specifications, and directions of the Engineer.

Aluminum fencing must meet minimum specifications with factory AAMA 2604-5 Premium Powder Coat Finish from factory (BLACK)

Industrial Grade Aluminum Fencing 3 Rail Flush Bottom	
Pickets	1.0" x .1.0" x .060" wall
Stringers	1.5"x1.5"
Side wall Top wall	0.100" 0.070"
Posts	2.5" x 2.5" x 0.075" walls
Gate Posts	4" x 4" x 0.125" wall 6" x 6" x 0.125" wall
Picket Spacing Spacing between pickets	4 7/8" on center 3 7/8" air space
Height	72" or 6'
Alloy	6105-T5-35,000 PSI

GATES shall be constructed of pickets, posts, and rails of the sizes to match the Fence used.

Contractor to furnish and install Double swing 6' x 8' (2 EA) maintenance access gate and one 6' x 4' Walkthrough gate with 4" post

Fences and Gates shall be fabricated in strict accordance with the plans and approved Shop Drawings.

Posts and pickets shall, in all cases, be truly vertical. Rails and bars shall be parallel to grade.

Double Gates: All necessary fittings and gate holders to lock gates in both open and closed positions shall be furnished.

GATE LATCH - Single Gates: Shall be a lockable stirrup type.

Installation Requirements

Installation shall follow all requirements and instructions of applicable manufacturer.

The Contractor shall visit job sites and be responsible for all field measurements and aware of job conditions.

Installation shall be done in a neat workman-like manner. The fence shall follow the natural contour of the ground (no gaps under fence) in a straight line from one point (corner) to another unless otherwise noted on the drawing.

Fence posts shall be plumb, and the top rails shall be attached in a manner that forms a smooth horizontal alignment.

Some repair jobs will be minimal and only require one (1) person. The City reserves the right to determine if a specific job warrants a one (1) or more person crew.

Installation of chain link fence shall be in accordance with ASTM F 567, and with the following:

Post spacing shall be spaced a maximum of 10'0" on center. Terminal spans may be less, to a minimum of 7'0" to adjust line spans to even footage.

Post foundations (footings) shall be:

- a. A minimum of 24" deep plus three (3) inches for each increase in fabric height above four (4) feet.
- b. The diameter of the post foundation shall be four (4) times the post diameter.
- c. The depth of the post hole shall be three (3) times the diameter of the post and the hole diameter shall be one-half (1/2) inch greater than the diameter of the post.

Gate post foundations shall be in accordance with ASTM F 567

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WA- Well Abandonment.

Payment for this bid item shall be made at the unit price set forth in the proposal and shall constitute full compensation for materials, restoration of area, equipment, labor, permits and any other related work that is necessary for abandonment of existing wells, Performed by a FL. State Licensed Well Driller as specified in Chapter 62-532.440 Abandonment of Water Wells of the State of Florida D.E.P Regulations on Water Well Permitting and Construction Requirement.