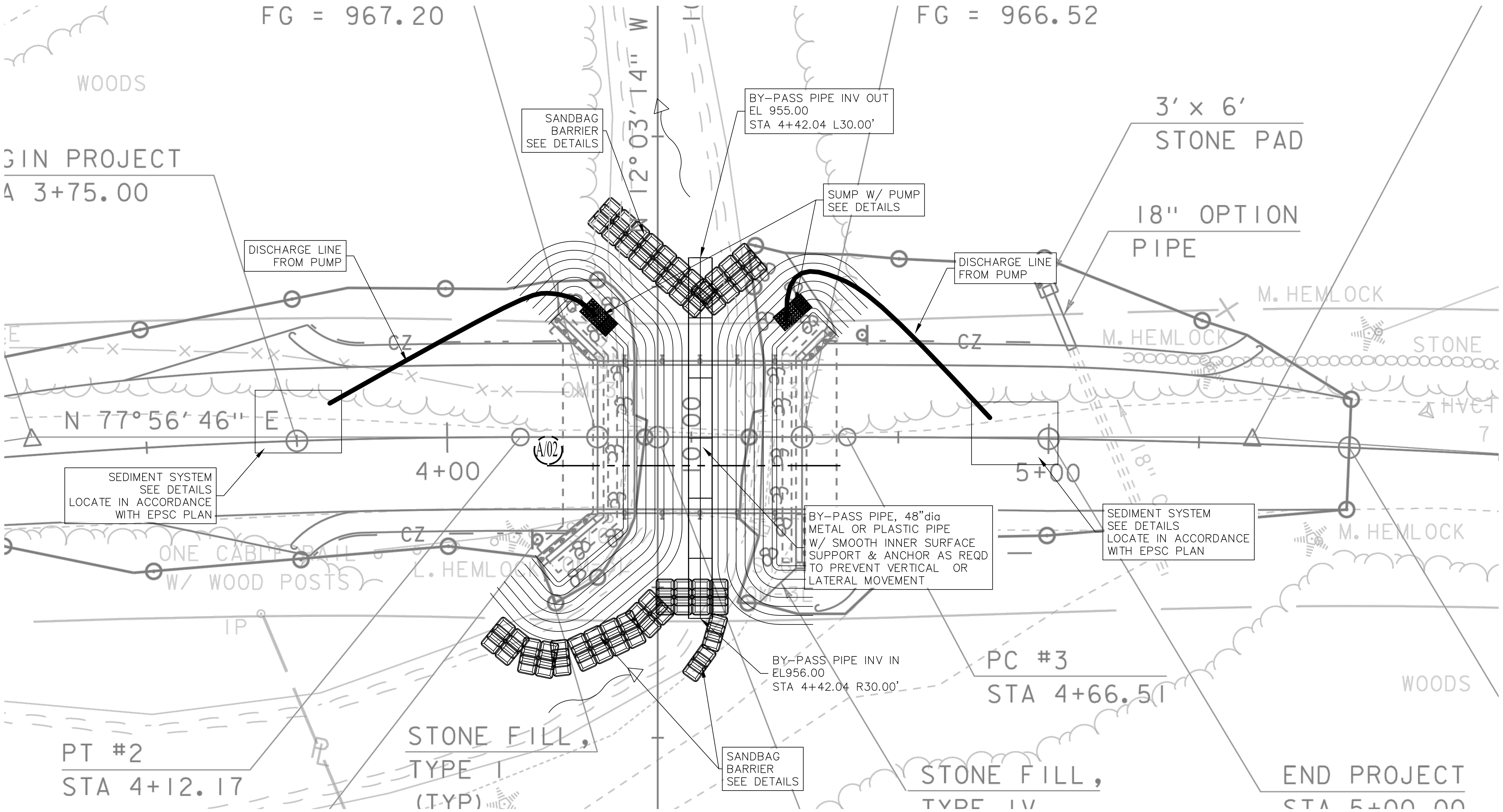


GENERAL PLAN

1" = 10'

Water Control Requirements:

1. The water control system is to be coordinated with the EPSC work.
2. This work shall consist of the construction, material excavation within, dewatering, maintenance and removal of water control system in accordance with the specifications at locations designated in the Plans or in the Contract.
3. This work shall consist of providing a method for the purpose of constructing, in the dry, a specific foundation or other component of a structure in accordance with Contract requirements.
4. This involves construction, maintenance, and removal of a watertight structure or may involve alternate methods of de-watering and stabilizing the specific site.
5. The Contractor shall obtain any and all necessary permits or clearances for alternate methods.
6. The locations and elevations for excavation shall be as indicated on the Plans.
7. The Engineer may order removal of poor foundation material below the normal designated elevation and replacement with an approved material.
8. Dewatering system elements shown on the plan are approximate
9. Actual location and sizing of dewatering system elements are to be based on current field conditions
10. During the performance of all work under this contract, the Contractor shall adopt such precautions in the conduct of his operation as may be necessary to avoid contaminating ground or surface water.
11. All earthwork, grading, moving of equipment, water control and other operation likely to create silting, shall be so planned and conducted as to minimize pollution in any wetland resource area.
12. Water used for any purpose whatsoever by the Contractor, which has become contaminated with soil, bitumen, salt, concrete or other pollutants shall not be discharged into any wetland resource area.
13. Under no circumstances shall the Contractor discharge pollutants into a wetland resource area.
14. The Contractor shall not store fuel or permit any refueling of construction equipment while such equipment is within 100 feet of any resource area.
15. The contractor shall make all efforts to control the run-off of water and sediment from the project site during path construction.
16. All work to be done in the dry.
17. The Contractor shall use such equipment and shall perform his operations in such a manner that boiling or other disturbances of the soil in the construction area will be prevented.
18. He shall keep the area being excavated dry by such means that water will be prevented from entering from the adjacent soils.
19. All dewatering and related earthworks shall be conducted in such a manner as to prevent siltation or contamination of the brook.
20. The pumping discharge shall not be allowed to enter directly into the brook.
21. The water from the work areas shall be pumped to a sediment system in accordance with the EPSC Plan.
22. The Contractor shall provide and maintain ample pumps, pipes and other devices to promptly and continually remove and dispose of water from the excavation areas.
23. The size and configuration of pumps and pipes shall be selected by the contractor.
24. After having served its purpose, the water control system shall become the property of the Contractor and shall be removed by the Contractor from the site subject to the Engineer's approval.

Water Control Procedure:

1. The Water Control System is to control water intrusion into the work areas such that the work can be performed "in-the-dry"
2. Water control includes all dewatering necessary to accomplish existing bridge removal, new bridge base material placement, new bridge construction, and new stream bed construction "in-the-dry"
3. The need and extent of sedimentation systems and dewatering techniques and sedimentation controls needed to control water and sediment at the site are to be determined in the field based on current conditions and the EPSC Plan.
4. Provide the means of removing all sediment from water pumped from the excavation areas
5. Apply pumping operations, installation of sandbags, geotextile fabrics, and all other means to collect, settle, and discharge water back in to the waterway as required during construction
6. Stream diversions shall be conducted in such a manner as to minimize siltation and prevent contamination of the waterway
7. Ensure that water control operations neither cause the accumulation of siltation nor any adverse effect to the water or the environment
8. The effectiveness of the water control method used will vary based on the field conditions at the time at which the work is being performed
9. Weather monitoring will be required.
10. If a storm is forecast additional adequate measures are to be at the ready to handle anticipated flow increases.
11. Flow increases can be handled by addition of by-pass pumps in size and number to be determined in the field based on current conditions and anticipated flow increases.
12. If flows are beyond the capacity of all available measures, the water control system is to be remove, the excavation flooded and all obstacle preventing free flow of the stream removed.
13. The Water Control System is non-permanent and is to not harm the ecology of the waterway, land under water, and surrounding land

General Notes

GENERAL NOTES:
1. Existing conditions are taken from Contract Drawings.
2. All dimensions relative to existing elements are to be field checked prior to fabrication and installation of proposed elements.
3. Control datums are those from the Contract Documents.

-130516-

No.	Revision/Issue	Date
1	address reviewer comments	130715

Firm Name and Address
TAW Associates
Waterville Valley, NH
603-236-4247 www.TAWAssociates.net

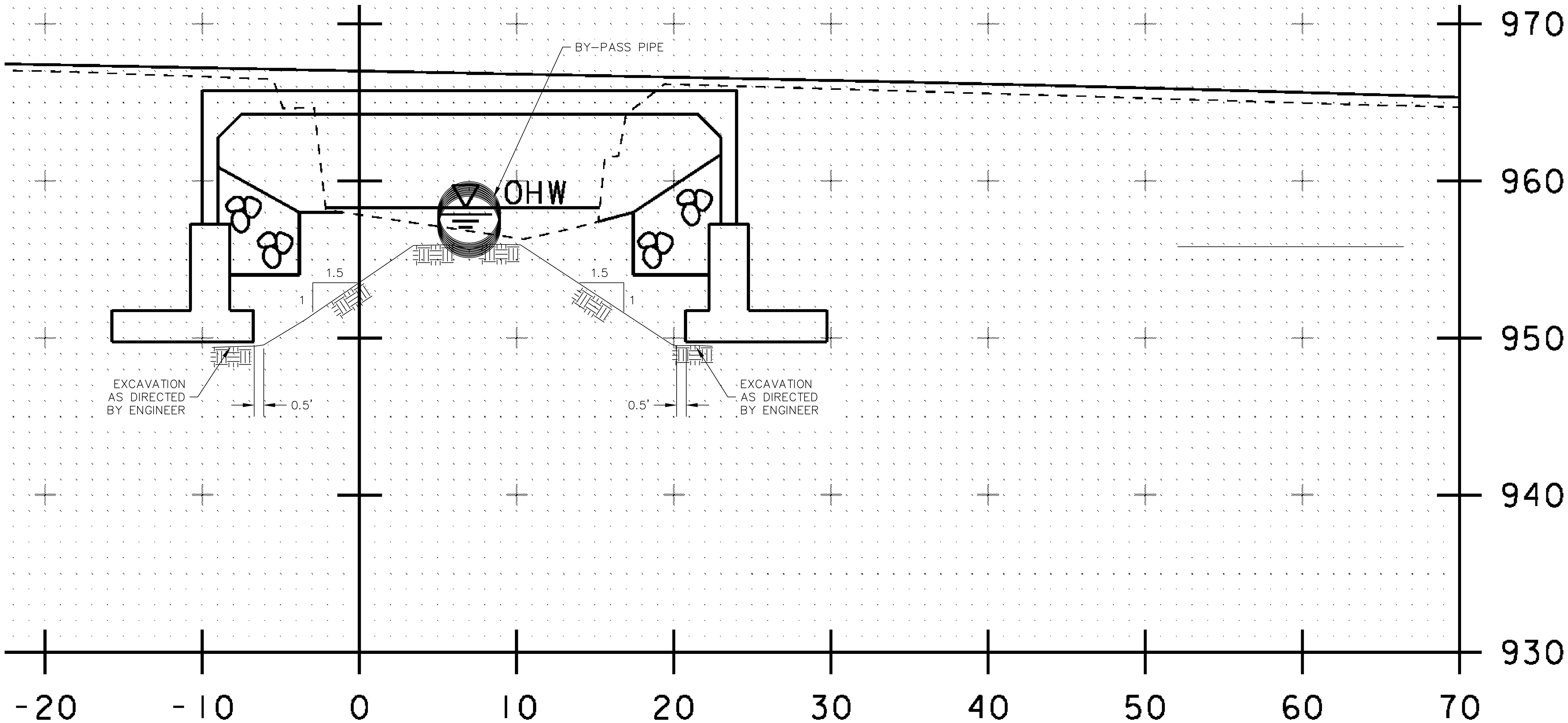
Woodstock, VT
VTrans BRO 1444(55)

Project Name and Address
WATER CONTROL

GENERAL PLAN

Project	130901A	Sheet
Date	May 16, 2013	WC01
Scale	noted	

B.U.R. CONSTRUCTION



A/02 VIEW
1/4" = 1'

General Notes

No.	Revision/Issue	Date
1	address reviewer comments	130715

Firm Name and Address
TAW Associates
Waterville Valley, NH
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Woodstock, VT
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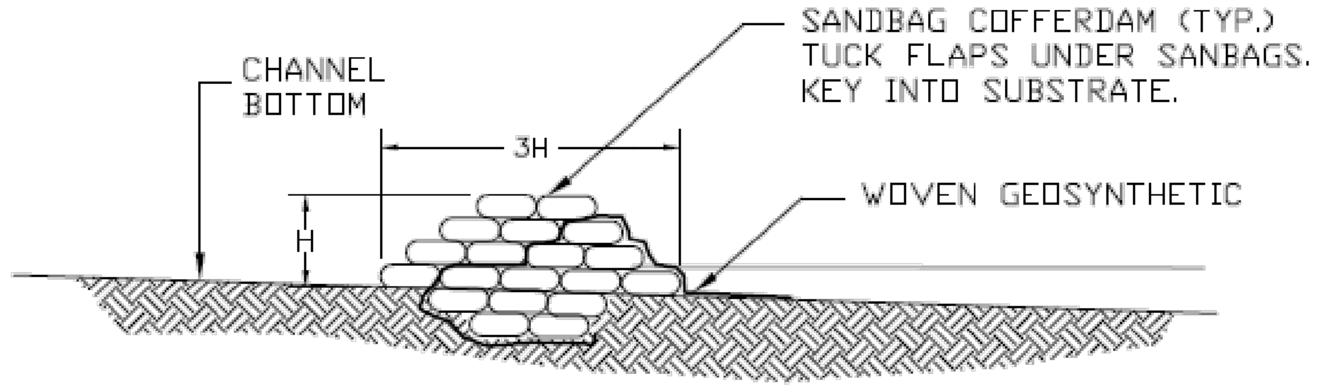
Project Name and Address
WATER CONTROL

SECTIONS

Project 130901A
Date May 16, 2013
Scale noted
Sheet WC02

B.U.R. CONSTRUCTION



HEIGHT OF BERM	BAGS/100FEET
1 FOOT	800
2 FEET	2000
3 FEET	3400

SOURCE: NEW ENGLAND DIVISION ARMY CORPS OF ENGINEERS

NOTES:

1) Sandbag Preparation

a. Utilize polypropylene or burlap bags about 14" – 18" wide and 30" –36" deep.

b. A heavy bodied or sandy soil is most desirable for filling sandbags. On–site soil sources may be utilized, as appropriate.

c. Bags should be filled between one–third (1/3) to one–half (1/2) of their capacity. This keeps the bag from getting too heavy, and permits the bags to be stacked with a good seal.

d. Untied sandbags are recommended for most situations. Tied sandbags should be used only for special situations when pre–filling and stockpiling may be required, or for specific purposes such as filling holes, holding objects in position, or to form barriers backed by supportive planks. Tied sandbags are generally easier to handle and stockpile.

2) Sandbag Placement

a. Remove any debris from the area where the bags are to be placed.

b. Fold the open end of the unfilled portion of the bag to form a triangle. If tied bags are used, flatten or flare the tied end.

c. Place the partially filled bags lengthwise and parallel to the direction of flow, with the open end facing against the water flow.

d. Tuck the flaps under, keeping the unfilled portion under the weight of the sack.

e. Place succeeding bags on top, offsetting by one–half (1/2) filled length of the previous bag, and stamp into place to eliminate voids, and form a tight seal.

f. Stagger the joint connections when multiple layers are necessary. For unsupported layers over three (3) courses high, use the pyramid placement method.

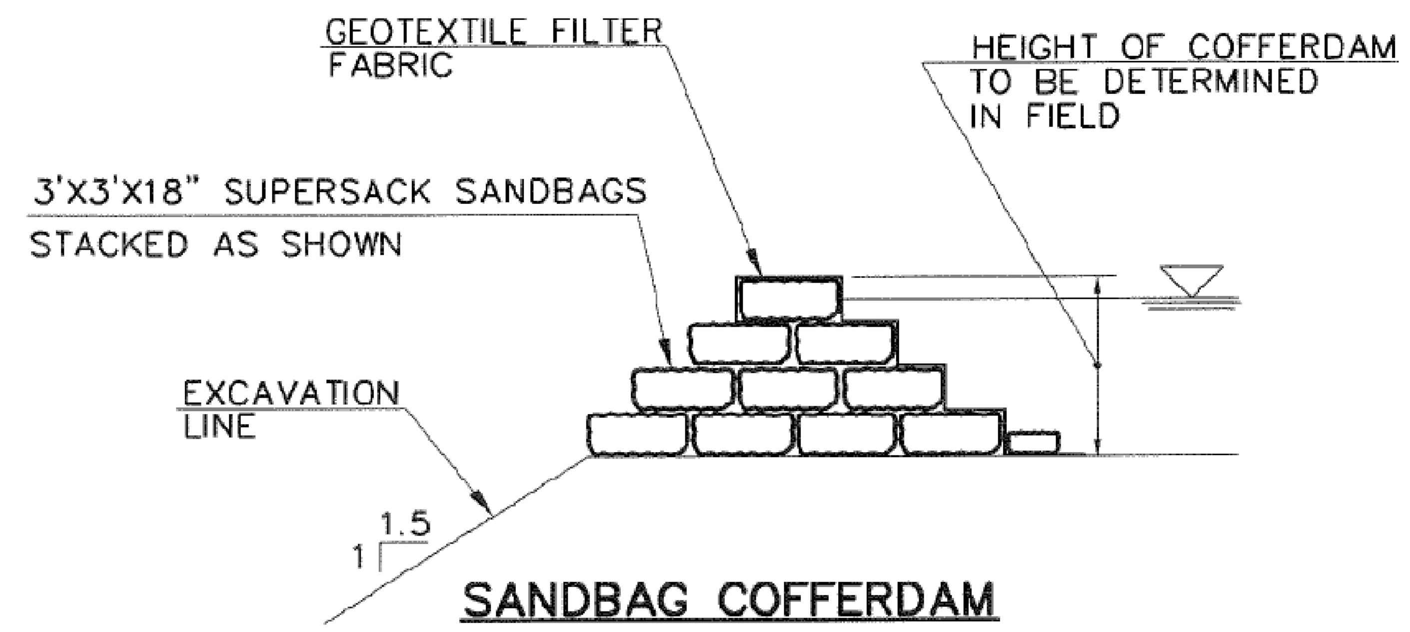
3) Pyramid Placement Method

The pyramid placement is used to increase the height of sandbag protection.

a. Place the sandbags to form a pyramid by alternating header courses (bags placed crosswise) and stretcher courses (bags placed lengthwise).

b. Stamp each bag in place, overlap sacks, maintain staggered joint placement, and tuck in any loose ends.

c. Use the table on this Figure to estimate the number of bags required



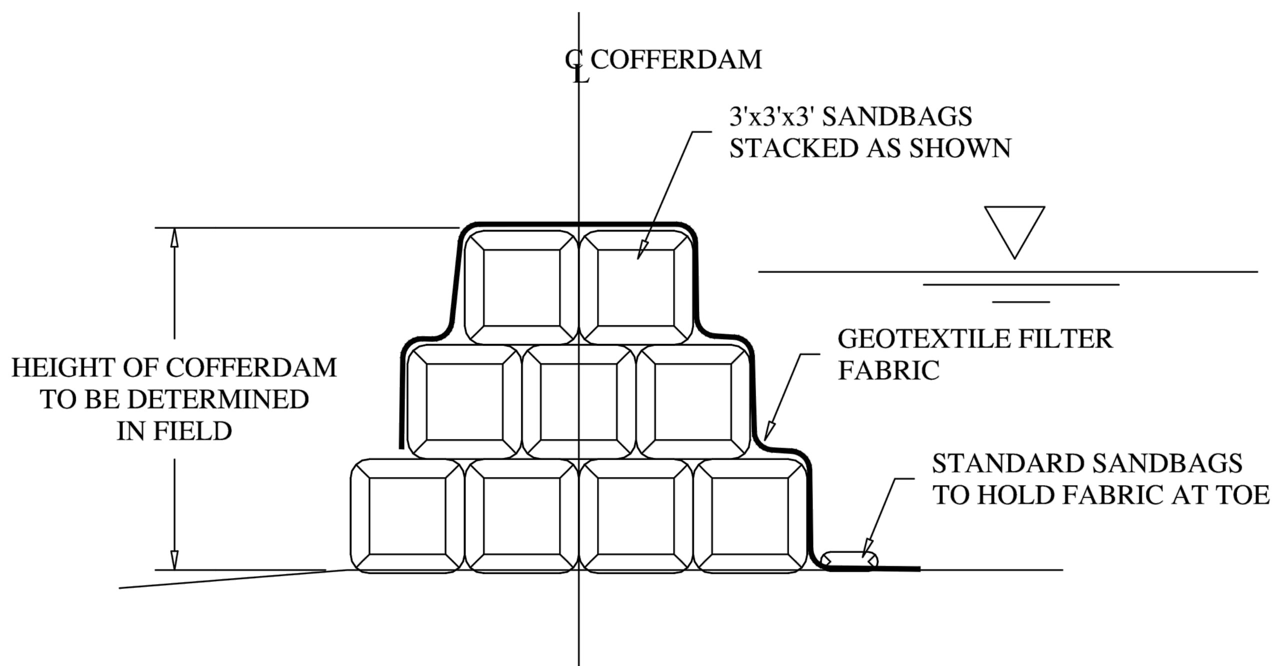
SANDBAG COFFERDAM

NOT TO SCALE

NOTES:

1. SANDBAG COFFERDAM IS TO BE CONSTRUCTED IN A PYRAMID SHAPE BASED ON THE REQUIRED HEIGHT AND NUMBER OF BAGS REQUIRED.
2. THE SANDBAGS ARE TO BE PLACED OVERLAPPING ALONG THE LENGTH OF THE COFFERDAM.

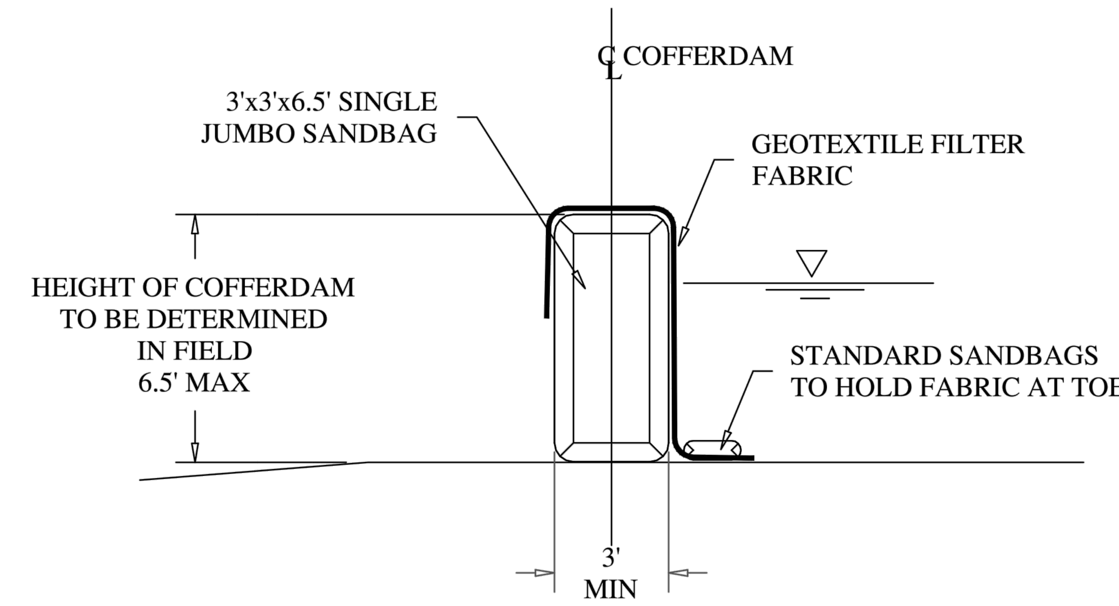
HEIGHT OF COFFERDAM	NUMBER OF SANDBAGS REQUIRED FOR COFFERDAM
0" TO 18"	1
18" TO 3'	3
3' TO 4'-6"	6
4'-6" TO 6'	10



1. Sandbag Cofferdam is to be constructed in a pyramid shape always with a minimum of two bags side by side at the top level based on the required height and number of bags required
2. The Sandbags are to be placed overlapping along the length of the cofferdam
3. A single Sandbag may be used for cofferdam heights up to and including 3'

JUMBO SANDBAG OPTION

NTS



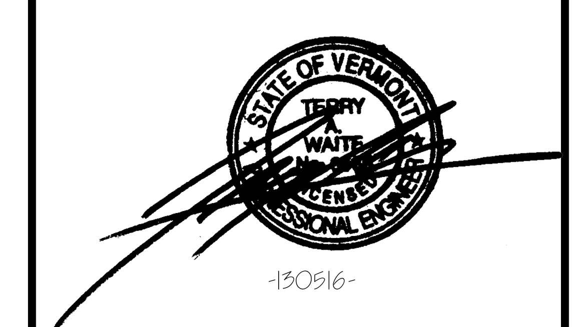
1. Sandbag Cofferdam section is to be of single bag construction with a maximum height of 6.5'

NOTE: This option provides a slender section to meet limiting width conditions, but does not meet AASHTO specified Factors of Safety

SINGLE JUMBO SANDBAG OPTION

NTS

General Notes



No.	Revision/Issue	Date
⚠	address reviewer comments	130715

Firm Name and Address

TAW Associates
Waterville Valley, NH
603-236-4247 www.TAWAssociates.net

Woodstock, VT
VTrans BRO 1444(55)

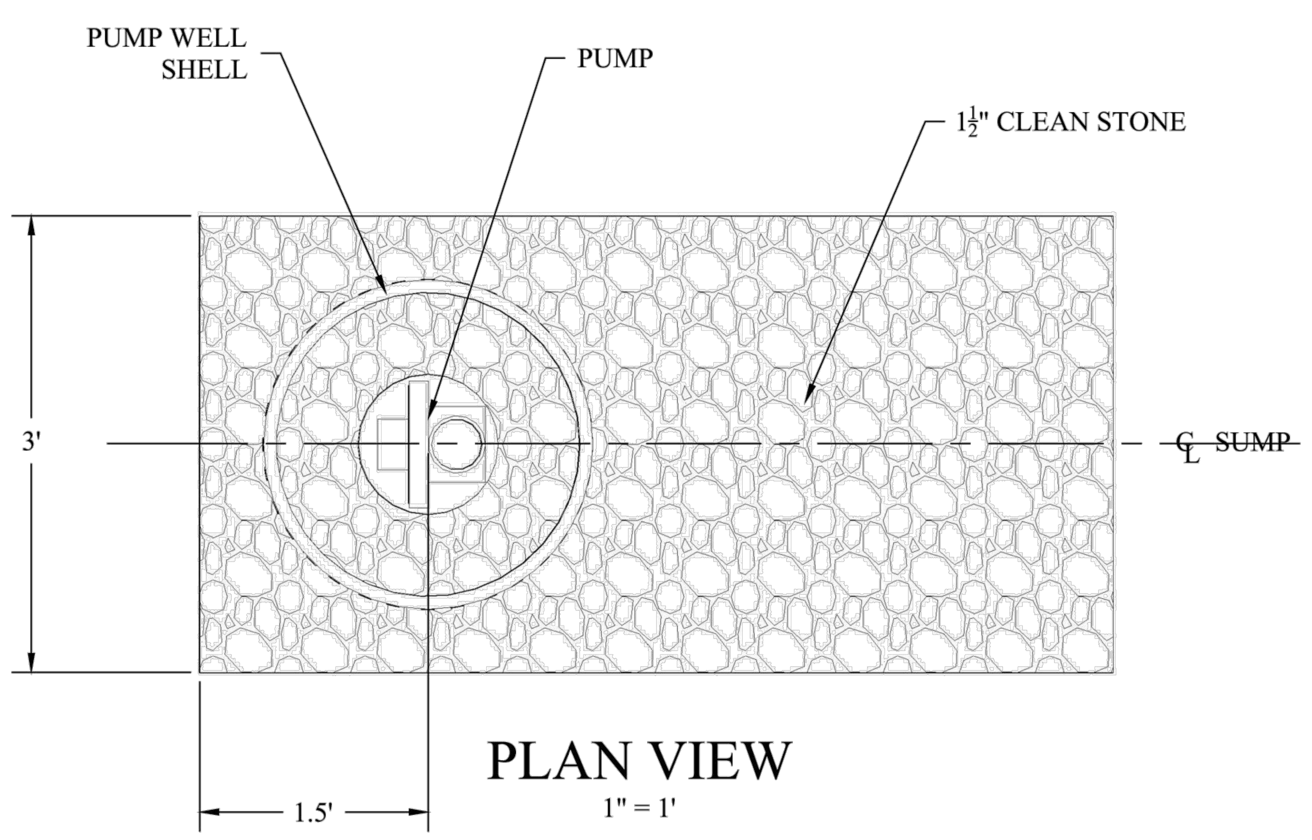
Project Name and Address

WATER CONTROL

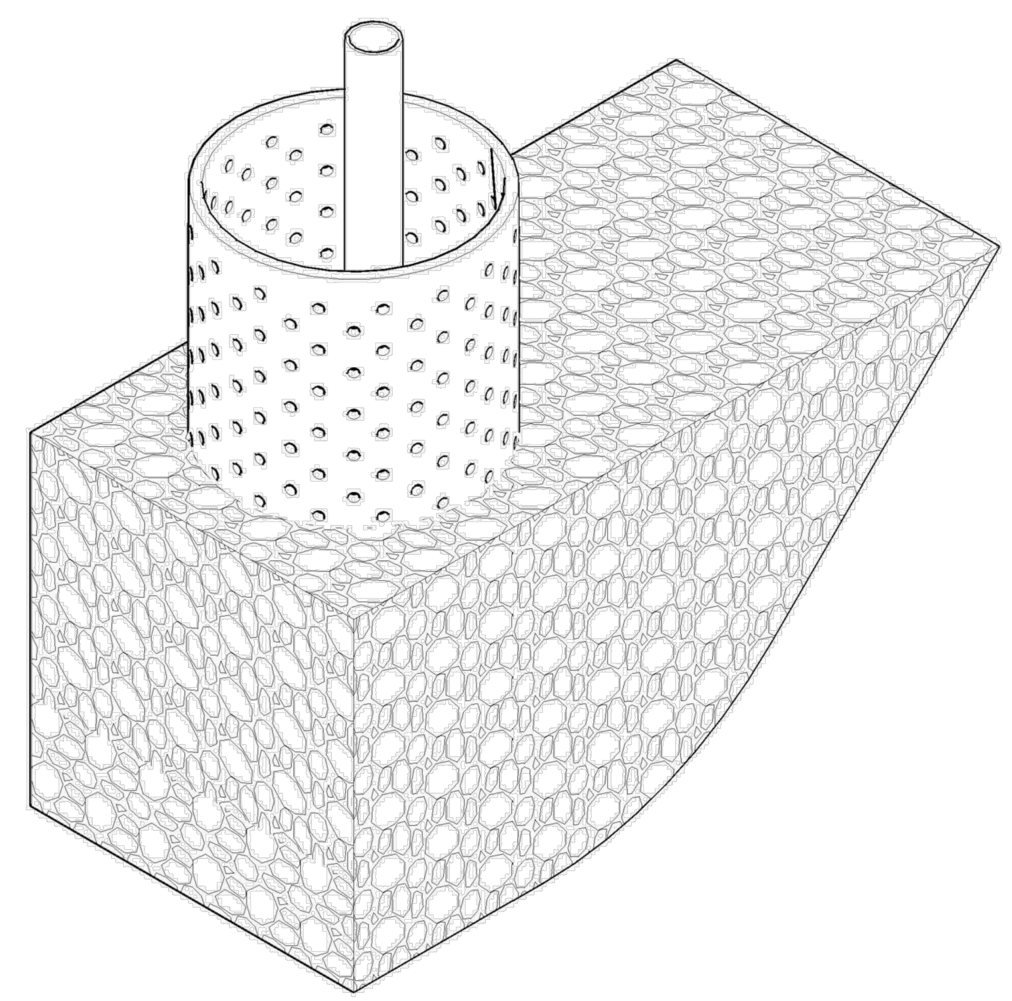
SANDBAG
BARRIER DETAILS

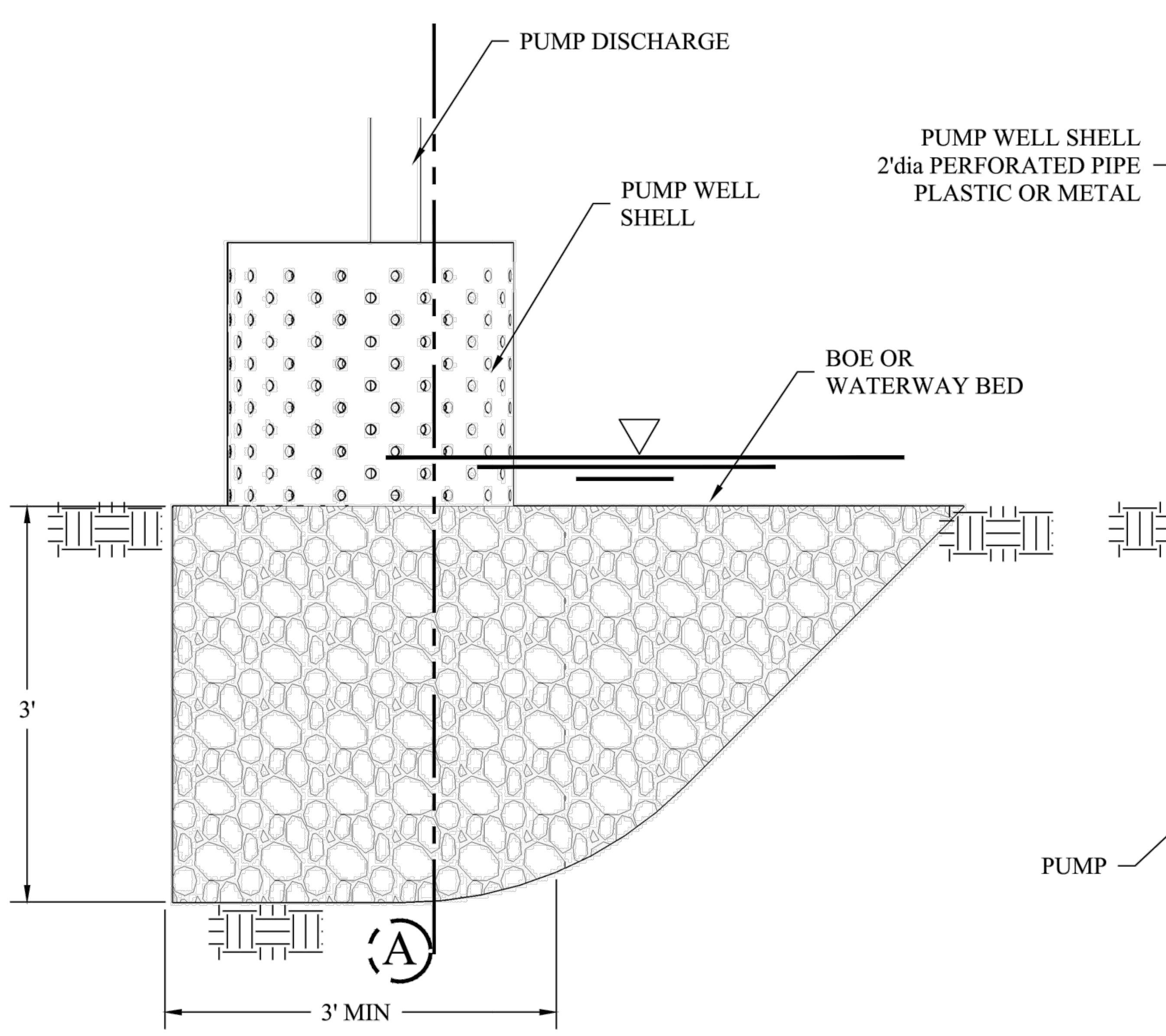
Project 130901A	Sheet WC03
Date May 16, 2013	
Scale noted	

B.U.R. CONSTRUCTION

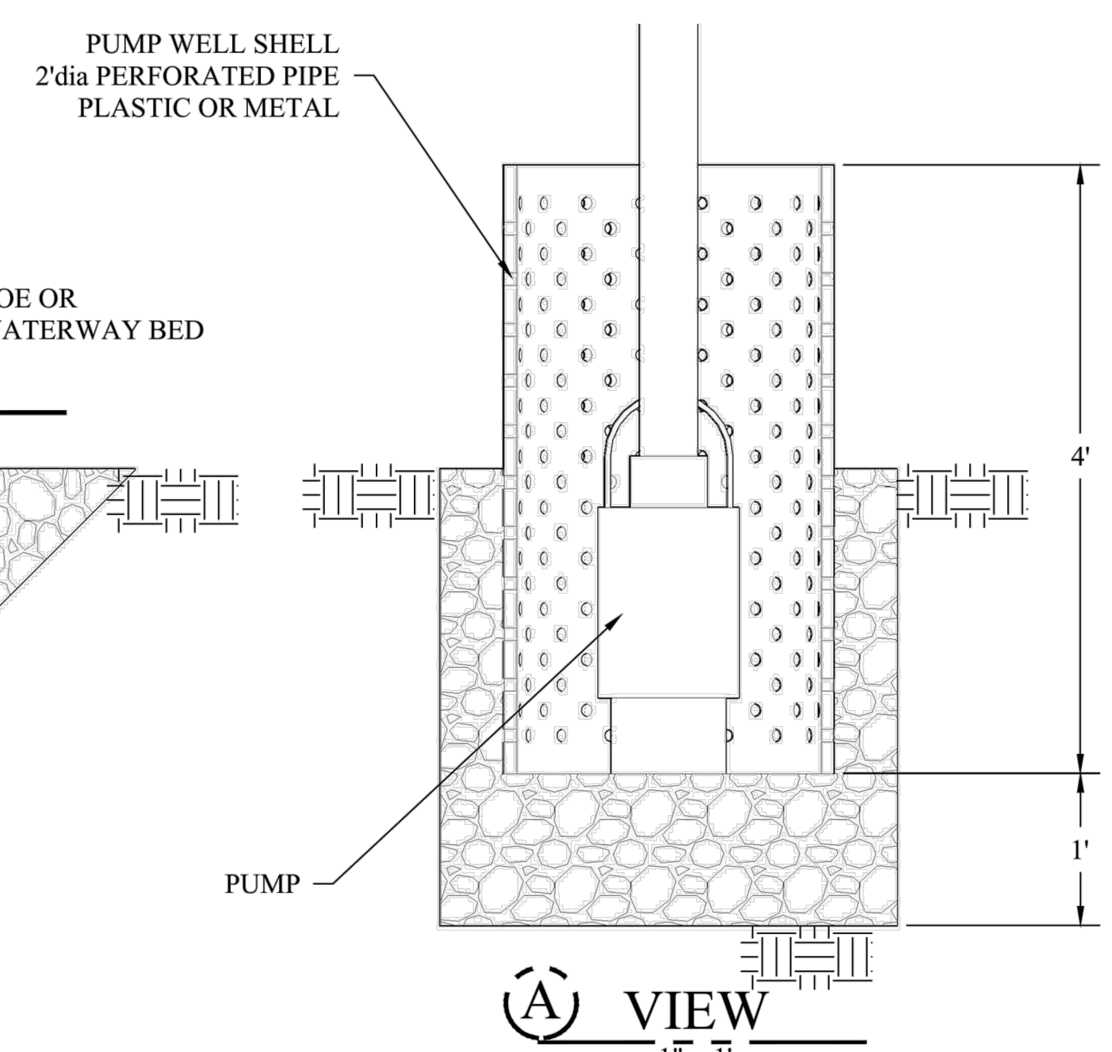


PLAN VIEW
1" = 1'





ELEVATION



A VIEW
1" = 1'

SUMP DETAIL
NTS

S SERIES® SLIMLINE SUBMERSIBLE PUMPS

Dependable Portability

For drilled wells, narrow cofferdams and hard-to-reach places, Gorman-Rupp's Slimline submersible pumps are lighter and easier to handle than their larger Widebase cousins. Even so, there is a strong family resemblance: Gorman-Rupp puts extra protection into the seals, and the impeller is rugged and dependable.

GORMAN-RUPP PUMPS
www.GRpumps.com

ECONOMY

The Slimline design offers an economy of space that allows these pumps to go where many others cannot. Their portability makes them exceptionally useful. Where additional head is needed, two Slimline pumps can be used in tandem for twice the head at the same flow.

DEPENDABLE

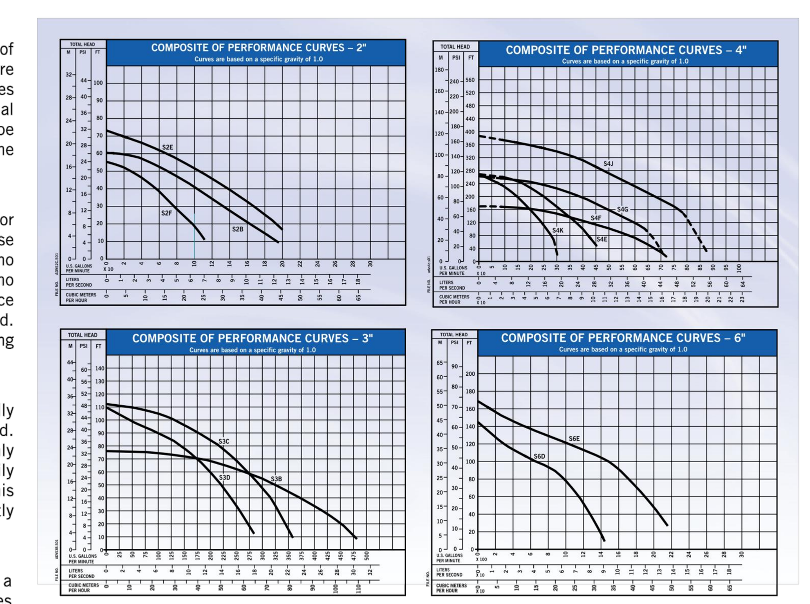
Slimline submersibles are designed for continuous, unattended operation. These electric motor-driven pumps need no winterizing and fuel checks. There is no danger of flooding these pumps since they operate fully or partially submerged. They work well in warm or subfreezing conditions.

SLIM DESIGN

The Slimline design is especially suited for use where space is limited. The 2" (50 mm) submersible is only 7-1/2" (191 mm) in diameter, easily fitting in an 8" (203 mm) casing. This eliminates the need for larger, more costly casings and screens.

LIGHTWEIGHT AND PORTABLE

Gorman-Rupp Slimline pumps feature a compact, lightweight design that makes handling and installation simple. Our 1 HP, 2" (50 mm) model weighs only 43 lbs. (19.5 kg), yet pumps up to 110 GPM (6.9 lps) with heads to 55' (17 m). The 3" (75 mm) model weighs only 120 lbs. (54.5 kg), pumping up to 475 GPM (30 lps) with heads to 105' (32 m).



SLIMLINE SUBMERSIBLE DATA

Model	Discharge	Height	Diameter	Max. Solids	Power	Hertz	Speed	Phase	Voltage	Cable Size
S2F1	2" (50 mm)	22.62" (574.5 mm)	7.50" (190.5 mm)	0.31" (7.87 mm)	1 HP	60	3450 RPM	1, 3	115/230/460/575	#14, #10
S2B1, S2B18*	2" (50 mm)	24.97" (634.2 mm)	7.50" (190.5 mm)	0.31" (7.87 mm)	2 HP	60	3450 RPM	1, 3	115/230/460/575	#14, #10
S2E1, S2E18*	2" (50 mm)	25.19" (639.8 mm)	7.50" (190.5 mm)	0.31" (7.87 mm)	3.5 HP	60	3450 RPM	3	200/230/460/575	#14
S3D1	3" (75 mm)	27.19" (690.6 mm)	9.62" (244.3 mm)	0.38" (9.65 mm)	5 HP	60	3450 RPM	3	200/230	#10
S3B1, S3B18*	3" (75 mm)	26.58" (675.1 mm)	9.88" (251.0 mm)	0.38" (9.65 mm)	6 HP	60	3450 RPM	1, 3	230/460/575	#10
S3C1, S3C18*	3" (75 mm)	26.58" (675.1 mm)	9.62" (244.3 mm)	0.38" (9.65 mm)	6 HP	60	3450 RPM	1, 3	230/460/575	#10
S4C1, S4C18*	4" (100 mm)	29.62" (752.3 mm)	10.81" (274.6 mm)	0.38" (9.65 mm)	10 HP	60	3450 RPM	3	230/460/575	#10, #8
S4D1, S4D18*	4" (100 mm)	29.22" (742.2 mm)	10.81" (274.6 mm)	0.38" (9.65 mm)	10 HP	60	3450 RPM	3	200/230/460/575	#10, #8
S4H1	4" (100 mm)	28.41" (721.6 mm)	10.81" (274.6 mm)	0.38" (9.65 mm)	10 HP	60	3450 RPM	3	200/230/460/575	#8
S4K1	4" (100 mm)	36.35" (923.3 mm)	14.24" (361.7 mm)	0.38" (9.65 mm)	15 HP	60	3450 RPM	3	460/575	#12
S4E1	4" (100 mm)	40.04" (1017.0 mm)	14.24" (361.7 mm)	0.38" (9.65 mm)	20 HP	60	3450 RPM	3	460/575	#8
S4F1	4" (100 mm)	40.06" (1017.5 mm)	14.24" (361.7 mm)	0.38" (9.65 mm)	20 HP	60	3450 RPM	3	460/575	#8
S4G1	4" (100 mm)	50.44" (1281.1 mm)	15.88" (403.4 mm)	0.50" (12.70 mm)	30 HP	60	3450 RPM	3	460/575	#8
S4J1	4" (100 mm)	59.63" (1514.6 mm)	17.38" (441.4 mm)	0.50" (12.70 mm)	60 HP	60	3450 RPM	3	460/575	#6
S6D1	6" (150 mm)	51.75" (1314.4 mm)	15.88" (403.4 mm)	0.50" (12.70 mm)	30 HP	60	3450 RPM	3	460/575	#8
S6E1	6" (150 mm)	61.34" (1558.0 mm)	17.38" (441.4 mm)	0.50" (12.70 mm)	60 HP	60	3450 RPM	3	460/575	#6

*Stainless steel fitted.

This chart represents only a small cross-section of models available. Specifications are subject to change. Consult your Gorman-Rupp distributor for detailed information.

Product information is subject to change; consult factory for details.

GORMAN-RUPP PUMPS

The Gorman-Rupp Company
Mansfield Division
P.O. Box 1217
Mansfield, Ohio 44901-1217
Tel: 419-755-1011
Fax: 419-755-1251
E-mail: grsales@gormanrupp.com

Gorman-Rupp International
P.O. Box 1217
Mansfield, Ohio 44901-1217
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Gorman-Rupp of Canada, Ltd.
70 Burwell Road
St. Thomas, Ontario N5P 3R7, Canada
Tel: 519-631-2870
Fax: 519-631-4624
E-mail: grcanada@grcanada.com

ISO 9001:2000 REGISTERED COMPANY MANSFIELD DIVISION

AV-02268SL_REV407

www.GRpumps.com

Printed in the USA

PUMP DETAIL
NTS

General Notes

No.	Revision/Issue	Date
1	address reviewer comments	130715

Firm Name and Address
TAW Associates
Waterville Valley, NH
603-236-4247 www.TAWAssociates.net

Woodstock, VT
VTrans BRO 1444(55)

Project Name and Address
WATER CONTROL

DEWATERING
SYSTEM DETAILS

Project	130901A	Sheet
Date	May 16, 2013	WC04
Scale	noted	

B.U.R. CONSTRUCTION

DIRTBAG®

Pumped Sediment Removal System

Whenever accumulated water must be pumped!

Protect the environment effectively and economically with Dirtbag®! Collect sand, silt and fines. Avoid silting streams, surrounding property and storm sewers. As more and more emphasis is put on saving our wetlands, regulations are becoming more stringent regarding the pumping of dirty water from holes around construction sites-such as foundations, pipe line construction, repairing municipal water/sewer lines, marine construction, utility, highway and site development areas. Dirtbag® applications are endless.

Use Recommendations

ACF Environmental manufactures Dirtbag® using a variety of woven and nonwoven geotextile fabrics. The fabric properties on the Specifications page affirm the strength of Dirtbag® and are a result of tests conducted at on-site laboratories at the geotextile factory. All test methods are ASTM or industry standards.

Each standard Dirtbag® has a fill spout large enough to accommodate a 4" discharge hose. Straps are attached to secure the hose and prevent pumped water from escaping without being filtered.

Strap the neck of Dirtbag® tightly to the discharge hose. To increase the efficiency of filtration, place the bag on an aggregate or haybale bed to maximize water flow through the surface area of the bag.

Dirtbag® is full when it no longer can efficiently filter sediment or pass water at a reasonable rate. Flow rates will vary depending on the size of Dirtbag®, the type and amount of sediment discharged into Dirtbag, the type of ground, rock or other substance under the bag. Under most circumstances Dirtbag® will accommodate flow rates of 750 gallons per minute. Use of excessive flow rates or overfilling Dirtbag® with sediment will cause ruptures of the bags or failure of the hose attachment straps.

Dirtbag must be monitored during use.

Dirtbag® Specification
Control of Sediment In Pumped Water

1.0 Description

1.1 This work shall consist of furnishing, placing and removing Dirtbag® pumped sediment control device as directed by the design enginer or as shown on the contract drawings. Dirtbag® pumped-silt control system is marketed by:

ACF Environmental, Inc.
2831 Cardwell Road
Richmond, Virginia 23234
Phone: 800-448-3636 ● Fax: 804-743-7779
www.acfenvironmental.com

2.0 Materials

2.1 Dirtbag®

2.1.1 Dirtbag® shall be manufactured using a polypropylene nonwoven geotextile sewn into a bag with a double needle matching using a high strength thread.

2.1.2 Each standard Dirtbag® has a fill spout large enough to accommodate a 4" discharge hose. Straps are attached to secure the hose and prevent pumped water from escaping without being filtered.

2.1.3 Dirtbag® seams shall have an average wide width strength per ASTM D-4884 as follows:

Dirtbag® Style	Test Method	Test Method
Dirtbag® 53	ASTM D-4884	60 lbs./in
Dirtbag® 55	ASTM D-4884	100 lbs./in

Property	Test Method	Units	Test Results Style 53	Test Results Style 55
Weight	ASTM D-3776	oz/yd	8	10
Grab Tensile	ASTM D-4632	lbs.	205	250
Puncture	ASTM D-4833	lbs.	110	150
Flow Rate	ASTM D-4491	gal/min/ft^2	110	85
Permittivity	ASTM D-4491	sec.$^{-1}$	1.5	1.2
Mullen Burst	ASTM D-3786	lbs. ^{in2}	350	460
UV Resistant	ASTM D-4355	%	70	70
AOS % Retained	ASTM D-4751	US Sieve	80	100

All properties are Minimum Average Roll Value (MARV) except the weight of the fabric which is given for information only. Depending on soil conditions and filtration requirements, additional geotextile options are available. Please call our engineering staff for solutions.

3.0 Construction Sequence

3.1.1 To install Dirtbag® on a slope so incoming water flows downhill through Dirtbag® without creating more erosion. Strap the neck of Dirtbag® tightly to the discharge hose. To increase the efficiency of filtration, place the bag on an aggregate or haybale bed to maximize water flow through the surface area of the bag.

3.1.2 Dirtbag® is full when it no longer can efficiently filter sediment or allow water to pass at a reason able rate. Flow rates will vary depending on the size of Dirtbag®, the type and amount of sediment discharged into Dirtbag®, the type of ground, rock or other substance under the bag and the degree of the slope on which the bag lies. Under most circumstances Dirtbag® will accommodate flow rates of 750 gallons per minute. Use of excessive flow rates or overfilling Dirtbag® with sediment will cause the bag to rupture or failure of the hose attachment straps.

*Must be monitored during use.

3.1.3 Dispose Dirtbag® as directed by the site engineer. If allowed, Dirtbag® may be cut open and the contents seeded after removing visible fabric. Dirtbag® is strong enough to be lifted with optional straps if it must be hauled away. Off-site disposal may be facilitated by placing Dirtbag® in the back of a dump truck or flatbed prior to use and allowing the water to drain from the bag while in place, thereby eliminating the need to lift Dirtbag®.

4.0 Basis of Payment

4.1 The payment for any Dirtbag® used during construction is to be included in the bid of overall erosion and sediment control plan unless a unit price is requested.

*ACF Environmental is not liable for failures or misue of the Dirtbag.

Easy To Use

First, Dirtbag® is easy to transport to the site. To install, simply unfold and insert up to 4" pump discharge the hose into the hand-sewn spout and secure with the attached straps. Pump dirty water into Dirtbag®. The bag collects sediment silt as the clean water gently filters out from all sides.

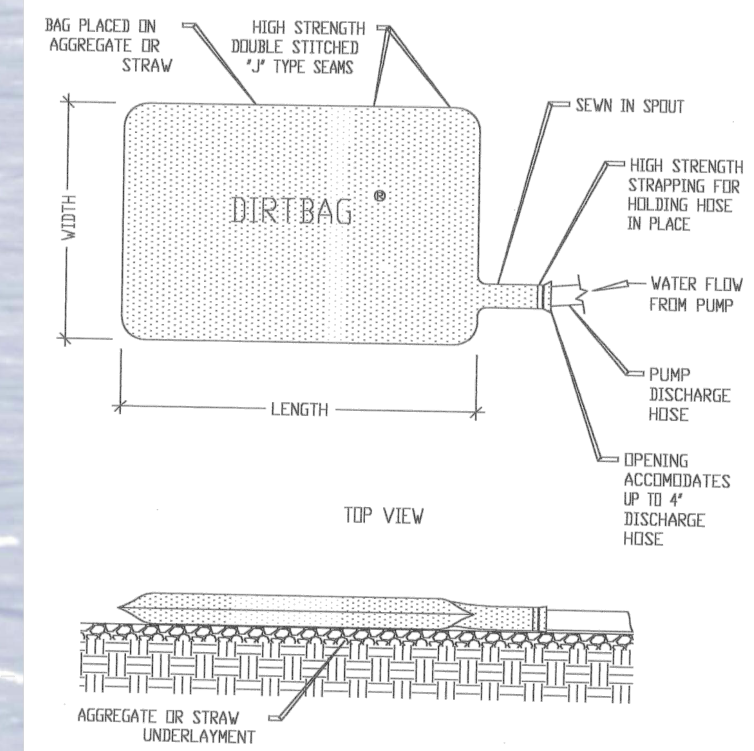
Compare Dirtbag® to the alternatives such as straw bale forts which are more cumbersome to transport, to build and to clean afterward. Best of all, Dirtbag® poses no threat to the environment when disposed properly.

Dirtbag® Features

- Designed and produced from a variety of fabrics to meet engineering specifications for flow rates, strength and permeability.
- Stabilized to provide resistance to ultra-violet degradation.
- Meets municipal, state and Corps of Engineers specifications.
- Available in 10'x15', 12 ½' x 15' and 15' x 15' sizes. Custom sizes available.

Hillside Installation on Straw Underlayment

Typical Dirtbag® Construction



Above: Dirtbag® installation shown on inclined hillside for maximum flow.

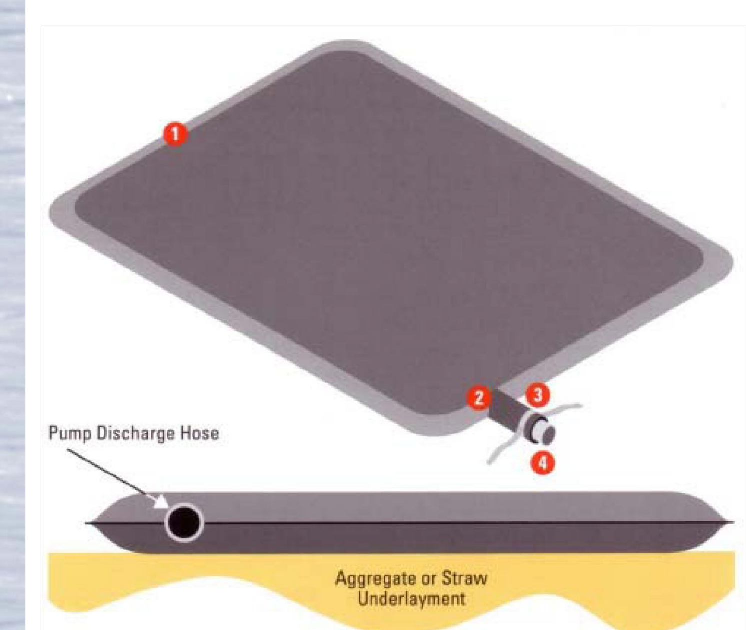
Disposal

Dispose of Dirtbag® as directed by the site engineer. If allowed, Dirtbag® may be cut open and the contents seeded after removing visible fabric. Dirtbag® is strong enough to be lifted with optional straps if it must be hauled away. Off-site disposal may be facilitated by placing Dirtbag® in the back of a dump truck or flatbed prior to use and allowing the water to drain from the bag while in place, thereby eliminating the need to lift Dirtbag®.

Dirtbag® Features:

1. High strength double stitched "J" type seams.
2. Sewn in spout.
3. High strength strapping for holding hose in place.
4. Hose opening accommodate up to 4" discharge hose.

For optimal flow, install over straw or aggregate.



DIRT BAG DETAIL

NTS

General Notes

STATE OF VERMONT TERRY A. WAITE LICENSED PROFESSIONAL ENGINEER
-130516-

No.	Revision/Issue	Date
1	address reviewer comments	130715

Firm Name and Address
TAW Associates
Waterville Valley, NH
603-236-4247 www.TAWAssociates.net

Woodstock, VT
VTrans BRO 1444(55)

Project Name and Address
WATER CONTROL
SEDIMENT SYSTEM DETAILS

Project: 130901A
Date: May 16, 2013
Scale: noted
Sheet: WC05

B.U.R. CONSTRUCTION

DOCUMENT: 130901A REV01

Engineering Computations

WATER CONTROL PLAN

-

For The Project:
Bennington, VT
VTrans ER BHF 010-1(45)

-

for

B.U.R. Construction

by

TAW ASSOCIATES

July 16, 2013

TABLE OF CONTENTS

WATER CONTROL SYSTEM:

Water Control Requirements:

1. The water control system is to be coordinated with the EPSC work.
2. This work shall consist of the construction, material excavation within, dewatering, maintenance and removal of water control system in accordance with the specifications at locations designated in the Plans or in the Contract.
3. This work shall consist of providing a method for the purpose of constructing, in the dry, a specific foundation or other component of a structure in accordance with Contract requirements.
4. This involves construction, maintenance, and removal of a watertight structure or may involve alternate methods of de-watering and stabilizing the specific site.
5. The Contractor shall obtain any and all necessary permits or clearances for alternate methods.
6. The locations and elevations for excavation shall be as indicated on the Plans.
7. The Engineer may order removal of poor foundation material below the normal designated elevation and replacement with an approved material.
8. Dewatering system elements shown on the plan are approximate
9. Actual location and sizing of dewatering system elements are to be based on current field conditions
10. During the performance of all work under this contract, the Contractor shall adopt such precautions in the conduct of his operation as may be necessary to avoid contaminating ground or surface water.
11. All earthwork, grading, moving of equipment, water control and other operation likely to create silting, shall be so planned and conducted as to minimize pollution in any wetland resource area.
12. Water used for any purpose whatsoever by the Contractor, which has become contaminated with soil, bitumen, salt, concrete or other pollutants shall not be discharged into any wetland resource area.
13. Under no circumstances shall the Contractor discharge pollutants into a wetland resource area.
14. The Contractor shall not store fuel or permit any refueling of construction equipment while such equipment is within 100 feet of any resource area.
15. The contractor shall make all efforts to control the run-off of water and sediment from the project site during path construction.
16. All work to be done in the dry.
17. The Contractor shall use such equipment and shall perform his operations in such a manner that boiling or other disturbances of the soil in the construction area will be prevented.
18. He shall keep the area being excavated dry by such means that water will be prevented from entering from the adjacent soils.
19. All dewatering and related earthworks shall be conducted in such a manner as to prevent siltation or contamination of the brook.
20. The pumping discharge shall not be allowed to enter directly into the brook.
21. The water from the work areas shall be pumped to a sediment system in accordance with the EPSC Plan.
22. The Contractor shall provide and maintain ample pumps, pipes and other devices to promptly and continually remove and dispose of water from the excavation areas.
23. The size and configuration of pumps and pipes shall be selected by the contractor.

24. After having served its purpose, the water control system shall become the property of the Contractor and shall be removed by the Contractor from the site subject to the Engineer's approval.

Water Control Procedure:

1. The Water Control System is to control water intrusion into the work areas such that the work can be performed "in-the-dry"
2. Water control includes all dewatering necessary to accomplish existing bridge removal, new bridge base material placement, new bridge construction, and new stream bed construction "in-the-dry"
3. The need and extent of sedimentation systems and dewatering techniques and sedimentation controls needed to control water and sediment at the site are to be determined in the field based on current conditions and the EPSC Plan.
4. Provide the means of removing all sediment from water pumped from the excavation areas
5. Apply pumping operations, installation of sandbags, geotextile fabrics, and all other means to collect, settle, and discharge water back in to the waterway as required during construction
6. Stream diversions shall be conducted in such a manner as to minimize siltation and prevent contamination of the waterway
7. Ensure that water control operations neither cause the accumulation of siltation nor any adverse effect to the water or the environment
8. The effectiveness of the water control method used will vary based on the field conditions at the time at which the work is being performed
9. Weather monitoring will be required.
10. If a storm is forecast additional adequate measures are to be at the ready to handle anticipated flow increases.
11. Flow increases can be handled by addition of by-pass pumps in size and number to be determined in the field based on current conditions and anticipated flow increases.
12. If flows are beyond the capacity of all available measures, the water control system is to be remove, the excavation flooded and all obstacle preventing free flow of the stream removed.
13. The Water Control System is non-permanent and is to not harm the ecology of the waterway, land under water, and surrounding land

SUPPORTING ANALYSIS:

FLOW ANALYSIS

From the Contract Documents,

HYDROLOGIC DATA Date: Jan. 2013

DRAINAGE AREA : 4.3 sq. mi.
CHARACTER OF TERRAIN : Hilly to mountaious, mostly forested with some open areas
STREAM CHARACTERISTICS : Sinuous, alluvial and probably incised
NATURE OF STREAMBED : Mostly gravel and cobbles with some sand and boulders

PEAK FLOW DATA

Q 2.33 =	240 cfs	Q 50 =	910 cfs
Q 10 =	540 cfs	Q 100 =	1100 cfs
Q 25 =	730 cfs	Q 500 =	1500 cfs

EXISTING STRUCTURE INFORMATION

STRUCTURE TYPE: Single span steel beam bridge with timber deck
YEAR BUILT: 1939
CLEAR SPAN(NORMAL TO STREAM): 18'
VERTICAL CLEARANCE ABOVE STREAMBED: 6.5'
WATERWAY OF FULL OPENING: 108 sq. ft.
DISPOSITION OF STRUCTURE: Remove and replace
TYPE OF MATERIAL UNDER SUBSTRUCTURE: Unknown

WATER SURFACE ELEVATIONS AT:

Q2.33 =	961.3'	VELOCITY =	7.3 fps
Q10 =	963.5'	"	10.1 fps
Q25 =	964.3'	"	11.0 fps
Q50 =	965.8'	"	8.4 fps
Q100 =	966.5'	"	8.5 fps

PERMIT INFORMATION

		DEPTH OR ELEVATION:
AVERAGE DAILY FLOW:	9 cfs	
ORDINARY LOW WATER:	4 cfs	Depth = 0.5'
ORDINARY HIGH WATER:	100 cfs	Depth = 2.0'

Restricted Channel Flow

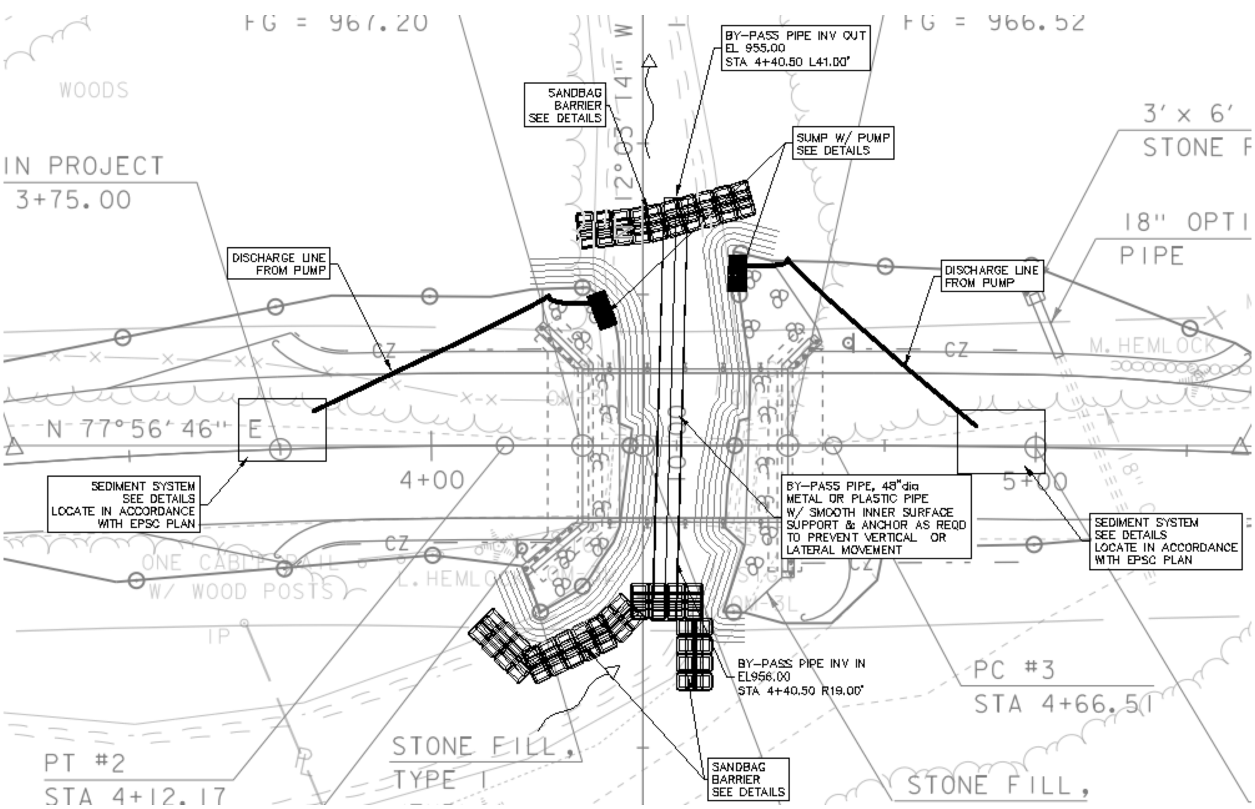
During construction, the existing stream flow will be restricted by sandbag barriers, cofferdams and training walls to provide for dry work areas and to direct flow into the By-Pass Pipe.

The cofferdams/training walls of the Water Control System will restrict channel flow to an extent as they reduce the channel width to

$w = 4'\pm$

It also limits the flow depth to

$d = 3.75'$ (0.25' freeboard)



Assumed for bare soil channel bottom

Open Channels	
Lined Channels	
Asphalt	0.013 to 0.017
Brick	0.012 to 0.018
Concrete	0.011 to 0.020
Rubble or riprap	0.020 to 0.035
Vegetal	0.030 to 0.040
Excavated or Dredged	
Earth, straight and uniform	0.020 to 0.030
Earth, winding, fairly uniform	0.025 to 0.040
Rock	0.030 to 0.045
Unmaintained	0.050 to 0.140
Natural Channels (minor streams, top width at flood state < 100 feet)	
Fairly regular section	0.030 to 0.070
Irregular section with pools	0.040 to 0.100

an assumed

$n = 0.033$

for a length of

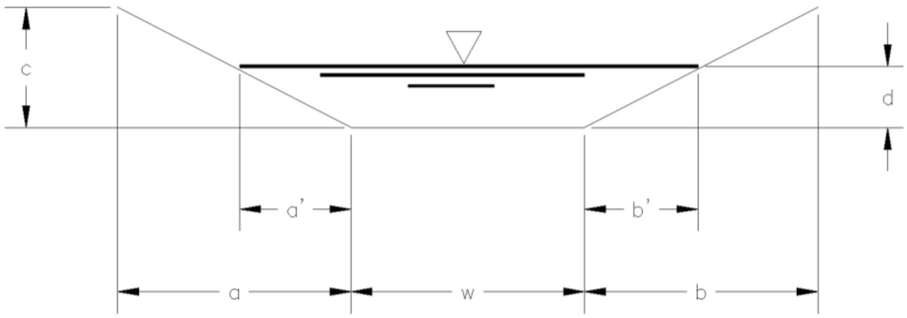
L = 50’±

at a slope

$S = 0.0167$

assumed to be the slope of the channel for the design area for the restricted channel flow analyses.

Analyzing the channel with these restrictions results in a maximum flow of



Hydraulic Slope = S = 0.016667 ft/ft

w	ft	4
a	ft	4.00
b	ft	4.00
c	ft	4.00
d	ft	3.75
S	ft/ft	0.01667
n		0.033
a'	ft	3.75
b'	ft^2	3.75
P	ft	14.607
A	ft^2	29.063
R=A/P	ft	1.990
$Q = A\ (1.486/n)\ R^{2/3}\ S^{1/2}$	cfs	267
V=Q/A	fps	9.20

Q = 267 cfs

$Q_{restrocted}$ = 267cfs > Q_{ADF} = 9cfs OK

$Q_{restrocted}$ = 267cfs > $Q_{2.33}$ = 240cfs OK

As the in water work is limited to low flow periods, this is adequate to allow for anticipated flows.

Flow increases can be handled by addition of by-pass pumps in size and number to be determined in the field based on current conditions.

By-Pass Pipe Flow

A By-pass Pipe is to be placed to pass stream flow through the work area.

L = 60 ft

The slopes at the three locations are

$S_1 = (EL_{upstream} - EL_{downstream}) / L = (957 - 956) / 60 = 0.0167$

Use a 48"dia culvert pipe:

Assume Iron or Plastic (smooth lined) pipe,

Manning's Roughness Coefficients ("n")

Conduit	Manning's Coefficients
Closed Conduits	
Asbestos-Cement Pipe	0.011 to 0.015
Brick	0.013 to 0.017
Cast Iron Pipe	
Cement-lined and seal-coated	0.011 to 0.015
Concrete (Monolithic)	
Smooth forms	0.012 to 0.014
Rough forms	0.015 to 0.017
Concrete Pipe	0.011 to 0.015
Corrugated-Metal Pipe (1/2 - STUL 34470 2 1/2-inch corrgtn.)	
Plain	0.022 to 0.026
Paved invert	0.018 to 0.022
Spun asphalt-lined	0.011 to 0.015
Plastic Pipe (Smooth)	0.011 to 0.015
Vitrified Clay	
Pipes	0.011 to 0.015
Liner channels	0.013 to 0.017

n = 0.013

Mannings					$Q = a \times \frac{1.486}{n} \times R^{2/3} \times S^{1/2}$		
Q = volume is cubic feet per second							
R = Hydraulic Radius (ft) or [m] = a/Pw					Assume n=		**0.013**
a = Cross-Sectional Area of Flow (ft^2) or [m^2]					Assume slope=		**0.0167**
S = Channel Slope				in feet	Assume diameter=		**4**
n = Manning's Roughness Coefficient					Assume % full pipe=		**0.75**
radius	2		Total area				
$radius^2$	4	πr^2 =	12.56637	sq feet	Minimum Velocity		2.5
depth		3	1	feet			
Area exempted		circle	cos	60	0.5		
		0.333333	4.18879	sq feet			
		rectangle	sin	0.8660254	1.7321		
a=	**10.10963122**	**sq feet**	1.732051	sq.feet	Area exempted		2.4567
Hydraulic radius		Pw	240	degrees	12.566	total circumference	
			0.666667	% of total	8.3776	feet	
R (Hydraulic radius) =		**a/Pw=**	**1.206748**				
	a		n	R 2/3	S 1/2		
V	10.10963122	1.486	0.013	1.1334729	0.1292	16.74 fps	
Q	**169.27**	**cfs**					
957 inv		60 length		1.002 fall		956.00 inv	

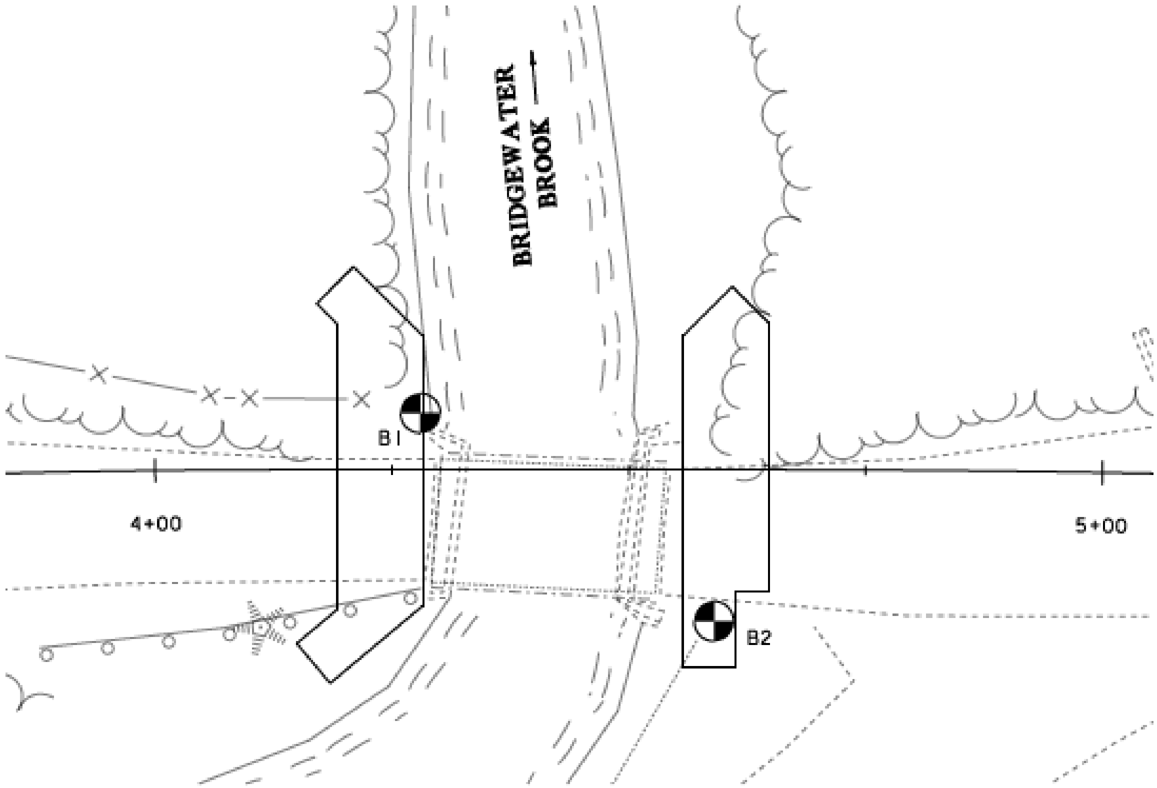
$Q_{restrocted}$ = 169cfs > Q_{ADF} = 9cfs OK

$Q_{restrocted}$ = 169cfs < $Q_{2.33}$ = 240cfs will require attention

As the in water work is limited to low flow periods, this is adequate to allow for anticipated flows.

Weather monitoring will be required. If a storm is forecast additional adequate measures are to be at the ready to handle anticipated flow increases. Flow increases can be handled by addition of by-pass pumps in size and number to be determined in the field based on current conditions and anticipated flow increases.

Soils Investigation:



BORING LAYOUT

TO: David Frothingham DeWolfe Engineering Associates, Inc. P.O. Box 1576 Montpelier, VT 05602	PROJECT NAME: LOCATION: MBC JOB #:	N. Bridgewater Road Bridge Woodstock, VT 09017	SHEET: 1 DATE: 3-13-09 HOLE #: B-1 LINE & STA. OFFSET:

Ground Water Observations none at _0_ hours	Augers-Size I.D. 3.25" Split Spoon 2" Hammer Wt. 140# Hammer Fall 30"	Surface Elevation: Date Started: 3-13-09 Date Completed: 3-13-09 Boring Foreman: Mike McGinley Inspector: David Frothingham Soils Engineer:

LOCATION OF BORING: NORTH WEST CORNER OF BRIDGE

Sample Depths From/To (Feet)	Type of Sample	Blows per 6" on Sampler	Moisture Density or Consist.	Strata Change Elev.	Soil Identification	Sample		
						No.	Pen. Inches	Rec. Inches
5'-7'	Dry	54/36/18/22	Dry	7'	Medium gravel with large stone fragments into weathered ledge	1	24	19
10'-12'	Dry	13/16/18/21	Dry		Gray silty very fine sand with stones	2	24	20
15'-17'	Dry	44/33/36/42	Damp		Gray silty very fine sand with stones –spoon broke bad recovery	3	24	3
20'-22'	Dry	13/38/48/72	-		No recovery	4	24	0

TO: David Frothingham DeWolfe Engineering Associates, Inc. P.O. Box 1576 Montpelier, VT 05602	PROJECT NAME: LOCATION: MBC JOB #:	N. Bridgewater Road Bridge Woodstock, VT 09017	SHEET: 2 DATE: 3-13-09 HOLE #: B-2 LINE & STA. OFFSET:

Ground Water Observations none at _0_ hours	Augers-Size I.D. 3.25" Split Spoon 2" Hammer Wt. 140# Hammer Fall 30"	Surface Elevation: Date Started: 3-13-09 Date Completed: 3-13-09 Boring Foreman: Mike McGinley Inspector: David Frothingham Soils Engineer:

LOCATION OF BORING: SOUTH EAST CORNER OF BRIDGE

Sample Depths From/To (Feet)	Type of Sample	Blows per 6" on Sampler	Moisture Density or Consist.	Strata Change Elev.	Soil Identification	Sample		
						No.	Pen. Inches	Rec. Inches
5'-7'	Dry	4/14/12/18	Dry	6.5'	Brown fine sand with silt into a medium sand and small stones with some organics (roots, wood)	1	24	20
10'-10'10"	Dry	30/100 for 4"	Dry		Brown medium sand with fractured rock into a gray silty very fine sand	2	10	8
15'-17'	Dry	39/39/49/60	Dry		Gray very hard packed silty sand and stones (hardpan)	3	24	14
					Auger refusal at 17'			
					100 blows for ¼" No recovery			

The soils of interest are those from 10’ through 17’ down.

For B1 soils,
N’ = 56 bpf (silty sand)

For B2 soils,
N’ = 92 bpf (silty sand)

Friction Angle Based on SPT

Table 34 presents baseline relationships for evaluating the drained friction angle of cohesionless soils. This table is based on data for relatively clean sands. Given this, selected values of ϕ′ based on SPT N values should be reduced by 5° for clayey sands and the value from the table should be increased by 5° for gravelly sands.

Table 34. Relationship among relative density, SPT N value, and internal friction angle of cohesionless soils (after Meyerhof, 1956).

State of Packing	Relative Density (%)	Standard Penetration Resistance, N (blows/300 mm)	Friction angle, ϕ′ (°)
Very loose	<20	<4	< 30
Loose	20-40	4-10	30-35
Compact	40-60	10-30	35-40
Dense	60-80	30-50	40-45
Very dense	>80	>50	>45

Note: N = 15 + (N′ - 15) / 2 for N′ > 15 in saturated very fine or silty sand, where N′ = measured blow count and N = blow count corrected for dynamic pore pressure effects during the SPT.

The soils are silty sand soils, therefore the blow counts must be adjusted.

N = 15 + (56 – 15) / 2 = 36 bpf Governs!

&

N = 15 + (92 – 15) / 2 = 54 bpf

Therefore, the soils can be considered to be

Dense, silty sand
ϕ = 40° to 45° less 5° for clayey sand = 35° to 40°, Say 37°

This translates to a slope of

tanϕ = 0.754, or 1.33 on 1.0.

Therefore,

Specify a 1.5 on 1 slope of excavation.

Sandbag Cofferdam:

Sandbag berms/cofferdams are to be installed as cofferdams and training walls in the waterway at the upstream and downstream ends of the by-pass pipes.

Height and access limitations make a sandbag type cofferdam more practicle and constructable beneath the existing bridge structure.

Design Assumptions:

Unless otherwise noted the assumptions used as a basis for the design as applicable are as follows:

1. weight of water, γ_w = 62.4pcf
2. weight of sand, γ_s' = 125pcf

AASHTO 5.2.2.3 calls for design of overall stability of retaining to have a minimum Factor of Safety of 1.3 for static loads and 1.5 for installations with a low tolerance for failure.

Coefficient of Friction:

Imperical Coefficient of Friction for poly sandbags.

A field test was conducted to determine the Coefficient of Friction (C_f) for poly sandbags on various surfaces to used in sandbag cofferdam design computations. The test was conducted by TAW Associates on November 18, 2011 between 12:30 pm and 1:30 pm. Weather was partly cloudy and breezy with temperatures at 35°F. The test was conducted at a flowing stream testing four conditions of sandbag/riverbed configurations. Sandbags were approximately 35# in wet weight, one flagged with red, the other flagged with blue. Sandbags were saturated then weighed at the beginning of the test. Sandbags were weighed again at the end of the test. A digital fish accurate to within one ounce was used to weight each sandbag and to determine the horizontal force required to overcome static friction. Sandbags were rigged with a nylon rope tied to the neck of each and extending approximately 2 feet to a tied loop to which the scale was attached.

Configuration	Red Flagged	Blue Flagged	Stacked
weight saturated at start	32.2	34.6	66.8
on water-warn granite bedrock, silt covered	17.1		28.0
on clean water-warn granite bedrock	22.7	28.6	51.0
on clean rocky gravel riverbed	20.1	27.0	42.8
on clean sand river bed		21.2	39.0
sandbag on sandbag		14.9	
weight saturated at end	32.0	33.9	65.9

From the tests, the imperical C_f for each configuration is determined below by dividing the measured horizontal force to overcome static friction by the average of the start and finish saturated weights for each

Configuration	Red Flagged	Blue Flagged	Stacked
on water-warn granite bedrock, silt covered	0.53	n/a	0.42
on clean water-warn granite bedrock	0.71	0.84	0.77
on clean rocky gravel riverbed	0.63	0.79	0.65
on clean sand river bed	n/a	0.62	0.59
sandbag on sandbag	n/a	0.44	n/a

Selecting the minimum in each case, the coefficients used for computations are

$C_{f\ SB\ on\ silty\ bedrock}$ = 0.42

$C_{f\ SB\ on\ clean\ bedrock}$ = 0.71

$C_{f\ SB\ on\ gravel\ riverbed}$ = 0.63

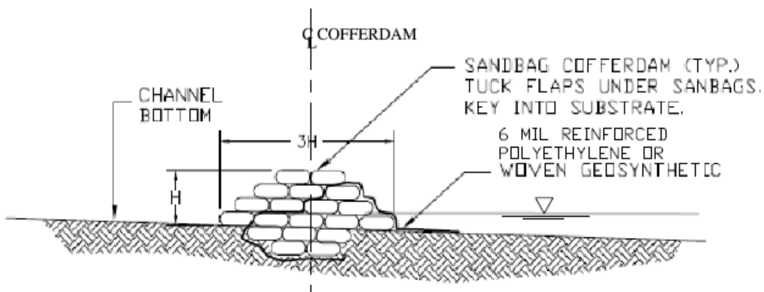
$C_{f\ SB\ on\ sand\ riverbed}$ = 0.59

$C_{f\ SB\ on\ SB}$ = 0.44

Assume the worst case, then

$$C_{f\ sandbag\ cd} = 0.42$$

Small Sand Bag Cofferdam:



HEIGHT OF BERM	BAGS/100FEET
1 FOOT	800
2 FEET	2000
3 FEET	3400

SOURCE: NEW ENGLAND DIVISION ARMY CORPS OF ENGINEERS

NOTES:

1) Sandbag Preparation

a. Utilize polypropylene or burlap bags about 14" – 18" wide and 30" –36" deep.

b. A heavy bodied or sandy soil is most desirable for filling sandbags. On–site soil sources may be utilized, as appropriate.

c. Bags should be filled between one–third (1/3) to one–half (1/2) of their capacity. This keeps the bag from getting too heavy, and permits the bags to be stacked with a good seal.

d. Untied sandbags are recommended for most situations. Tied sandbags should be used only for special situations when pre–filling and stockpiling may be required, or for specific purposes such as filling holes, holding objects in position, or to form barriers backed by supportive planks. Tied sandbags are generally easier to handle and stockpile.

2) Sandbag Placement

a. Remove any debris from the area where the bags are to be placed.

b. Fold the open end of the unfilled portion of the bag to form a triangle. If tied bags are used, flatten or flare the tied end.

c. Place the partially filled bags lengthwise and parallel to the direction of flow, with the open end facing against the water flow.

d. Tuck the flaps under, keeping the unfilled portion under the weight of the sack.

e. Place succeeding bags on top, offsetting by one–half (1/2) filled length of the previous bag, and stamp into place to eliminate voids, and form a tight seal.

f. Stagger the joint connections when multiple layers are necessary. For unsupported layers over three (3) courses high, use the pyramid placement method.

3) Pyramid Placement Method

The pyramid placement is used to increase the height of sandbag protection.

a. Place the sandbags to form a pyramid by alternating header courses (bags placed crosswise) and stretcher courses (bags placed lengthwise).

b. Stamp each bag in place, overlap sacks, maintain staggered joint placement, and tuck in any loose ends.

c. Use the table on this Figure to estimate the number of bags required

SMALL SANDBAG SECTION OPTION

Therefore, for any H:

Check Sliding:

$F_{driving} = 1/2 * \gamma_w * H^2 =$ $31.2H^2$ lbs
where:
γ_w = density of water = 62.4 pcf
H = height of water (design for full height of sandbags) = H ft

$F_{resisting} = 1/2 (\gamma'_s * H * W) * C_f = 1/2 (\gamma'_s * 3H^2) * C_f =$ $61.9H^2$ lbs
where:
γ'_s = density of saturated sand in sandbags = 125 pcf
H = height of sandbag cofferdam = H ft
W = width of sandbags at base = 3H ft
C_f = coefficient of friction sandbags on sandbags/riverbed = 0.42

$FS_{sliding} = F_{resisting} / F_{driving} =$ 1.98 OK

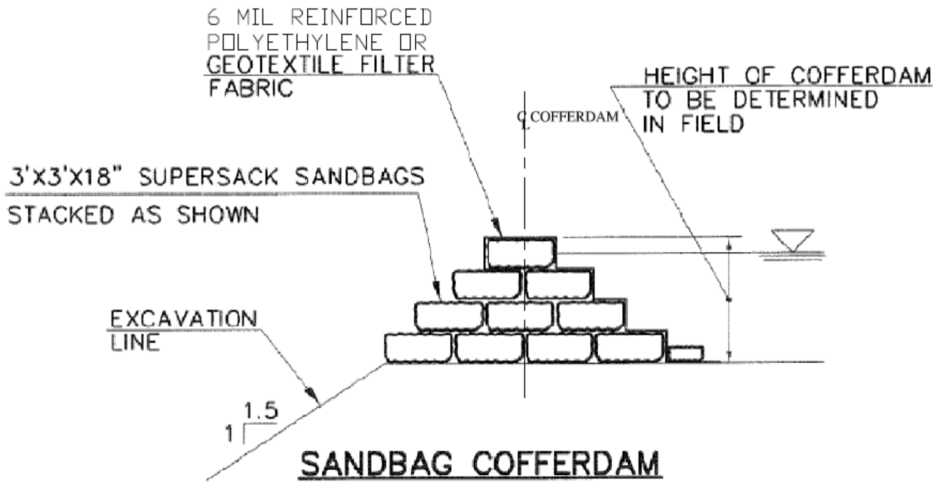
Check Overturning:

$F_{driving} = 1/2 * \gamma_w * H^3/3 =$ $10.4H^3$ lbs
where:
γ_w = density of water = 62.4 pcf
H = height of water (design for full height of sandbags) = H ft

$F_{resisting} = 1/2 (\gamma'_s * H * W) * KW/2 = 1/2 (\gamma'_s * 3H^2) * K3H/2 =$ $210.9H^3$ lbs
where:
γ'_s = density of saturated sand in sandbags = 125 pcf
H = height of sandbag cofferdam = H ft
W = width of sandbags at base = 3H ft
K = reduction factor for moment arm to bring it in from edge = 0.75

$FS_{overturning} = F_{resisting} / F_{driving} =$ 20.28 OK

Large Sand Bag Cofferdam:



SANDBAG COFFERDAM
NOT TO SCALE

NOTES:

1. SANDBAG COFFERDAM IS TO BE CONSTRUCTED IN A PYRAMID SHAPE BASED ON THE REQUIRED HEIGHT AND NUMBER OF BAGS REQUIRED.
2. THE SANDBAGS ARE TO BE PLACED OVERLAPPING ALONG THE LENGTH OF THE COFFERDAM.

HEIGHT OF COFFERDAM	NUMBER OF SANDBAGS REQUIRED FOR COFFERDAM
0" TO 18"	1
18" TO 3'	3
3' TO 4'-6"	6
4'-6" TO 6'	10

LARGE SANDBAG SECTION OPTION

Therefore, for any H:

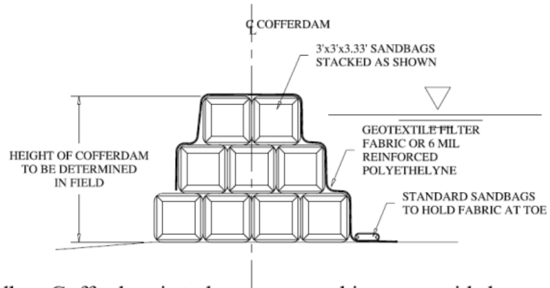
Check Sliding:

$F_{driving}$ = 1/2 * γ_w * H^2 =	31.20 H^2 lbs	
where:		
γ_w = density of water =	62.4 pcf	
H = height of water (design for full height of sandbags) =	H ft	
$F_{resisting}$ = 1/2 (γ_s * H * W) * C_f = 1/2 (γ_s * $2H^2$) * C_f =	52.5 H^2 lbs	
where:		
γ_s = density of saturated sand in sandbags =	125 pcf	
H = height of sandbag cofferdam =	H ft	
W = width of sandbags at base =	2H ft	
C_f = coefficient of friction sandbags on sandbags/riverbed =	0.42	
$FS_{sliding}$ = $F_{resisting}$ / $F_{driving}$ =	1.68	OK

Check Overturning:

$F_{driving}$ = 1/2 * γ_w * $H^3/3$ =	10.40 H^3 lbs	
where:		
γ_w = density of water =	62.4 pcf	
H = height of water (design for full height of sandbags) =	H ft	
$F_{resisting}$ = 1/2 (γ_s * H * W) * KW/2 = 1/2 (γ_s * $2H^2$) * KH =	93.75 H^3 lbs	
where:		
γ_s = density of saturated sand in sandbags =	125 pcf	
H = height of sandbag cofferdam =	H ft	
W = width of sandbags at base =	2H ft	
K = reduction factor for moment arm to bring it in from edge =	0.75	
$FS_{overturning}$ = $F_{resisting}$ / $F_{driving}$ =	9.01	OK

Jumbo Sandbag Option



1. Sandbag Cofferdam is to be constructed in a pyramid shape always with a minimum of two bags side by side at the top level based on the required height and number of bags required
2. The Sandbags are to be placed overlapping along the length of the cofferdam
3. A single Sandbag may be used for cofferdam heights up to and including 3.33'

JUMBO SANDBAG SECTION OPTION
(3'x3'x40" BAGS)

Therefore, for any H:

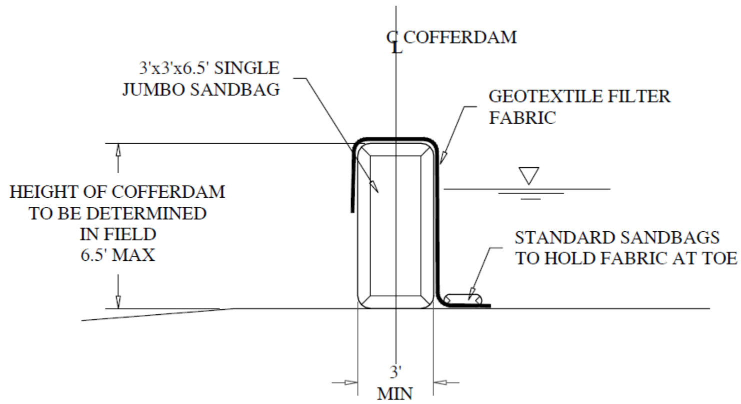
Check Sliding:

$F_{driving} = 1/2 * \gamma_w * H^2 =$	31.20	H^2lbs	
where:			
γ_w = density of water =	62.4	pcf	
H = height of water (design for full height of sandbags) =	H	ft	
$F_{resisting\ 3.33'} = (\gamma'_s * H * W) * C_f = [\gamma'_s * (36/40)H^2] * C_f =$	47.25	H^2lbs	
[for a single bag high, single bag wide configuration]			
where:			
γ'_s = density of saturated sand in sandbags =	125	pcf	
H = height of sandbag cofferdam =	H	ft	
W = width of sandbags at base =	H	ft	
C_f = coefficient of friction sandbags on sandbags/riverbed =	0.42		
$FS_{sliding\ 3.33'} = F_{resisting} / F_{driving} =$	1.51		OK
$F_{resisting\ 6.67'} = 5/6 (\gamma'_s * H * W) * C_f = 5/6 [\gamma'_s * 1.5(36/40)H^2] * C_f =$	59.06	H^2lbs	
where:			
γ'_s = density of saturated sand in sandbags =	125	pcf	
H = height of sandbag cofferdam =	H	ft	
W = width of sandbags at base =	1.5H	ft	
C_f = coefficient of friction sandbags on sandbags/riverbed =	0.42		
$FS_{sliding\ 6.67'} = F_{resisting} / F_{driving} =$	1.89		OK
$F_{resisting\ 10'} = 9/12 (\gamma'_s * H * W) * C_f = 3/4 [\gamma'_s * 1.33(36/40)H^2] * C_f =$	47.13	H^2lbs	
where:			
γ'_s = density of saturated sand in sandbags =	125	pcf	
H = height of sandbag cofferdam =	H	ft	
W = width of sandbags at base =	1.33H	ft	
C_f = coefficient of friction sandbags on sandbags/riverbed =	0.42		
$FS_{sliding\ 10'} = F_{resisting} / F_{driving} =$	1.51		OK

Check Overturning:

$F_{driving}$ = 1/2 * γ_w * H³/3 =	10.40	H³lbs	
where:			
γ_w = density of water =	62.4	pcf	
H = height of water (design for full height of sandbags) =	H	ft	
$F_{resisting\ 3.33'}$ = (γ'_s * H * W) * KW/2 = [γ'_s * (36/40)H²] * K(36/40)H/2 =	37.97	H³lbs	
[for a single bag high, single bag wide configuration]			
where:			
γ'_s = density of saturated sand in sandbags =	125	pcf	
H = height of sandbag cofferdam =	H	ft	
W = width of sandbags at base =	H	ft	
K = reduction factor for moment arm to bring it in from edge =	0.75		
$FS_{overturning\ 3.33'}$ = $F_{resisting}$ / $F_{driving}$ =	3.65		OK
$F_{resisting\ 6.67'}$ = 5/6 (γ'_s * H * W) * KW/2 = 5/6 [γ'_s * 1.5(36/40)H²] * 1.5K(36/40)H/2 =	71.19	H³lbs	
where:			
γ'_s = density of saturated sand in sandbags =	125	pcf	
H = height of sandbag cofferdam =	H	ft	
W = width of sandbags at base =	1.5H	ft	
K = reduction factor for moment arm to bring it in from edge =	0.75		
$FS_{overturning\ 6.67'}$ = $F_{resisting}$ / $F_{driving}$ =	6.85		OK
$F_{resisting\ 10'}$ = 9/12 (γ'_s * H * W) * KW/2 = 3/4 [γ'_s * 1.33(36/40)H²] * 1.5K(36/40)H/2 =	56.81	H³lbs	
where:			
γ'_s = density of saturated sand in sandbags =	125	pcf	
H = height of sandbag cofferdam =	H	ft	
W = width of sandbags at base =	1.33H	ft	
K = reduction factor for moment arm to bring it in from edge =	0.75		
$FS_{overturning\ 10'}$ = $F_{resisting}$ / $F_{driving}$ =	5.46		OK

Single Jumbo Bag Option:



1. Sandbag Cofferdam section is to be of single bag construction with a maximum height of 6.5'

NOTE: This option provides a slender section to meet limiting width conditions, but does not meet AASHTO specified Factors of Safety

SINGLE JUMBO SANDBAG OPTION

NTS

Therefore, for any H:

Check Sliding:

$F_{driving}$ = 1/2 * γ_w * H^2 = 1318.2 lbs
where:
γ_w = density of water = 62.4 pcf
H = height of water (design for full height of sandbags) = 6.5 ft
W_T = 3.00 ft W_B = 3.00 ft
$F_{resisting\ 6.5'}$ = (γ'_s * H * W_{AVE}) * C_f = 1462.5 lbs
[for a single bag high, single bag wide configuration]
where:
γ'_s = density of saturated sand in sandbags = 125 pcf
H = height of sandbag cofferdam = 6.5 ft
W_{AVE} = average width of sandbags at Top & Bottom = 3.00 ft
C_f = coefficient of friction sandbags on sand/riverbed = 0.6
$FS_{sliding\ 3.33'}$ = $F_{resisting}$ / $F_{driving}$ = 1.11 OK

Check Overturning:

$F_{driving}$ = 1/2 * γ_w * $H^3/3$ = 2856.1 lbs
where:
γ_w = density of water = 62.4 pcf
H = height of water (design for full height of sandbags) = 6.5 ft

$F_{resisting\ 6.5'}$ = (γ'_s * H * W_{AVE}) * $KW_B/2$ = 3107.8 lbs
[for a single bag high, single bag wide configuration]
where:
γ'_s = density of saturated sand in sandbags = 125 pcf
H = height of sandbag cofferdam = 6.5 ft
W_{AVE} = average width of sandbags at Top & Bottom = 3.0 ft
K = reduction factor for moment arm to bring it in from edge = 0.85
$FS_{overturning\ 3.33'}$ = $F_{resisting}$ / $F_{driving}$ = 1.09 OK

EQUIPMENT & MATERIALS:

PUMPS:

S SERIES® SLIMLINE SUBMERSIBLE PUMPS

Dependable Portability

For drilled wells, narrow cofferdams and hard-to-reach places, Gorman-Rupp's Slimline submersible pumps are lighter and easier to handle than their larger Widebase cousins. Even so, there is a strong family resemblance: Gorman-Rupp puts extra protection into the seals, and the impeller is rugged and dependable.

GORMAN-RUPP
PUMPS
www.GRpumps.com

ECONOMY

The Slimline design offers an economy of space that allows these pumps to go where many others cannot. Their portability makes them exceptionally useful. Where additional head is needed, two Slimline pumps can be used in tandem for twice the head at the same flow.

DEPENDABLE

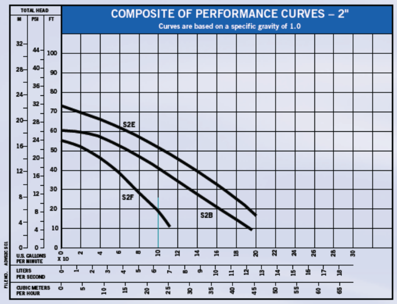
Slimline submersibles are designed for continuous, unattended operation. These electric motor-driven pumps need no winterizing and fuel checks. There is no danger of flooding these pumps since they operate fully or partially submerged. They work well in warm or subfreezing conditions.

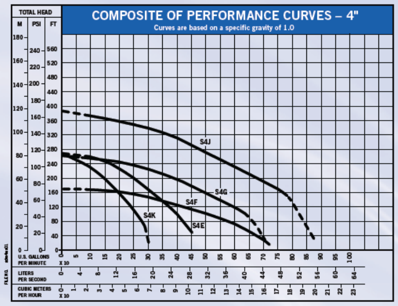
SLIM DESIGN

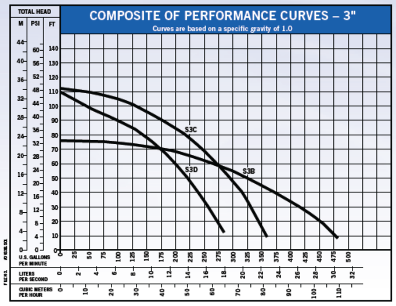
The Slimline design is especially suited for use where space is limited. The 2" (50 mm) submersible is only 7-1/2" (191 mm) in diameter, easily fitting in an 8" (203 mm) casing. This eliminates the need for larger, more costly casings and screens.

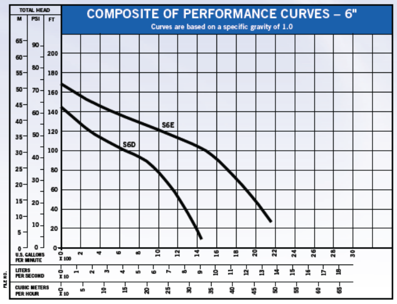
LIGHTWEIGHT AND PORTABLE

Gorman-Rupp Slimline pumps feature a compact, lightweight design that makes handling and installation simple. Our 1 HP, 2" (50 mm) model weighs only 43 lbs. (19.5 kg), yet pumps up to 110 GPM (6.9 lps) with heads to 55' (17 m). The 3" (75 mm) model weighs only 120 lbs. (54.5 kg), pumping up to 475 GPM (30 lps) with heads to 105' (32 m).









GORMAN RUPP'S DURABLUE™

Polyurethane seal plate, diffuser, and suction head are specially designed for submersible pumps. Several models available with DuraBlue urethane, for longer life, more abrasion resistance.

SLIMLINE SUBMERSIBLE DATA

Model	Discharge	Height	Diameter	Max. Solids	Power	Hertz	Speed	Phase	Voltage	Cable Size
S2F1	2" (50 mm)	22.62" (574.5 mm)	7.50" (190.5 mm)	0.31" (7.87 mm)	1 HP	60	3450 RPM	1, 3	115/230/460/575	#14, #10
S2B1, S2B18*	2" (50 mm)	24.97" (634.2 mm)	7.50" (190.5 mm)	0.31" (7.87 mm)	2 HP	60	3450 RPM	1, 3	115/230/460/575	#14, #10
S2E1, S2E18*	2" (50 mm)	25.19" (639.8 mm)	7.50" (190.5 mm)	0.31" (7.87 mm)	3.5 HP	60	3450 RPM	3	200/230/460/575	#14
S3D1	3" (75 mm)	27.19" (690.6 mm)	9.62" (244.3 mm)	0.38" (9.65 mm)	5 HP	60	3450 RPM	3	200/230	#10
S3B1, S3B18*	3" (75 mm)	26.58" (675.1 mm)	9.88" (251.0 mm)	0.38" (9.65 mm)	6 HP	60	3450 RPM	1, 3	230/460/575	#10
S3C1, S3C18*	3" (75 mm)	26.58" (675.1 mm)	9.62" (244.3 mm)	0.38" (9.65 mm)	6 HP	60	3450 RPM	1, 3	230/460/575	#10
S4C1, S4C18*	4" (100 mm)	29.62" (752.3 mm)	10.81" (274.6 mm)	0.38" (9.65 mm)	10 HP	60	3450 RPM	3	230/460/575	#10, #8
S4D1, S4D18*	4" (100 mm)	29.22" (742.2 mm)	10.81" (274.6 mm)	0.38" (9.65 mm)	10 HP	60	3450 RPM	3	200/230/460/575	#10, #8
S4H1	4" (100 mm)	28.41" (721.6 mm)	10.81" (274.6 mm)	0.38" (9.65 mm)	10 HP	60	3450 RPM	3	200/230/460/575	#8
S4K1	4" (100 mm)	36.35" (923.3 mm)	14.24" (361.7 mm)	0.38" (9.65 mm)	15 HP	60	3450 RPM	3	460/575	#12
S4E1	4" (100 mm)	40.04" (1017.0 mm)	14.24" (361.7 mm)	0.38" (9.65 mm)	20 HP	60	3450 RPM	3	460/575	#8
S4F1	4" (100 mm)	40.06" (1017.5 mm)	14.24" (361.7 mm)	0.38" (9.65 mm)	20 HP	60	3450 RPM	3	460/575	#8
S4G1	4" (100 mm)	50.44" (1281.1 mm)	15.88" (403.4 mm)	0.50" (12.70 mm)	30 HP	60	3450 RPM	3	460/575	#8
S4J1	4" (100 mm)	59.63" (1514.6 mm)	17.38" (441.4 mm)	0.50" (12.70 mm)	60 HP	60	3450 RPM	3	460/575	#6
S6D1	6" (150 mm)	51.75" (1314.4 mm)	15.88" (403.4 mm)	0.50" (12.70 mm)	30 HP	60	3450 RPM	3	460/575	#8
S6E1	6" (150 mm)	61.34" (1558.0 mm)	17.38" (441.4 mm)	0.50" (12.70 mm)	60 HP	60	3450 RPM	3	460/575	#6

*Stainless steel fitted.

This chart represents only a small cross-section of models available. Specifications are subject to change. Consult your Gorman-Rupp distributor for detailed information.

Product information is subject to change; consult factory for details.

GORMAN-RUPP PUMPS

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www.GRpumps.com

ISO 9001:2000 REGISTERED COMPANY MANSFIELD DIVISION

AV-02268SL_REV407

Printed in the USA

The Gorman-Rupp Company

S Series (Slimline Submersible)

For drilled wells, narrow cofferdams and hard-to-reach places, Gorman-Rupp's Slimline submersible pumps are lighter and easier to handle than their larger

Widebase cousins. Even so, there is a strong family resemblance: Gorman-Rupp puts extra protection into the seals, and the impeller is rugged and dependable.

Specifications

Size:	1-1/2" (37.5 mm), 2" (50 mm), 3" (75 mm), 4" (100 mm), 6" (150 mm)
Max Capacity:	2,100 GPM (133 lps)
Max Head:	380' (116 m)
Max Solids:	0.5" (13 mm)
Max Temperature:	122 F (50 C)
Materials of Construction:	Aluminum, Cast Iron, Ductile Iron, Stainless Steel
Motor - Voltage:	115 V 1P, 200 V 3P, 230 V 1P, 230 V 3P, 460 V 3P, 575 V 3P
Motor - Cycles:	60 Hz
Horsepower:	1 HP - 60 HP

Features

Compact Design

Gorman-Rupp Slimline Submersibles are designed for cramped quarters and hard-to-reach places where other pumps can't go. They're light in weight, which makes handling and installation simple. And these pumps have only two moving parts and three wearing surfaces so maintenance and repairs are minimal.

Dual Seals, Double Protection

Primary seal keeps dirty water in the pump end and prevents contamination of the oil cavity. A second "fail safe" seal provides extra protection against the possibility of damage to the motor. Positive oil lubrication enables the pump to run dry without seal damage.

Abrasive Handling Impeller

Abrasion resistant ductile iron impellers stand up to sand, gravel and other abrasive materials. The fully shrouded impeller back reduces seal pressure and helps prevent foreign material from entering the seal cavity. Seal life is extended and operational life of the pump is increased. Optional impellers of CD4MCu are available for corrosive/abrasive applications.

Specifications are subject to change. Please contact your Gorman-Rupp Distributor for more details.

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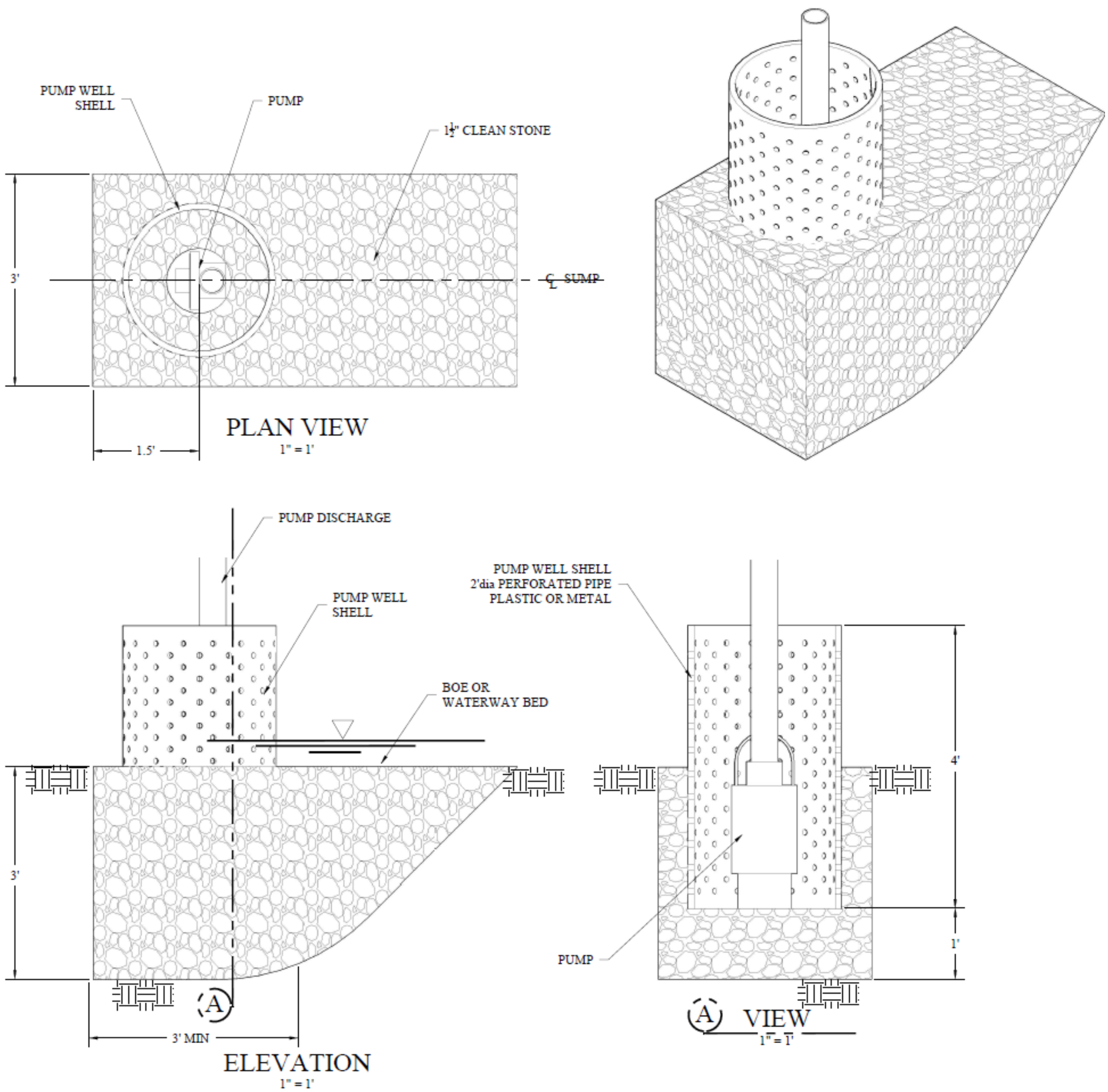
SUMP:


PUMP WELL SHELL
PUMP
1½" CLEAN STONE
3'
CL SUMP
1.5'
PLAN VIEW
1" = 1'
PUMP DISCHARGE
PUMP WELL SHELL
BOE OR WATERWAY BED
3'
3' MIN
A
ELEVATION
1" = 1'
PUMP WELL SHELL
2'dia PERFORATED PIPE
PLASTIC OR METAL
4'
1'
PUMP
A VIEW
1" = 1'

DIRT BAG:

DIRTBAG®

Pumped Sediment Removal System

Whenever accumulated water must be pumped!

Protect the environment effectively and economically with Dirtbag®! Collect sand, silt and fines. Avoid silting streams, surrounding property and storm sewers. As more and more emphasis is put on saving our wetlands, regulations are becoming more stringent regarding the pumping of dirty water from holes around construction sites-such as foundations, pipe line construction, repairing municipal water/sewer lines, marine construction, utility, highway and site development areas. Dirtbag® applications are endless.

Use Recommendations

ACF Environmental manufactures Dirtbag® using a variety of woven and nonwoven geotextile fabrics. The fabric properties on the Specifications page affirm the strength of Dirtbag® and are a result of tests conducted at on-site laboratories at the geotextile factory. All test methods are ASTM or industry standards.

Each standard Dirtbag® has a fill spout large enough to accommodate a 4" discharge hose. Straps are attached to secure the hose and prevent pumped water from escaping without being filtered.

Strap the neck of Dirtbag® tightly to the discharge hose. To increase the efficiency of filtration, place the bag on an aggregate or haybale bed to maximize water flow through the surface area of the bag.

Dirtbag® is full when it no longer can efficiently filter sediment or pass water at a reasonable rate. Flow rates will vary depending on the size of Dirtbag®, the type and amount of sediment discharged into Dirtbag, the type of ground, rock or other substance under the bag. Under most circumstances Dirtbag® will accommodate flow rates of 750 gallons per minute. Use of excessive flow rates or overfilling Dirtbag® with sediment will cause ruptures of the bags or failure of the hose attachment straps.

Dirtbag must be monitored during use.

Easy To Use

First, Dirtbag® is easy to transport to the site. To install, simply unfold and insert up to 4" pump discharge the hose into the hand-sewn spout and secure with the attached straps. Pump dirty water into Dirtbag®. The bag collects sediment silt as the clean water gently filters out from all sides.

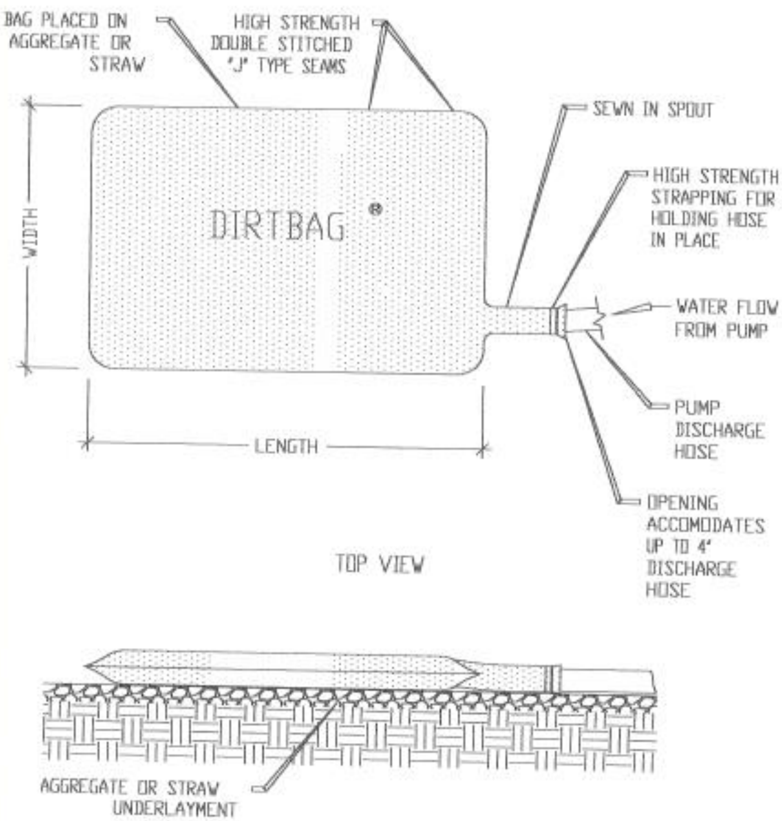
Compare Dirtbag® to the alternatives such as straw bale forts which are more cumbersome to transport, to build and to clean afterward. Best of all, Dirtbag® poses no threat to the environment when disposed properly.

Dirtbag® Features

- Designed and produced from a variety of fabrics to meet engineering specifications for flow rates, strength and permeability.
- Stabilized to provide resistance to ultra-violet degradation.
- Meets municipal, state and Corps of Engineers specifications.
- Available in 10'x15', 12 ½' x 15' and 15' x 15' sizes. Custom sizes available.

Hillside Installation on Straw Underlayment

Typical Dirtbag® Construction



Dirtbag® Specification
Control of Sediment In Pumped Water

1.0 Description

1.1 This work shall consist of furnishing, placing and removing Dirtbag® pumped sediment control device as directed by the design enginer or as shown on the contract drawings. Dirtbag® pumped-silt control system is marketed by:

ACF Environmental, Inc.
2831 Cardwell Road
Richmond, Virginia 23234
Phone: 800-448-3636 ● Fax: 804-743-7779
www.acfenvironmental.com

2.0 Materials

2.1 Dirtbag®

2.1.1 Dirtbag® shall be manufactured using a polypropylene nonwoven geotextile sewn into a bag with a double needle matching using a high strength thread.

2.1.2 Each standard Dirtbag® has a fill spout large enough to accommodate a 4" discharge hose. Straps are attached to secure the hose and prevent pumped water from escaping without being filtered.

2.1.3 Dirtbag® seams shall have an average wide width strength per ASTM D-4884 as follows:

Dirtbag® Style	Test Method	Test Method
Dirtbag®53	ASTM D-4884	60 lbs./in
Dirtbag®55	ASTM D-4884	100 lbs./in

Property	Test Method	Units	Test Results Style 53	Test Results Style 55
Weight	ASTM D-3776	oz/yd	8	10
Grab Tensile	ASTM D-4632	lbs.	205	250
Puncture	ASTM D-4833	lbs.	110	150
Flow Rate	ASTM D-4491	gal/min/ft²	110	85
Permittivity	ASTM D-4491	sec.⁻¹	1.5	1.2
Mullen Burst	ASTM D-3786	lbs. in²	350	460
UV Resistant	ASTM D-4355	%	70	70
AOS % Retained	ASTM D-4751	US Sieve	80	100

All properties are Minimum Average Roll Value (MARV) except the weight of the fabric which is given for information only. Depending on soil conditions and filtration requirements, additional geotextile options are available. Please call our engineering staff for solutions.

3.0 Construction Sequence

3.1.1 To install Dirtbag® on a slope so incoming water flows downhill through Dirtbag® without creating more erosion. Strap the neck of Dirtbag® tightly to the discharge hose. To increase the efficiency of filtration, place the bag on an aggregate or haybale bed to maximize water flow through the surface area of the bag.

3.1.2 Dirtbag® is full when it no longer can efficiently filter sediment or allow water to pass at a reason able rate. Flow rates will vary depending on the size of Dirtbag®, the type and amount of sediment discharged into Dirtbag®, the type of ground, rock or other substance under the bag and the degree of the slope on which the bag lies. Under most circumstances Dirtbag® will accommodate flow rates of 750 gallons per minute. Use of excessive flow rates or overfilling Dirtbag® with sediment will cause the bag to rupture or failure of the hose attachment straps.

*Must be monitored during use.

3.1.3 Dispose Dirtbag® as directed by the site engineer. If allowed, Dirtbag® may be cut open and the contents seeded after removing visible fabric. Dirtbag® is strong enough to be lifted with optional straps if it must be hauled away. Off-site disposal may be facilitated by placing Dirtbag® in the back of a dump truck or flatbed prior to use and allowing the water to drain from the bag while in place, thereby eliminating the need to lift Dirtbag®.

4.0 Basis of Payment

4.1 The payment for any Dirtbag® used during construction is to be included in the bid of overall erosion and sediment control plan unless a unit price is requested.

*ACF Environmental is not liable for failures or misue of the Dirtbag.

Above: Dirtbag® installation shown on inclined hillside for maximum flow.

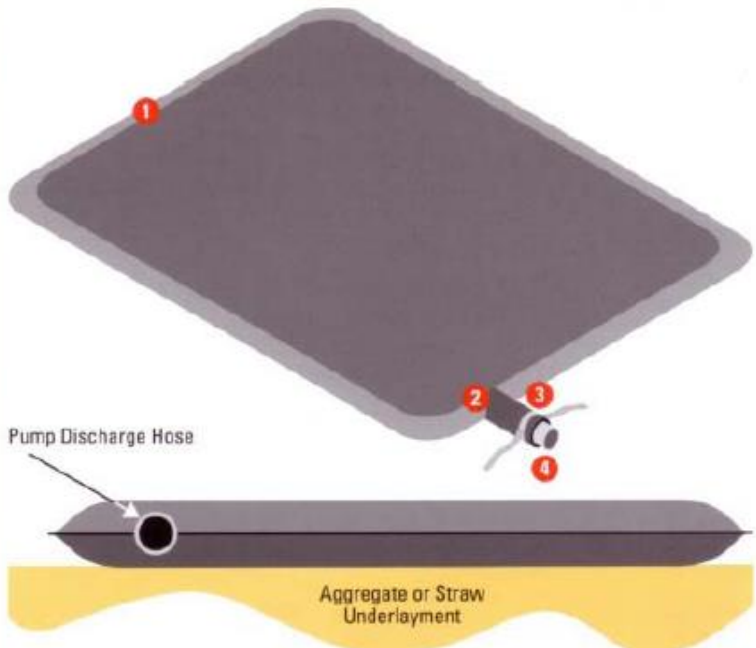
Disposal

Dispose of Dirtbag® as directed by the site engineer. If allowed, Dirtbag® may be cut open and the contents seeded after removing visible fabric. Dirtbag® is strong enough to be lifted with optional straps if it must be hauled away. Off-site disposal may be facilitated by placing Dirtbag® in the back of a dump truck or flatbed prior to use and allowing the water to drain from the bag while in place, thereby eliminating the need to lift Dirtbag®.

Dirtbag® Features:

1. High strength double stitched "J" type seams.
2. Sewn in spout.
3. High strength strapping for holding hose in place.
4. Hose opening accommodate up to 4" discharge hose.

For optimal flow, install over straw or aggregate.



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ACF Environmental

"Complete Source for Stormwater Solutions"

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