From:	Terry Spragg <spraggbag@gmail.com>
Sent:	Wednesday, May 06, 2015 10:13 AM
To:	MPWSP-EIR
Cc:	Carol Rische; Kevin Hunt; Clifford Goudey; Deano Perlatti; Baus Fish; Peter Laborde; Timothy.Sullivan@CPUC.CA.GOV
Subject:	Monterey Peninsula Water Supply Project Comments
Attachments:	MONTECITO Letter to Bob Hazard w attachments Feb 24 2015.pdf; Solar-powered water bag two-pager.pdf; Cliff Goudey letter June 9 2008.txt.pdf

Andrew Barnsdale
CPUC
c/o Environmental Sciences Associates
San Francisco, CA.

Dear Mr. Barnsdale,

I am responding to your PUBLIC NOTICE, Availability of Draft Environmental Impact Report for the Monterey Peninsula Water Supply Project.

I want to thank Executive Director Tim Sullivan, of the CPUC for taking my phone call and for circulating this email among the appropriate parties both in and outside the CPUC.

Spragg & Associates has been submitting comments and suggestions to the various persons and entities responsible for the Monterey Peninsula Water Supply Project for almost two decades. We have made proposals as how to test and demonstrate a water transport technology that can easily and economically deliver 10 MGD of water to Monterey from Humboldt Bay. We hope to duplicate the voyage we implemented in Washington State in California, which is described below.

A YouTube video of television news coverage of our 100 mile, three day voyage in Washington State can be seen at: http://www.youtube.com/watch?v=4TEJp6UZaDI. More information and photos can be seen on our website at: www.waterbag.com. Attached is a letter from Cliff Goudey, one of our MIT engineers, that explains how and why waterbag technology works.

The Humboldt Bay MWD has sent an RFP to the MPWMD (and others) about the availability of water at Humboldt Bay but has not received a response. I would again like to make another attempt to bring our technology and our plans to the attention of Monterey Peninsula water officials and Monterey ratepayers in order to give it a full public review.

I believe that if our earlier proposals had been accepted by Monterey officials, Monterey ratepayers would have saved millions of dollars in ratepayer expenses to date, and at this moment would be receiving 10 MGD water deliveries. I recognize this comment is difficult to verify, especially because there are currently no waterbag transport systems operating anywhere in California. However, because of the current California drought this situation may change in the near future.

I have attached a proposal and technical and economic information that have been forwarded to Montecito/Santa Barbara officials that you might use as a comparison as to how waterbag technology could be used to deliver Humboldt Bay water to Monterey. The economics for delivering water to Monterey from

Humboldt Bay would be less expensive than the proposed Montecito economics due to the shorter distance travelled.

Our ability to use solar powered/diesel powered waterbag drones, guided by GPS to deliver water from Humboldt Bay to Monterey Bay (Seaside) will be easy to demonstrate and confirm. Transporting water using waterbag drones would have a significantly less effect on the environment than the operation of a desalination plant of a comparable capacity.

WE ARE NOT REQUESTING FUNDS FROM MONTEREY RATEPAYERS OR FROM THE STATE OF CALIFORNIA IN ORDER TO DEMONSTRATE THE VIABILITY AND RELIABILITY OF WATERBAG TECHNOLOGY FOR MONTEREY. ALL WE HAVE EVER REQUESTED IS FOR MONTEREY OFFICIALS TO SPEAK TO HUMBOLDT BAY OFFICIALS IN ORDER TO DETERMINE THE TECHNICAL AND ECONOMIC FEASIBILITY FOR TRANSPORTING WATER USING WATERBAG TECHNOLOGY, AND FOR MONTEREY OFFICIALS TO PUBLICALLY ANNOUNCE THEIR SUPPORT FOR A DEMONSTRATION OF THIS TECHNOLOGY. THIS PUBLIC SUPPORT FROM MONTEREY OFFICIALS WOULD ENABLE THE FUNDING FOR THE DEMONSTRATION OF WATERBAG TECHNOLOGY TO BEGIN.

THERE WOULD BE ZERO FINANCIAL RISK TO MONTEREY RATEPAYERS IF THIS PLAN IS ACCEPTED.

Your notice states that, ***"All written comments received by July 1, 2015, will be responded to..."***

I look forward to receiving this response in writing.

I would ask that you or someone from your office make a phone call to Carol Rische, General Manager of the Humboldt Bay MWD [(707) 443-5018], in order to understand what the HBMWD is proposing and the water that is available and why.

As I understand it, the HBMWD is offering up to 50 MGD at a dockside rate of approximately $100 per acre foot. Using our technology we can deliver this water to a location in the Monterey Peninsula area for less than $800 per acre foot.

From the economics I have reviewed, waterbag technology should be able to deliver water to the Monterey Peninsula for less than half the capital costs and operating costs of the proposed desalination plant.

MONTEREY RATEPAYERS WILL HAVE ZERO FINANCIAL RISK UNDER OUR PROPOSAL. IF WE FAIL TO DELIVER WATER OF THE QUALITY AND QUANTITY AGREED UPON MONTEREY RATEPAYERS WILL INCUR NO FINANCIAL OBLIGATIONS.

I look forward to your specific, *"written comments,"* on our technology, our economics, and our proposal. I would be happy to answer any questions you may have.

Best regards,

Terry Spragg

MIT SEA GRANT College Program

9 June 2008

Terry G. Spragg & Associates
420 Highland Avenue
Manhattan Beach, CA 90266

Dear Terry,

You mentioned that some people have expressed concerns over the control and stability of large towed objects. These concerns are legitimate since without proper design or precautions, problems can be experienced. The fact that during our exhaustive model and prototype tests no such problems occurred might not satisfy the critical observer in the absence of an explanation on why the SpraggBag™ system is different and immune to such behaviors.

I suspect much of this concern stems from the unfortunate experiences associated with the now-defunct Nordic Water Supply technologies. In that case, the flexible portion of the fabric barge had to transition into a rigid bow. As you may recall in our early development, we quickly dispensed with that option. By contrast, the SpraggBag system transfers the towing force directly into the prismatic portion of the lead bag and then these forces transfer from one bag to the next via the interconnection skirt. By doing this we insert no loads on the bow and stern of each bag and the role of these specially shaped panels is only to resist the hydrostatic pressure of the freshwater cargo and provide a reasonably streamlined bow and stern for the series of interconnected bags.

Because each bag is only filled to 90% capacity, there is ample opportunity for each portion of the bag to flex independently under the action of short-crested waves. As we consistently witnessed in our testing program, smaller high-frequency waves tend to be reflected off the bags. By contrast, medium-frequency waves would pass through the bag without causing any gross motions. Finally, low-frequency waves, i.e. wave lengths greater than the beam of the bag, would pass through and induce motions of the bag consistent with the orbital velocities of these long-period excitations.

In this respect, the bags are no different than towing any very large object in long-period waves. In high sea conditions, problems can occur because of the vastly different behaviors of the train of bags and the relatively small tugboat. These problems can manifest themselves in excessive towline tension or the failure of the towline termination point.

Again, in the engineering of the SpraggBag system, this latter issue has been mediated. However, a towline must be selected that is sufficiently long and has sufficient elasticity or catenary to allow for the relative tow/towboat motions. That said, normal precautions should apply when it comes to avoiding maritime operation during storm conditions.

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Phone: 617-253-7079 • Fax: 617-252-1615 • email: cgoudey@mit.edu
http://web.mit.edu/seagrant/aqua/cfer/index.html

I am intrigued with the idea of SpraggBag operations in a consistent, favorable ocean current. As you recall, none of our very-positive engineering and economic analyses enjoyed the boost that would be realized when the transit is assisted by such conditions.

While this situation would have a very favorable impact on towed operations involving long trains of SpraggBags and high-powered tugs, the fair-current scenario combined with society's interests in minimizing its carbon footprint brings with it some very intriguing possibilities. For example, and depending on the current velocities, the use of solar-powered propulsion might become a realistic alternative. Looking at a single 25-megaliter SpraggBag, we have approximately 2,000 sq. m. of exposed surface area. Even based on modest PV performance rates, that could yield over 100kW of power. That would translate into in excess of 150 horsepower of electric propulsion.

It should interest you to know that I have recently been working on mobile fish-farming operations – self-propelled ocean cages in particular. I have engineered electric propulsion systems that yield over 170 pounds of thrust per horsepower. That is approximately five times the thrust-per-horsepower ratio of ocean-going tugs. I am conducting sea trials of this system later this month in Culebra, PR.

This zero-carbon approach would be competitive even in a conventional delivery scenario. However, in a favorable current, the option of one solar-enhanced SpraggBag towing a modest train of passive units offers a stunning opportunity. Indeed, depending on the intensity and predictability of the current, the self-propulsion requirement might be modest; only what is needed to keep the transits along a prescribed route. I'd enjoy exploring these concepts further if the details of a route and delivery requirements can be specified.

You also mentioned that some people have had questions about the SpraggBag technology's ability to contain such massive amounts of water. I'm not sure how to respond except to say that our initial analyses were exhaustive, our material testing program was rigorous, our model tests verified the sea-keeping predictions, the prototype inflation tests proved the adequacy of the fabrications, and the pilot-scale demonstration tows revealed the feasibility of the entire system.

Suffice to say, the basic questions about the SpraggBag mode of water delivery have been answered. What remains is customizing the components and the operations to the particulars of the route.

I hope these comments are useful in explaining the key differences between the SpraggBag system and some of the inferior approaches to water transport that may have given rise to skepticism. Please let me know is there is any way I can help in conveying the merits of the SpraggBag technology.

Sincerely,

Cliff Goudey
Research Engineer

Terry G. Spragg & Associates
420 Highland Avenue
Manhattan Beach, CA 90266

24 February 2015

Bob Hazard, Associate Editor
Montecito Journal
1206 Coast Village Circle, Suite D
Montecito, CA 93150

Dear Bob,

You presented a much-welcome challenge to us with your message of January 8th. In it you asked us if we could sell water to Montecito for $1,000 per acre-foot. You also stipulated a plan that would provide 3,000 acre-feet per year. It's taken us some time to properly respond to this challenge because the specifics were outside of delivery scenarios we've previously considered.

In the past we've focused on very large deliveries with many waterbags in an interconnected train. That does not work well in this case because of the absence of locations to assemble and disassemble long trains in a protected area. Absent that capability, the use of high-horsepower, ocean-going tugs becomes uneconomic. Furthermore, the towing of single or small numbers of waterbags by such craft is also uneconomic because of charter fees and labor costs.

One of our goals is to develop a zero-carbon solution to moving water around the globe. That solution involves using the area on top of our waterbags to collect solar energy and to utilize that electric power to tow our cargo. In addition, we see small autonomous towing vessels as another key to efficient operations. Because of the size of our waterbags and the surface area they offer to state-of-the-art, flexible solar panels, our approach is technically feasible. By storing excess energy in batteries for continued operation during the night we can further increase our transport efficiency. Unfortunately, current costs of today's PV and battery technologies make it impossible to meet your target delivered price with this method.

As an interim approach we have examined the use of small diesel generators in place of solar panels and batteries. This hybrid feature is something we would include in our solar-powered drones and it provides us the ability to economically deliver water today and positions us to exploit PV and batteries as they inevitably come down in price and as fuel costs increase.

Using this approach we can deliver water from Humboldt Bay and meet your cost challenge. While there remain some unknown cost items, below are the capital and operational costs associated with the water delivery. You will see that we've included a route from Humboldt Bay to the Montecito Harbor entrance and from Humboldt Bay to Morro Bay. The latter seems to be a preferred port of entry if the wheeling logistics can be worked out.

Destination	Montecito	Morro Bay
Route distance (n.m.)	496	392
Amount per delivery (cu m)	3900	3900
(acre-feet)	3.1	3.1
Deliveries per year	960	960
Year-1 cost per acre-foot	$964	$845
Levelized 10-year cost	$1,069	$938

We have attached detailed output sheets of our economic analysis. These costs assume a three percent inflation rate and a ten-year contract to amortize our capital costs. However, it is important to note that unlike a desalinization plant with its enormous capital outlays and unavoidable carrying costs, the majority of our costs are related to water purchase costs and operating expenses. In the event that the community's delivery needs are reduced due to rainfall or other causes, so too could our costs. Furthermore, to the extent the mobile portions of our investment could be employed at other locations of water scarcity, we could further reduce any idle costs of our plan.

There are many issues yet to be worked out related to the infrastructure needed at both ends of these routes and where our responsibilities begin and end in getting water to the community. We are hoping that by offering these estimates we can engage in more detailed discussions with the parties involved. We would also be happy to present a pilot delivery plan that would involve a minimal investment but would allow the full evaluation of our technology and its promising role in mitigating the present drought in Southern California.

Sincerely,

Terry G. Spragg	Clifford A. Goudey	Robert Brooks
CEO	CTO	CFO

Enclosures: Montecito economic analyses: case summaries and financials

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Terry G. Spragg & Associates

Terry G. Spragg & Associates
Spragg Bag Water Transport System

CASES 1a AND 1b

Case 1a: Humboldt Bay to Montecito - Diesel Powered Drones (1 bag/drone)

5% Bag Repair/Maintenance Costs & 5% Drone Repair/Maintenance Costs

Year		Deliveries (acre-feet)	Revenues	Financed Capital (Debt/Equity)	Unfinanced Capital Costs	Bag Repair Costs	Water Supply Cost	Annual O&M	Transport Costs	Total Costs	Present Value
1	2015	3,000	3,039,347	-	9,600,000	462,500	300,000	800,000	409,450	11,571,950	11,571,950
2	2016	3,000	3,115,331	-	-	474,063	307,500	820,000	419,686	2,021,249	1,924,999
3	2017	3,000	3,193,214	-	-	485,914	315,188	840,500	430,179	2,071,780	1,879,166
4	2018	3,000	3,273,044	-	-	498,062	323,067	861,513	440,933	2,123,575	1,834,424
5	2019	3,000	3,354,870	-	-	510,513	331,144	883,050	451,956	2,176,664	1,790,747
6	2020	3,000	3,438,742	-	-	523,276	339,422	905,127	463,255	2,231,081	1,748,110
7	2021	3,000	3,524,711	-	-	536,358	347,908	927,755	474,837	2,286,858	1,706,488
8	2022	3,000	3,612,829	-	-	549,767	356,606	950,949	486,708	2,344,029	1,665,858
9	2023	3,000	3,703,149	-	-	563,511	365,521	974,722	498,875	2,402,630	1,626,194
10	2024	3,000	3,795,728	-	-	577,599	374,659	999,090	511,347	2,462,696	1,587,476
		30,000	34,050,966	-	9,600,000	5,181,564	3,361,015	8,962,705	4,587,227	31,692,511	27,335,412

Case 1b: Humboldt Bay to Montecito - Diesel Powered Drones (2 bags/drone)

5% Bag Repair/Maintenance Costs & 5% Drone Repair/Maintenance Costs

Year		Deliveries (acre-feet)	Revenues	Financed Capital (Debt/Equity)	Unfinanced Capital Costs	Bag Repair Costs	Water Supply Cost	Annual O&M	Transport Costs	Total Costs	Present Value
1	2015	3,000	2,873,217	-	9,850,000	475,000	300,000	800,000	203,024	11,628,024	11,628,024
2	2016	3,000	2,945,048	-	-	486,875	307,500	820,000	208,099	1,822,474	1,735,690
3	2017	3,000	3,018,674	-	-	499,047	315,188	840,500	213,302	1,868,036	1,694,364
4	2018	3,000	3,094,141	-	-	511,523	323,067	861,513	218,634	1,914,737	1,654,022
5	2019	3,000	3,171,494	-	-	524,311	331,144	883,050	224,100	1,962,605	1,614,640
6	2020	3,000	3,250,781	-	-	537,419	339,422	905,127	229,703	2,011,670	1,576,196
7	2021	3,000	3,332,051	-	-	550,854	347,908	927,755	235,445	2,061,962	1,538,668
8	2022	3,000	3,415,352	-	-	564,626	356,606	950,949	241,331	2,113,511	1,502,033
9	2023	3,000	3,500,736	-	-	578,741	365,521	974,722	247,365	2,166,349	1,466,270
10	2024	3,000	3,588,254	-	-	593,210	374,659	999,090	253,549	2,220,508	1,431,359
		30,000	32,189,748	-	9,850,000	5,321,606	3,361,015	8,962,705	2,274,551	29,769,877	25,841,266

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HUMBOLDT BAY TO MONTECITO - DIESEL POWERED DRONES SUMMARY

CASES 1a AND 1b

SCENARIO DEFINITIONS:

One-Way Distance (naut mi)		496
Facility Size:		
MGD		2.7
AF/year		3,000
m^3/year		3,700,595
Tug and Barge:		
Tug Lease ($/day)	$	-
Barge Lease ($/day)	$	-
Harbor Tug ($/day)	$	-
Tug Purchase Cost	$	-
Barge Purchase Cost	$	-
Annual Crew Cost	$	-
Bag Life (years)		10
Diesel-Powered Drone:		
Drones ($/drone)	$	100,000
Repair Cost ($/year)	$	475,000
Fuel Cost ($/gal)	$	2.85

KEY ASSUMPTIONS:

Capital Costs:			
On-Loading Facilities	$	-	(*)
Off-Loading Facilities	$	-	(*)
Bags	$	150,000	
Drone Operation Equip	$	100,000	
Operating Costs:			
On-Loading Facilities	$	-	(*)
Off-Loading Facilities	$	-	(*)
Drone Operations	$	200,000	
Bag Capacity (net @ 90% fill):			
AF		3.2	
m^3		3,951	
gallons		1,043,686	
Water Cost ($/AF)	$	100.00	
General Inflation Rate		2.5%	
Interest Rate on Borrowed Fund		5.0%	
Discount Rate		5.0%	

RESULTS:

	1 bag/drone	2 bags/drone
Levelized Cost:		
$/AF	$ 1,124	$ 1,062
$/MG	$ 3,448	$ 3,260
$/$m^3$	$ 0.91	$ 0.86
First Year Cost (rate increases w/ inflation):		
$/AF	$ 1,013	$ 958
$/MG	$ 3,109	$ 2,939
$/$m^3$	$ 0.82	$ 0.78
Number of Drones	37	19
Number of Bags	37	38
Number of Trips	26	25
Volume per Trip:		
AF	119	243
m^3	146,175	300,250
MG	39	79
Total Annual Volume (AF)	3,049	3,107

	1 bag/drone	2 bags/drone
Cost Breakdown:		
Supply Costs	11%	11%
Fuel Costs	14%	8%
Capital Costs	30%	33%
O&M Costs	45%	48%
Other Transport Costs	0%	0%
Total	100%	100%
Bags Needed (excl spares)	37	38
Repair & Maint. - Bags	5%	5%
Repair & Maint. - Drones	5%	5%
Trip Duration (days):		
Towing	10.0	10.5
On-Loading	-	-
Off-Loading	-	-
Returning	3.6	3.6
Total	13.6	14.1

(*) ESTIMATED LOADING AND OFF-LOADING CAPITAL AND OPERATING COSTS WILL BE DETERMINED UPON PHYSICAL INSPECTION OF THE SITES.

Terry G. Spragg & Associates
Spragg Bag Water Transport System

CASES 2a AND 2b

Case 2a: Humboldt Bay to Montecito - Diesel Powered Drones (1 bag/drone)

5% Bag Repair/Maintenance Costs & 1% Drone Repair/Maintenance Costs

Year		Deliveries (acre-feet)	Revenues	Financed Capital (Debt/Equity)	Unfinanced Capital Costs	Bag Repair Costs	Water Supply Cost	Annual O&M	Transport Costs	Total Costs	Present Value
1	2015	3,000	2,891,347	-	9,600,000	314,500	300,000	800,000	409,450	11,423,950	11,423,950
2	2016	3,000	2,963,631	-	-	322,363	307,500	820,000	419,686	1,869,549	1,780,523
3	2017	3,000	3,037,722	-	-	330,422	315,188	840,500	430,179	1,916,288	1,738,129
4	2018	3,000	3,113,665	-	-	338,682	323,067	861,513	440,933	1,964,195	1,696,745
5	2019	3,000	3,191,506	-	-	347,149	331,144	883,050	451,956	2,013,300	1,656,347
6	2020	3,000	3,271,294	-	-	355,828	339,422	905,127	463,255	2,063,632	1,616,910
7	2021	3,000	3,353,076	-	-	364,724	347,908	927,755	474,837	2,115,223	1,578,412
8	2022	3,000	3,436,903	-	-	373,842	356,606	950,949	486,708	2,168,104	1,540,831
9	2023	3,000	3,522,826	-	-	383,188	365,521	974,722	498,875	2,222,306	1,504,144
10	2024	3,000	3,610,896	-	-	392,767	374,659	999,090	511,347	2,277,864	1,468,331
		30,000	32,392,865	-	9,600,000	3,523,464	3,361,015	8,962,705	4,587,227	30,034,411	26,004,323

Case 2b: Humboldt Bay to Montecito - Diesel Powered Drones (2 bags/drone)

5% Bag Repair/Maintenance Costs & 1% Drone Repair/Maintenance Costs

Year		Deliveries (acre-feet)	Revenues	Financed Capital (Debt/Equity)	Unfinanced Capital Costs	Bag Repair Costs	Water Supply Cost	Annual O&M	Transport Costs	Total Costs	Present Value
1	2015	3,000	2,721,217	-	9,850,000	323,000	300,000	800,000	203,024	11,476,024	11,476,024
2	2016	3,000	2,789,248	-	-	331,075	307,500	820,000	208,099	1,666,674	1,587,309
3	2017	3,000	2,858,979	-	-	339,352	315,188	840,500	213,302	1,708,341	1,549,516
4	2018	3,000	2,930,453	-	-	347,836	323,067	861,513	218,634	1,751,050	1,512,622
5	2019	3,000	3,003,715	-	-	356,532	331,144	883,050	224,100	1,794,826	1,476,608
6	2020	3,000	3,078,807	-	-	365,445	339,422	905,127	229,703	1,839,696	1,441,450
7	2021	3,000	3,155,778	-	-	374,581	347,908	927,755	235,445	1,885,689	1,407,130
8	2022	3,000	3,234,672	-	-	383,945	356,606	950,949	241,331	1,932,831	1,373,627
9	2023	3,000	3,315,539	-	-	393,544	365,521	974,722	247,365	1,981,152	1,340,922
10	2024	3,000	3,398,427	-	-	403,383	374,659	999,090	253,549	2,030,681	1,308,995
		30,000	30,486,835	-	9,850,000	3,618,692	3,361,015	8,962,705	2,274,551	28,066,963	24,474,202

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Last Modified: 2/23/2015 5:03 pm

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Terry G. Spragg & Associates

HUMBOLDT BAY TO MONTECITO - DIESEL POWERED DRONES SUMMARY

CASES 2a AND 2b

SCENARIO DEFINITIONS:

One-Way Distance (naut mi)		496
Facility Size:		
MGD		2.7
AF/year		3,000
m^3/year		3,700,595
Tug and Barge:		
Tug Lease ($/day)	$	-
Barge Lease ($/day)	$	-
Harbor Tug ($/day)	$	-
Tug Purchase Cost	$	-
Barge Purchase Cost	$	-
Annual Crew Cost	$	-
Bag Life (years)		10
Diesel-Powered Drone:		
Drones ($/drone)	$	100,000
Repair Cost ($/year)	$	323,000
Fuel Cost ($/gal)	$	2.85

KEY ASSUMPTIONS:

Capital Costs:			
On-Loading Facilities	$	-	(*)
Off-Loading Facilities	$	-	(*)
Bags	$	150,000	
Drone Operation Equip	$	100,000	
Operating Costs:			
On-Loading Facilities	$	-	(*)
Off-Loading Facilities	$	-	(*)
Drone Operations	$	200,000	
Bag Capacity (net @ 90% fill):			
AF		3.2	
m^3		3,951	
gallons		1,043,686	
Water Cost ($/AF)	$	100.00	
General Inflation Rate		2.5%	
Interest Rate on Borrowed Fund		5.0%	
Discount Rate		5.0%	

RESULTS:

	1 bag/drone	2 bags/drone
Levelized Cost:		
$/AF	$ 1,069	$ 1,006
$/MG	$ 3,280	$ 3,087
$/$m^3$	$ 0.87	$ 0.82
First Year Cost (rate increases w/ inflation):		
$/AF	$ 964	$ 907
$/MG	$ 2,957	$ 2,783
$/$m^3$	$ 0.78	$ 0.74
Number of Drones	37	19
Number of Bags	37	38
Number of Trips	26	25
Volume per Trip:		
AF	119	243
m^3	146,175	300,250
MG	39	79
Total Annual Volume (AF)	3,049	3,107

	1 bag/drone	2 bags/drone
Cost Breakdown:		
Supply Costs	11%	12%
Fuel Costs	15%	8%
Capital Costs	32%	35%
O&M Costs	42%	45%
Other Transport Costs	0%	0%
Total	100%	100%
Bags Needed (excl spares)	37	38
Repair & Maint. - Bags	5%	5%
Repair & Maint. - Drones	1%	1%
Trip Duration (days):		
Towing	10.0	10.5
On-Loading	-	-
Off-Loading	-	-
Returning	3.6	3.6
Total	13.6	14.1

(*) ESTIMATED LOADING AND OFF-LOADING CAPITAL AND OPERATING COSTS WILL BE DETERMINED UPON PHYSICAL INSPECTION OF THE SITES.

Terry G. Spragg & Associates
Spragg Bag Water Transport System

CASES 3a AND 3b

Case 3a: Humboldt Bay to Morro Bay - Diesel Powered Drones (1 bag/drone)

5% Bag Repair/Maintenance Costs & 5% Drone Repair/Maintenance Costs

	Year	Deliveries (acre-feet)	Revenues	Financed Capital (Debt/Equity)	Unfinanced Capital Costs	Bag Repair Costs	Water Supply Cost	Annual O&M	Transport Costs	Total Costs	Present Value
1	2015	3,000	2,651,736	-	7,600,000	362,500	300,000	800,000	344,213	9,406,713	9,406,713
2	2016	3,000	2,718,029	-	-	371,563	307,500	820,000	352,818	1,851,881	1,763,696
3	2017	3,000	2,785,980	-	-	380,852	315,188	840,500	361,639	1,898,178	1,721,703
4	2018	3,000	2,855,629	-	-	390,373	323,067	861,513	370,680	1,945,632	1,680,710
5	2019	3,000	2,927,020	-	-	400,132	331,144	883,050	379,947	1,994,273	1,640,693
6	2020	3,000	3,000,195	-	-	410,135	339,422	905,127	389,445	2,044,130	1,601,629
7	2021	3,000	3,075,200	-	-	420,389	347,908	927,755	399,182	2,095,233	1,563,495
8	2022	3,000	3,152,080	-	-	430,899	356,606	950,949	409,161	2,147,614	1,526,269
9	2023	3,000	3,230,882	-	-	441,671	365,521	974,722	419,390	2,201,304	1,489,929
10	2024	3,000	3,311,654	-	-	452,713	374,659	999,090	429,875	2,256,337	1,454,455
		30,000	29,708,406	-	7,600,000	4,061,226	3,361,015	8,962,705	3,856,350	27,841,296	23,849,295

Case 3b: Humboldt Bay to Morro Bay - Diesel Powered Drones (2 bags/drone)

5% Bag Repair/Maintenance Costs & 5% Drone Repair/Maintenance Costs

	Year	Deliveries (acre-feet)	Revenues	Financed Capital (Debt/Equity)	Unfinanced Capital Costs	Bag Repair Costs	Water Supply Cost	Annual O&M	Transport Costs	Total Costs	Present Value
1	2015	3,000	2,523,214	-	7,850,000	375,000	300,000	800,000	175,395	9,500,395	9,500,395
2	2016	3,000	2,586,295	-	-	384,375	307,500	820,000	179,780	1,691,655	1,611,100
3	2017	3,000	2,650,952	-	-	393,984	315,188	840,500	184,275	1,733,946	1,572,741
4	2018	3,000	2,717,226	-	-	403,834	323,067	861,513	188,881	1,777,295	1,535,294
5	2019	3,000	2,785,157	-	-	413,930	331,144	883,050	193,603	1,821,727	1,498,740
6	2020	3,000	2,854,786	-	-	424,278	339,422	905,127	198,444	1,867,271	1,463,055
7	2021	3,000	2,926,155	-	-	434,885	347,908	927,755	203,405	1,913,952	1,428,221
8	2022	3,000	2,999,309	-	-	445,757	356,606	950,949	208,490	1,961,801	1,394,216
9	2023	3,000	3,074,292	-	-	456,901	365,521	974,722	213,702	2,010,846	1,361,020
10	2024	3,000	3,151,149	-	-	468,324	374,659	999,090	219,045	2,061,117	1,328,615
		30,000	28,268,535	-	7,850,000	4,201,268	3,361,015	8,962,705	1,965,019	26,340,007	22,693,396

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HUMBOLDT BAY TO MORRO BAY - DIESEL POWERED DRONES SUMMARY

CASES 3a AND 3b

SCENARIO DEFINITIONS:		
One-Way Distance (naut mi)		392
Facility Size:		
MGD		2.7
AF/year		3,000
m^3/year		3,700,595
Tug and Barge:		
Tug Lease ($/day)	$	-
Barge Lease ($/day)	$	-
Harbor Tug ($/day)	$	-
Tug Purchase Cost	$	-
Barge Purchase Cost	$	-
Annual Crew Cost	$	-
Bag Life (years)		10
Diesel-Powered Drone:		
Drones ($/drone)	$	100,000
Repair Cost ($/year)	$	375,000
Fuel Cost ($/gal)	$	2.85

KEY ASSUMPTIONS:			
Capital Costs:			
On-Loading Facilities	$	-	(*)
Off-Loading Facilities	$	-	(*)
Bags	$	150,000	
Drone Operation Equip	$	100,000	
Operating Costs:			
On-Loading Facilities	$	-	(*)
Off-Loading Facilities	$	-	(*)
Drone Operations	$	200,000	
Bag Capacity (net @ 90% fill):			
AF		3.2	
m^3		3,951	
gallons		1,043,686	
Water Cost ($/AF)	$	100.00	
General Inflation Rate		2.5%	
Interest Rate on Borrowed Fund		5.0%	
Discount Rate		5.0%	

RESULTS:	**1 bag/drone**		**2 bags/drone**	
Levelized Cost:				
$/AF	$	981	$	933
$/MG	$	3,009	$	2,863
$/$m^3$	$	0.79	$	0.76
First Year Cost (rate increases w/ inflation):				
$/AF	$	884	$	841
$/MG	$	2,712	$	2,581
$/$m^3$	$	0.72	$	0.68
Number of Drones		29		15
Number of Bags		29		30
Number of Trips		33		32
Volume per Trip:				
AF		93		192
m^3		114,569		237,040
MG		30		63
Total Annual Volume (AF)		3,049		3,107

	1 bag/drone	**2 bags/drone**
Cost Breakdown:		
Supply Costs	12%	13%
Fuel Costs	14%	7%
Capital Costs	27%	30%
O&M Costs	47%	50%
Other Transport Costs	0%	0%
Total	100%	100%
Bags Needed (excl spares)	29	30
Repair & Maint. - Bags	5%	5%
Repair & Maint. - Drones	5%	5%
Trip Duration (days):		
Towing	7.9	8.3
On-Loading	-	-
Off-Loading	-	-
Returning	2.8	2.8
Total	10.7	11.1

(*) ESTIMATED LOADING AND OFF-LOADING CAPITAL AND OPERATING COSTS WILL BE DETERMINED UPON PHYSICAL INSPECTION OF THE SITES.

Terry G. Spragg & Associates
Spragg Bag Water Transport System

CASES 4a AND 4b

Case 4a: Humboldt Bay to Morro Bay - Diesel Powered Drones (1 bag/drone)

5% Bag Repair/Maintenance Costs & 1% Drone Repair/Maintenance Costs

Year		Deliveries (acre-feet)	Revenues	Financed Capital (Debt/Equity)	Unfinanced Capital Costs	Bag Repair Costs	Water Supply Cost	Annual O&M	Transport Costs	Total Costs	Present Value
1	2015	3,000	2,535,736	-	7,600,000	246,500	300,000	800,000	344,213	9,290,713	9,290,713
2	2016	3,000	2,599,129	-	-	252,663	307,500	820,000	352,818	1,732,981	1,650,458
3	2017	3,000	2,664,107	-	-	258,979	315,188	840,500	361,639	1,776,305	1,611,161
4	2018	3,000	2,730,710	-	-	265,454	323,067	861,513	370,680	1,820,713	1,572,800
5	2019	3,000	2,798,978	-	-	272,090	331,144	883,050	379,947	1,866,231	1,535,353
6	2020	3,000	2,868,952	-	-	278,892	339,422	905,127	389,445	1,912,887	1,498,797
7	2021	3,000	2,940,676	-	-	285,864	347,908	927,755	399,182	1,960,709	1,463,111
8	2022	3,000	3,014,193	-	-	293,011	356,606	950,949	409,161	2,009,727	1,428,275
9	2023	3,000	3,089,548	-	-	300,336	365,521	974,722	419,390	2,059,970	1,394,269
10	2024	3,000	3,166,786	-	-	307,845	374,659	999,090	429,875	2,111,469	1,361,072
		30,000	28,408,813	-	7,600,000	2,761,634	3,361,015	8,962,705	3,856,350	26,541,704	22,806,009

Case 4b: Humboldt Bay to Morro Bay - Diesel Powered Drones (2 bags/drone)

5% Bag Repair/Maintenance Costs & 1% Drone Repair/Maintenance Costs

Year		Deliveries (acre-feet)	Revenues	Financed Capital (Debt/Equity)	Unfinanced Capital Costs	Bag Repair Costs	Water Supply Cost	Annual O&M	Transport Costs	Total Costs	Present Value
1	2015	3,000	2,403,214	-	7,850,000	255,000	300,000	800,000	175,395	9,380,395	9,380,395
2	2016	3,000	2,463,295	-	-	261,375	307,500	820,000	179,780	1,568,655	1,493,957
3	2017	3,000	2,524,877	-	-	267,909	315,188	840,500	184,275	1,607,871	1,458,387
4	2018	3,000	2,587,999	-	-	274,607	323,067	861,513	188,881	1,648,068	1,423,663
5	2019	3,000	2,652,699	-	-	281,472	331,144	883,050	193,603	1,689,270	1,389,767
6	2020	3,000	2,719,017	-	-	288,509	339,422	905,127	198,444	1,731,502	1,356,677
7	2021	3,000	2,786,992	-	-	295,722	347,908	927,755	203,405	1,774,789	1,324,375
8	2022	3,000	2,856,667	-	-	303,115	356,606	950,949	208,490	1,819,159	1,292,842
9	2023	3,000	2,928,084	-	-	310,693	365,521	974,722	213,702	1,864,638	1,262,060
10	2024	3,000	3,001,286	-	-	318,460	374,659	999,090	219,045	1,911,254	1,232,011
		30,000	26,924,130	-	7,850,000	2,856,862	3,361,015	8,962,705	1,965,019	24,995,601	21,614,135

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Terry G. Spragg & Associates

HUMBOLDT BAY TO MORRO BAY - DIESEL POWERED DRONES SUMMARY

CASES 4a AND 4b

SCENARIO DEFINITIONS:

One-Way Distance (naut mi)		392
Facility Size:		
MGD		2.7
AF/year		3,000
m^3/year		3,700,595
Tug and Barge:		
Tug Lease ($/day)	$	-
Barge Lease ($/day)	$	-
Harbor Tug ($/day)	$	-
Tug Purchase Cost	$	-
Barge Purchase Cost	$	-
Annual Crew Cost	$	-
Bag Life (years)		10
Diesel-Powered Drone:		
Drones ($/drone)	$	100,000
Repair Cost ($/year)	$	255,000
Fuel Cost ($/gal)	$	2.85

KEY ASSUMPTIONS:

Capital Costs:			
On-Loading Facilities	$	-	(*)
Off-Loading Facilities	$	-	(*)
Bags	$	150,000	
Drone Operation Equip	$	100,000	
Operating Costs:			
On-Loading Facilities	$	-	(*)
Off-Loading Facilities	$	-	(*)
Drone Operations	$	200,000	
Bag Capacity (net @ 90% fill):			
AF		3.2	
m^3		3,951	
gallons		1,043,686	
Water Cost ($/AF)	$	100.00	
General Inflation Rate		2.5%	
Interest Rate on Borrowed Fund		5.0%	
Discount Rate		5.0%	

RESULTS:

	1 bag/drone		2 bags/drone	
Levelized Cost:				
$/AF	$	938	$	889
$/MG	$	2,877	$	2,727
$/$m^3$	$	0.76	$	0.72
First Year Cost (rate increases w/ inflation):				
$/AF	$	845	$	801
$/MG	$	2,594	$	2,458
$/$m^3$	$	0.69	$	0.65
Number of Drones		29		15
Number of Bags		29		30
Number of Trips		33		32
Volume per Trip:				
AF		93		192
m^3		114,569		237,040
MG		30		63
Total Annual Volume (AF)		3,049		3,107

	1 bag/drone	2 bags/drone
Cost Breakdown:		
Supply Costs	13%	13%
Fuel Costs	15%	8%
Capital Costs	29%	31%
O&M Costs	44%	47%
Other Transport Costs	0%	0%
Total	100%	100%
Bags Needed (excl spares)	29	30
Repair & Maint. - Bags	5%	5%
Repair & Maint. - Drones	1%	1%
Trip Duration (days):		
Towing	7.9	8.3
On-Loading	-	-
Off-Loading	-	-
Returning	2.8	2.8
Total	10.7	11.1

(*) ESTIMATED LOADING AND OFF-LOADING CAPITAL AND OPERATING COSTS WILL BE DETERMINED UPON PHYSICAL INSPECTION OF THE SITES.

SOLAR-POWERED DELIVERY OF FRESH WATER
a refinement of nature's water cycle

Water scarcity is a growing geopolitical issue and one that may prove more troublesome than oil in generating global conflict. Much effort has gone into methods of turning non-potable water such as seawater, brackish water, or contaminated water into drinkable water using various purification techniques. However, methods such as distillation or reverse osmosis desalinization are expensive, extremely energy intensive, and often harmful to the environment.

There is no shortage of fresh water on Earth, only an unfortunately patchy distribution of it. Equally unfortunate is a distribution of population that does not match the distribution of rainfall or water availability. This mismatch seems to only be getting worse as the climate effects of global warming materialize. This distribution mismatch can be addressed using various means of transporting water from regions of high abundance to regions of scarcity. Various methods are available to do this including land-based pipelines and aqueducts, and the transport of water by truck, rail or ship. Not all are applicable to some situations but all can be expensive.

The development the Spraggbag by Spragg Associates represents a new approach to moving water. Described in U.S. patent number 5,413,065, it employs elongated flexible fabric barges that can accommodate many acre feet of fresh water, which, because of the density difference with seawater, floats conveniently at the ocean surface. These Spraggbags can be filled, towed either singly or interconnected in long arrays, and then emptied at a destination.

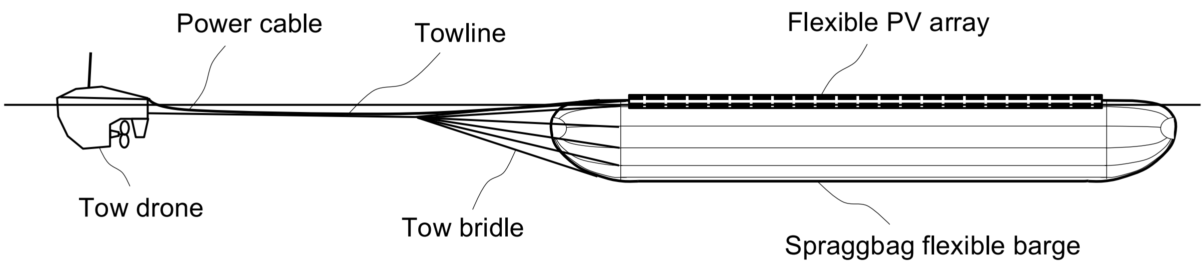
Spraggbags being filled in Port Angeles, WA

However, the towing of flexible fabric barges can be expensive due to the costs of the required tow vessel. In order to endure ocean passages, the vessel must be seaworthy, which generally means a large ocean-going tugboat of high horsepower. In order to make efficient use of such a vessel's towing power, an interconnected train of flexible fabric barges can be employed.

As autonomous vehicle technology, such as aircraft drones, driverless cars, and autonomous surface craft, has improved, society and regulatory structures have embraced them. Applying this technology to help solve the water distribution problem is an opportunity to mitigate water shortages without the negative economic and environmental impacts of present-day solutions.

One implementation of this concept would the use of small remotely piloted, diesel-powered tugboat similar to other commercial marine settings. However, there are inherent inefficiencies in such an approach when applied to low-speed towage. The typical marine propeller on a tug or trawler generates 25 pounds of thrust per horsepower. However, by employing ultra-large-diameter, slow-turning propellers, 112 pounds per horsepower can be achieved. In order to achieve this, Spragg Associates will be using affordable electric-drive thrusters. While electric propulsion could be powered by a diesel generator, the approach provides us the opportunity to avoid the use of fossil fuels and employ new, flexible photovoltaic technologies to exploit the expanse of area on the top of a Spraggbag.

For example, a 27’ diameter, 280’ long Spraggbag presents a useful top surface of 5,500 square feet of area suitable for photovoltaic solar panels. Today’s PV panels generate power ranging from 5 to 16 Watts per square foot.



The Solar-powered Spragg Associates water delivery system.

Using a rating of 10 W/sq. ft., this 4,000 cubic meter Spraggbag could generate 55 kW of power, which is enough to propel it at 4 knots. Assuming eight hours of useful sun the result is 32 nautical miles (nm) per day. However, if instead of using this power at the rate it is being generated, it can be stored to allow for 24/7 operations. Because of towing power requirements vary with the cube of the speed, a one-third reduction from 55 kW to 18 kW results in a towing speed of 2.3 knots and progress of 55 nm/day, a significant increase and continuous progress towards the destination.

The storage of the extra 293 kWh of energy can be stored in lithium-ion batteries such as those used by Tesla. The storage needed for continuous solar towing is equivalent to five Model S battery packs or 5,000 pounds total. Less expensive battery technologies would also suffice.

There is significant logistical convenience with the arrival of a single Spraggbag at a destination rather then a huge tow of many that would be required to make a conventional towing operation economically viable. The individual arrivals would be sequenced to match the ability of the destination to absorb the water. This minimizes the size and cost of the terminal facilities and eliminates the need for warehousing full or empty bags. However, if the fill and receiving sites are poised for larger deliveries, there is advantage in towing multiple Spraggbags because the overall towing resistance per amount of cargo is less due to the drafting effect. For example, towing two Spraggbags one behind the other would result in twice the power being available and would support a more powerful towing drone that could achieve a constant 3.1 knots or 74 nm per day.

This new approach by Spragg Associates to the age-old problem of moving water presents an affordable solution that can be quickly implemented and offers a much-reduced carbon footprint compared to other methods and is superior in cost and environmental impact compared to desalinization options. As a result, it represents a game changer, is the subject of a patent application, and is poised to relieve water stress around the planet. For more information please contact us at: Spraggbag@gmail.com or 562-461-9195.