

US EPA ARCHIVE DOCUMENT

# University of California

## Agriculture and Natural Resources



# Using Compost to Improve Post-fire Water Quality

David Crohn  
University of California, Riverside



# Acknowledgements

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CalRecycle

UCR Ag Ops

Inland Empire Regional Composting Authority

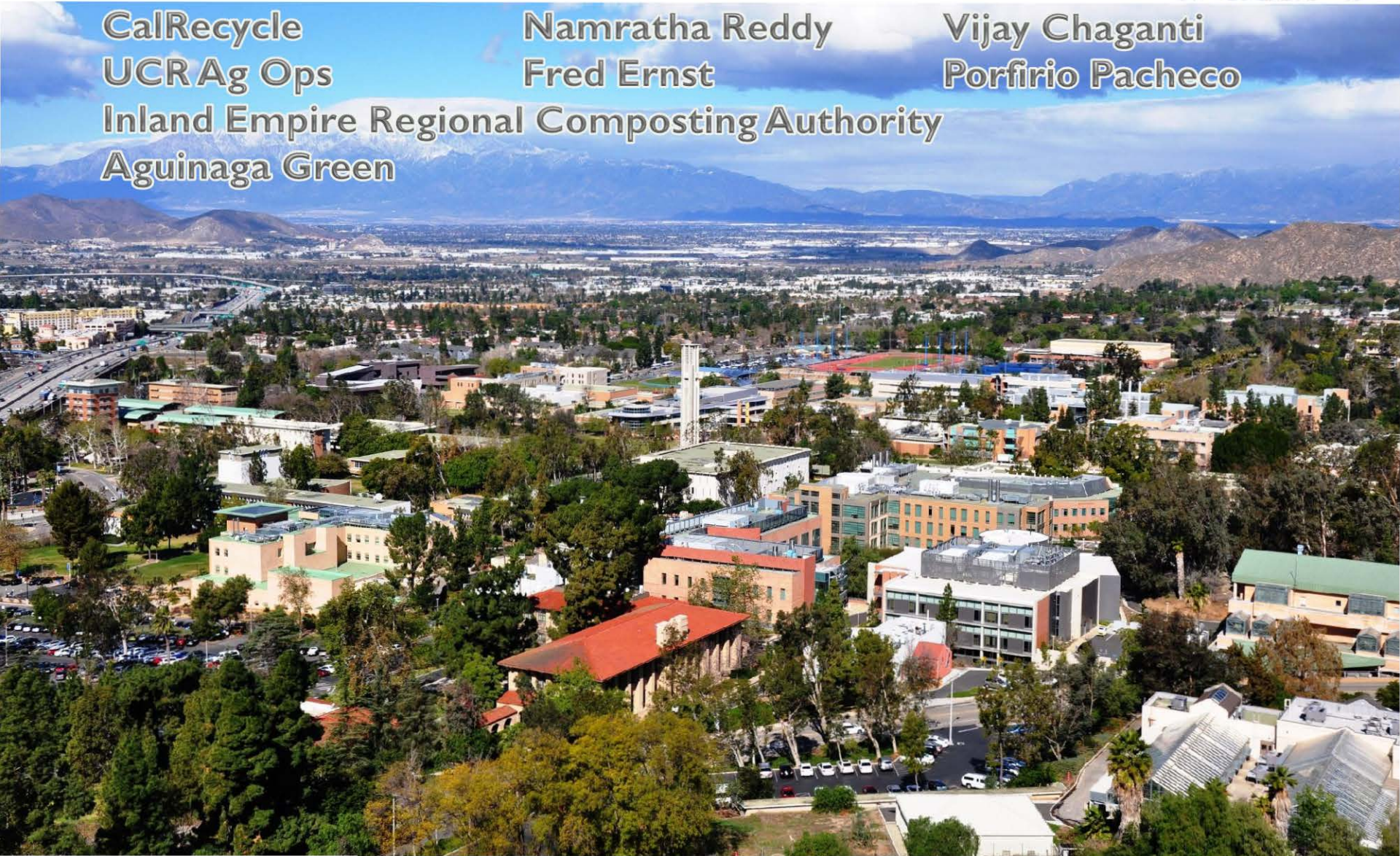
Aguinaga Green

Namratha Reddy

Fred Ernst

Vijay Chaganti

Porfirio Pacheco



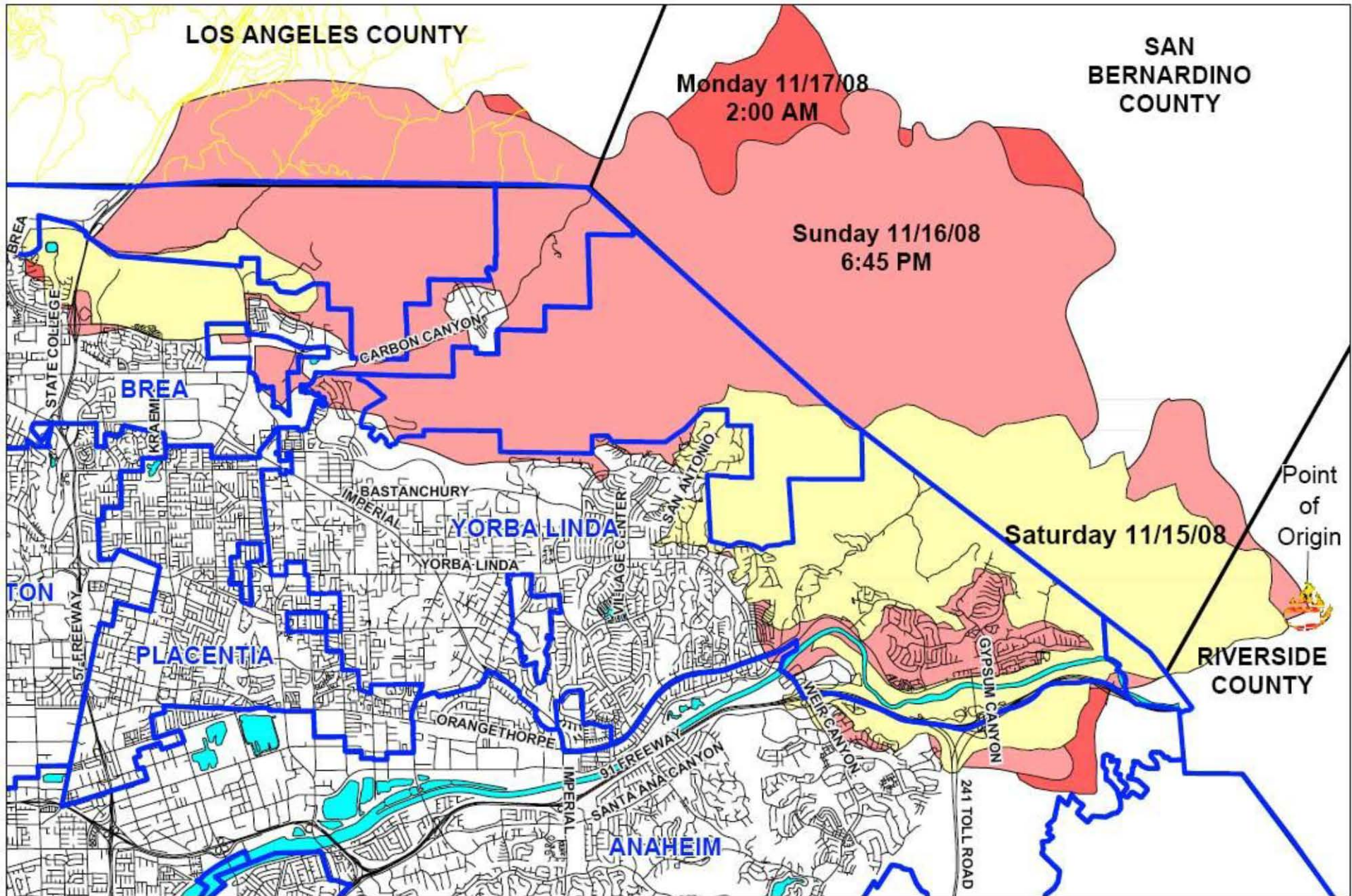


# Freeway Complex Fire, Nov. 2008

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# Freeway Complex Fire, Nov. 2008





# Official Report: Freeway Complex Fire

## **FREEWAY COMPLEX**

### Freeway Complex Incident Information:

<b>Last Updated:</b>	November 19, 2008 6:00 pm	<b>FINAL</b>
<b>Date/Time Started:</b>	November 15, 2008 9:07 am	
<b>Administrative Unit:</b>	CAL FIRE / Orange County Fire Authority / Corona City Fire / City of Anaheim / Chino Valley Fire / City of Brea / Los Angeles County Fire / CHP	
<b>County:</b>	Orange County/Riverside County	
<b>Location:</b>	Between Corona, Chino Hills, Yorba Linda, Brea & Anaheim	
<b>Acres Burned:</b>	<b>30,305</b>	
<b>Containment</b>	30,305 acres - 100% contained	
<b>Structures Destroyed:</b>	314 residence, 4 commercial and 43 outbuildings	
<b>Cause:</b>	Under investigation	
<b>Cooperating Agencies:</b>	CAL FIRE, Orange County Fire Authority, Corona Fire, Anaheim City Fire, Chino Valley Fire, CHP, CDCR and CCC.	
<b>Total Fire Personnel:</b>	1,633	
<b>Engines:</b>	156	
<b>Fire crews:</b>	48	
<b>Dozers:</b>	4	
<b>Water tenders:</b>	5	
<b>Costs to date:</b>	\$16.1 million	
<b>Conditions:</b>	The Freeway Complex is made up of the Freeway Fire and the Landfill Fire. CAL FIRE Incident Command Team #6 has transitioned into unified command.	





# Freeway Complex Fire, Nov. 2008

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# K-rail

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# Facing slopes in Temecula, CA

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# Experimental Site

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# Controlled burn – Summer 2009

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# Controlled burn

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# After the burn

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# Riverside Station 1 Fire Crew

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# Installed Slope

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# Collection Basin

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# Bins



# Maintenance

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It's wet out here...

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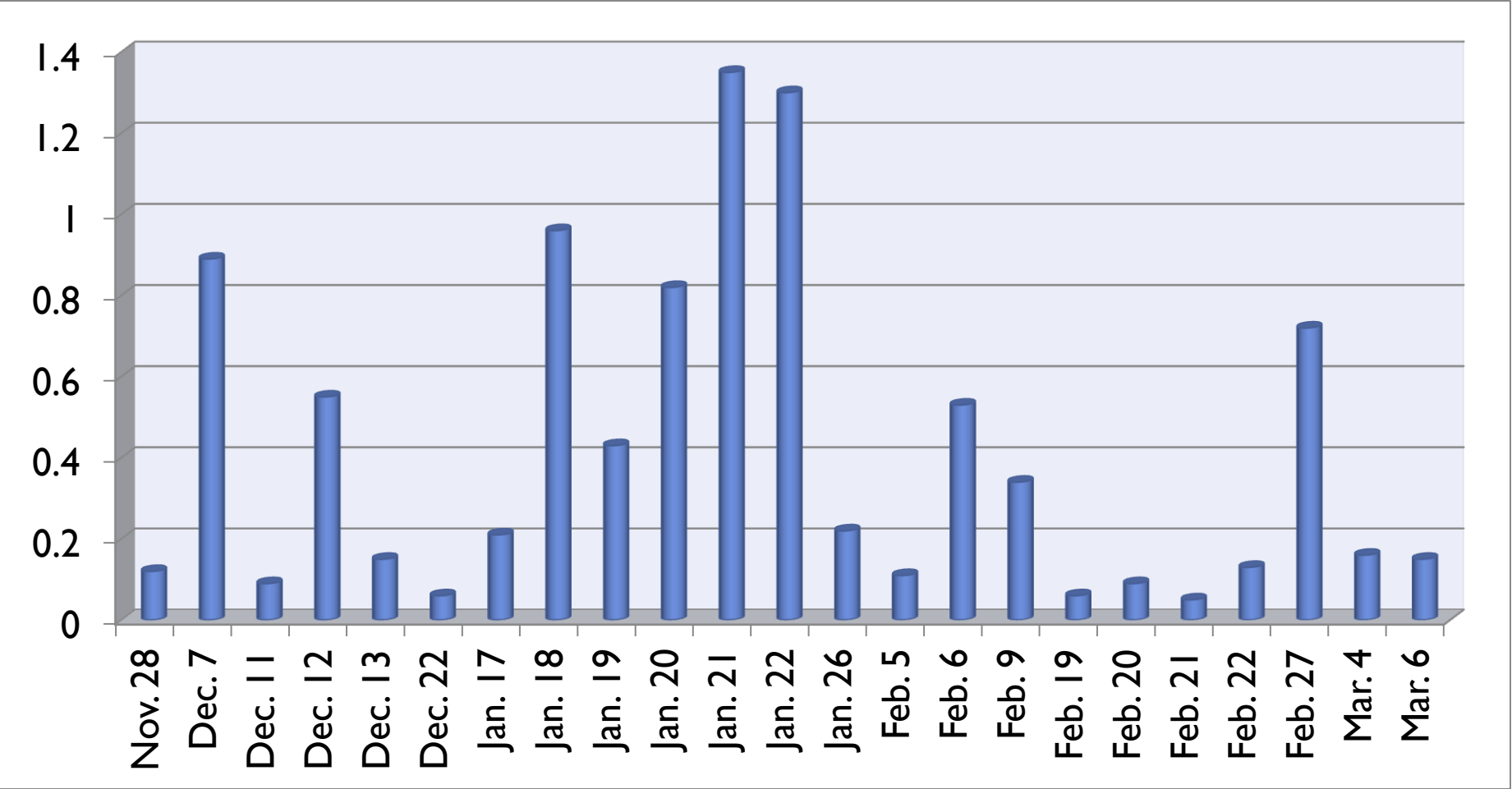
...but still dry in there

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# Precipitation (in)





## Four captured events (mm)

- ▶ December 15, 2009, following a 12.5 mm storm that fell over 48 hours
- ▶ January 19, 2010, following a 32 mm storm that fell over 36 hours
- ▶ January 21, 2010, following a 39 mm storm that fell over 36 hours
- ▶ January 23, 2010, following a 49 mm storm that fell over 36 hours

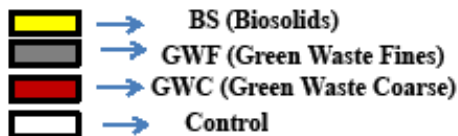
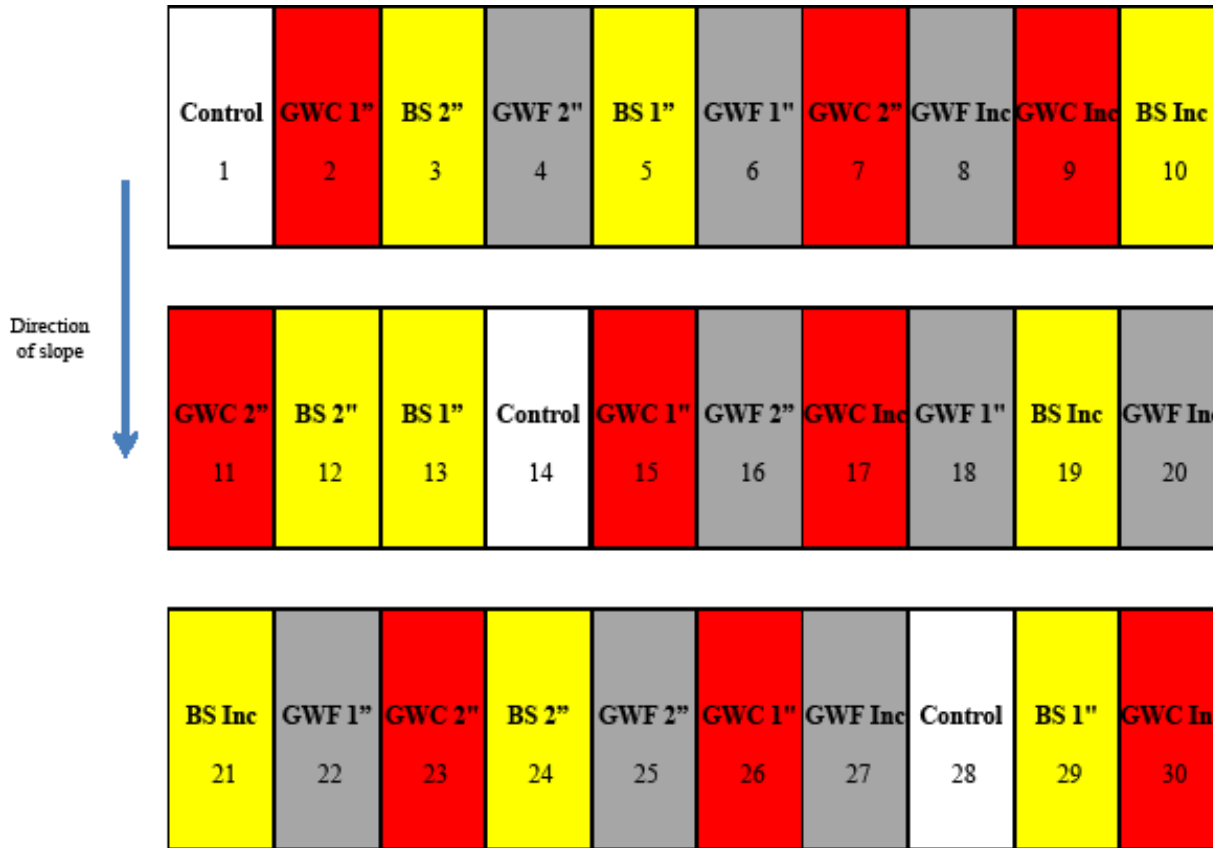


# After the first rains...

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# Randomized Complete Block Plot Design



1" = Compost applied @ 1" depth  
 2" = Compost applied @ 2" depth  
 Inc = compost Incorporated at 2" depth application

#'s 1-30 are plot numbers

## Materials

- ▶ Greenwaste compost fines
- ▶ Greenwaste compost overs
- ▶ Biosolids compost
- ▶ No compost

## Rates

- ▶ 1 inch
- ▶ 2 inches
- ▶ 2 inches incorporated





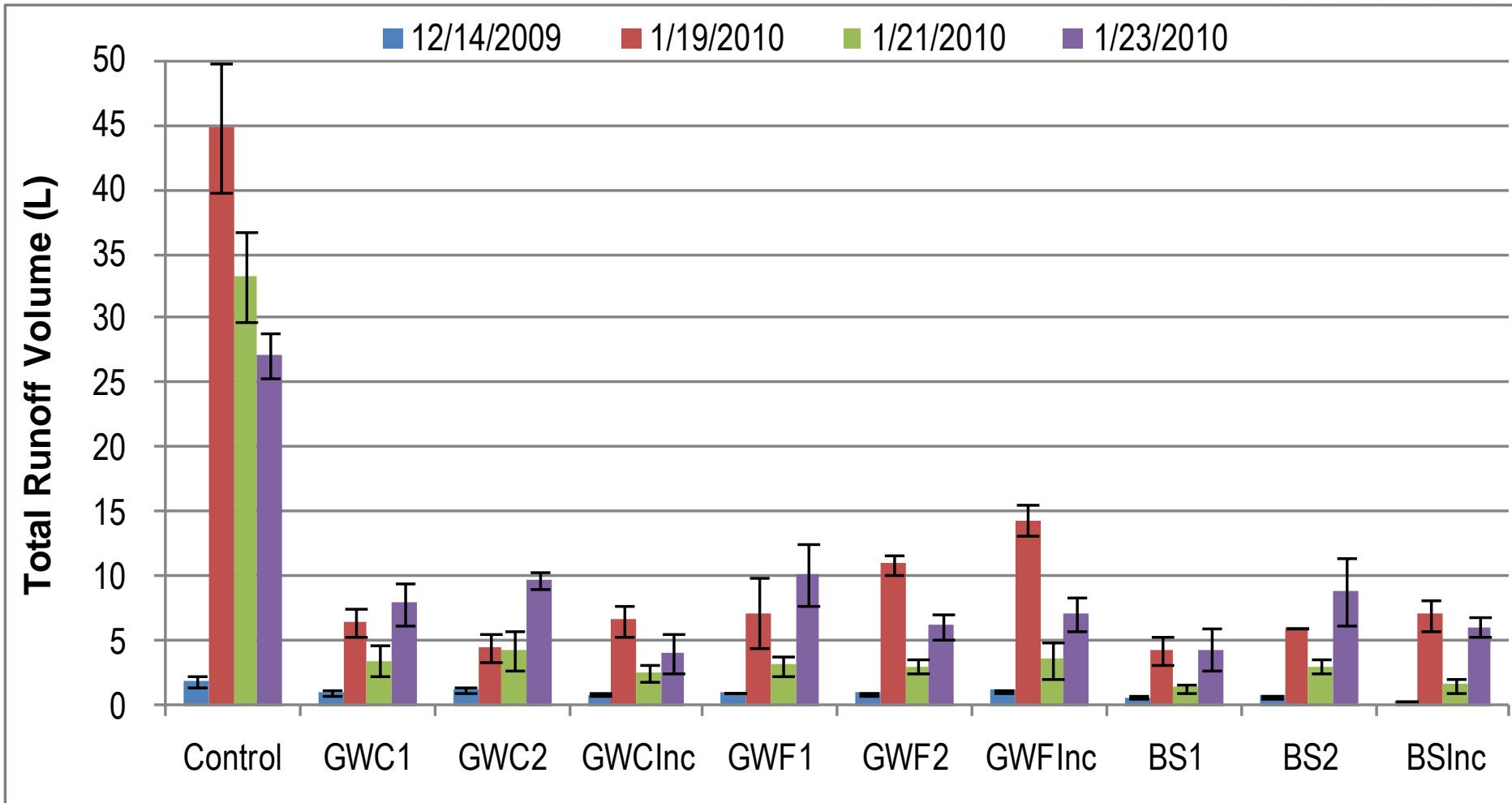
# Screening Composts

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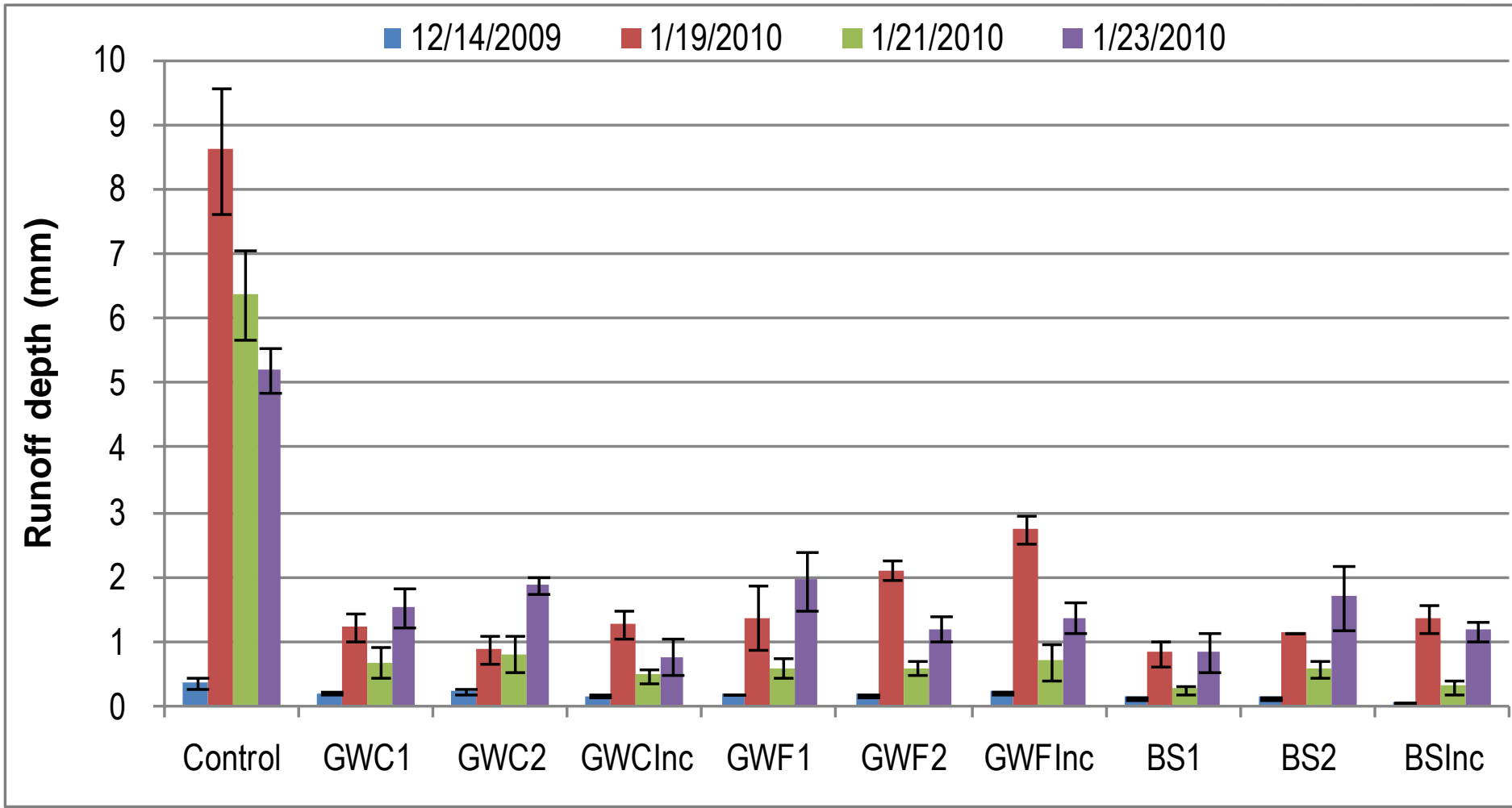


# Total Runoff Volume



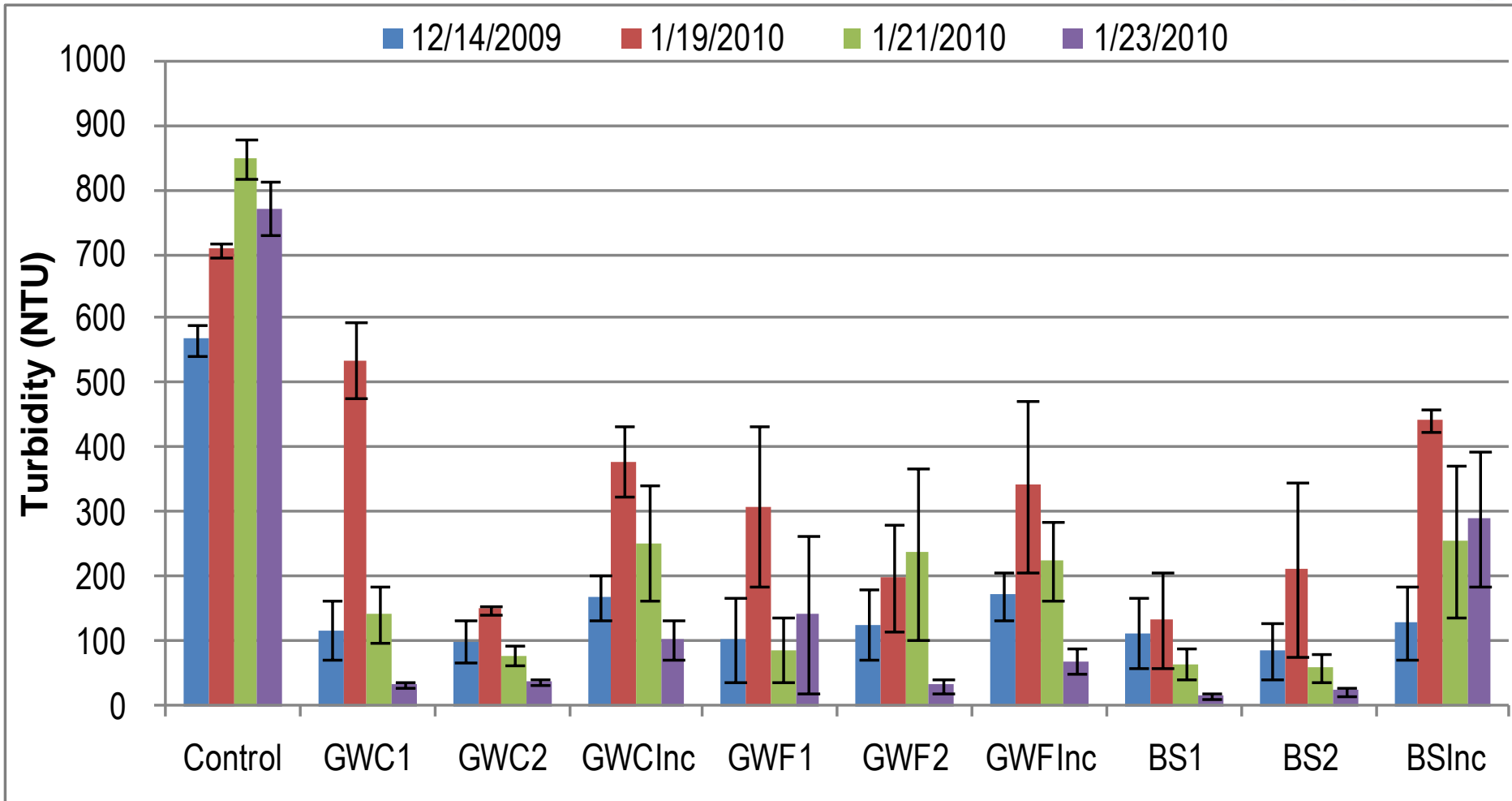


# Total Runoff Depth



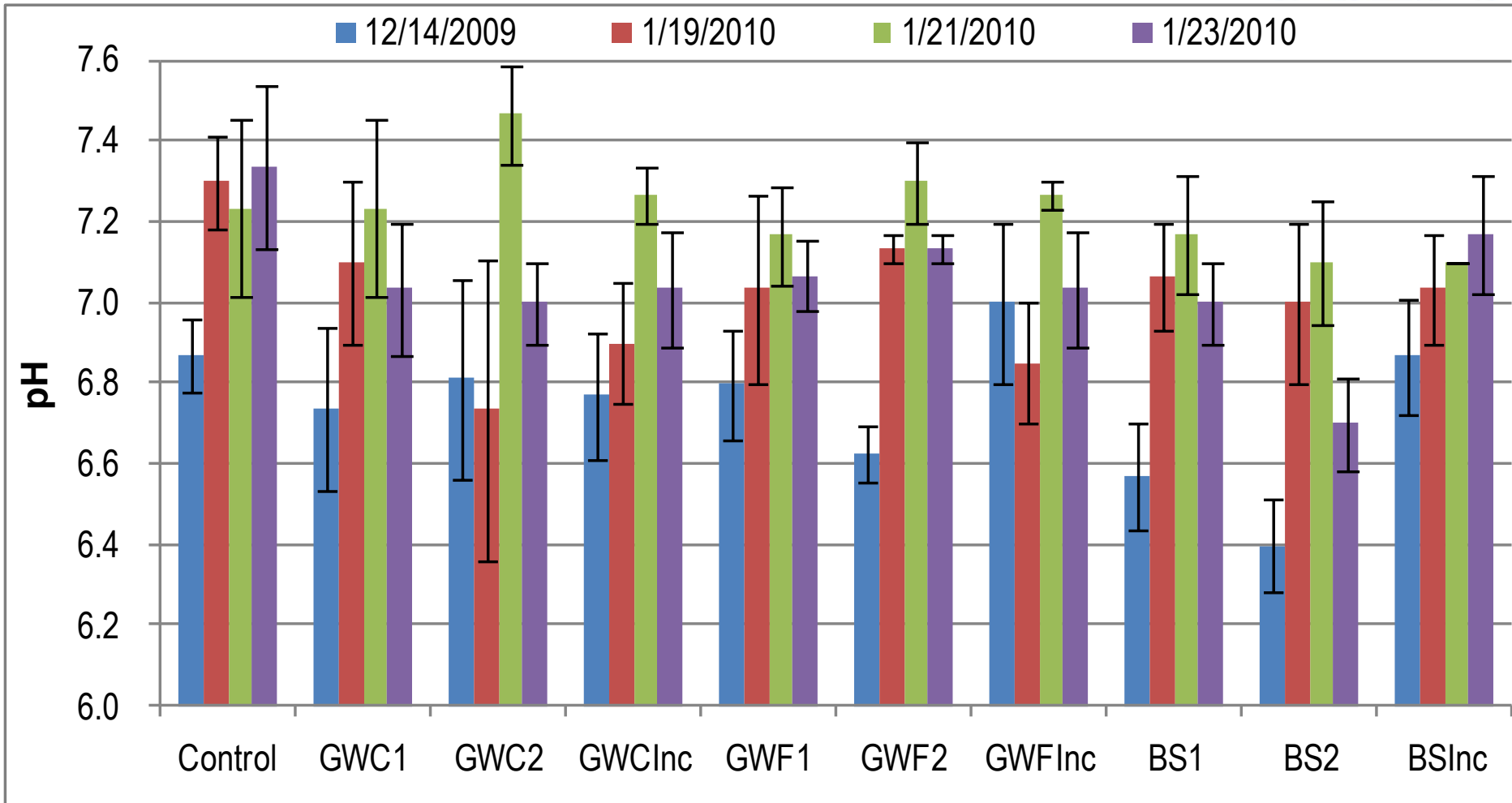


# Turbidity



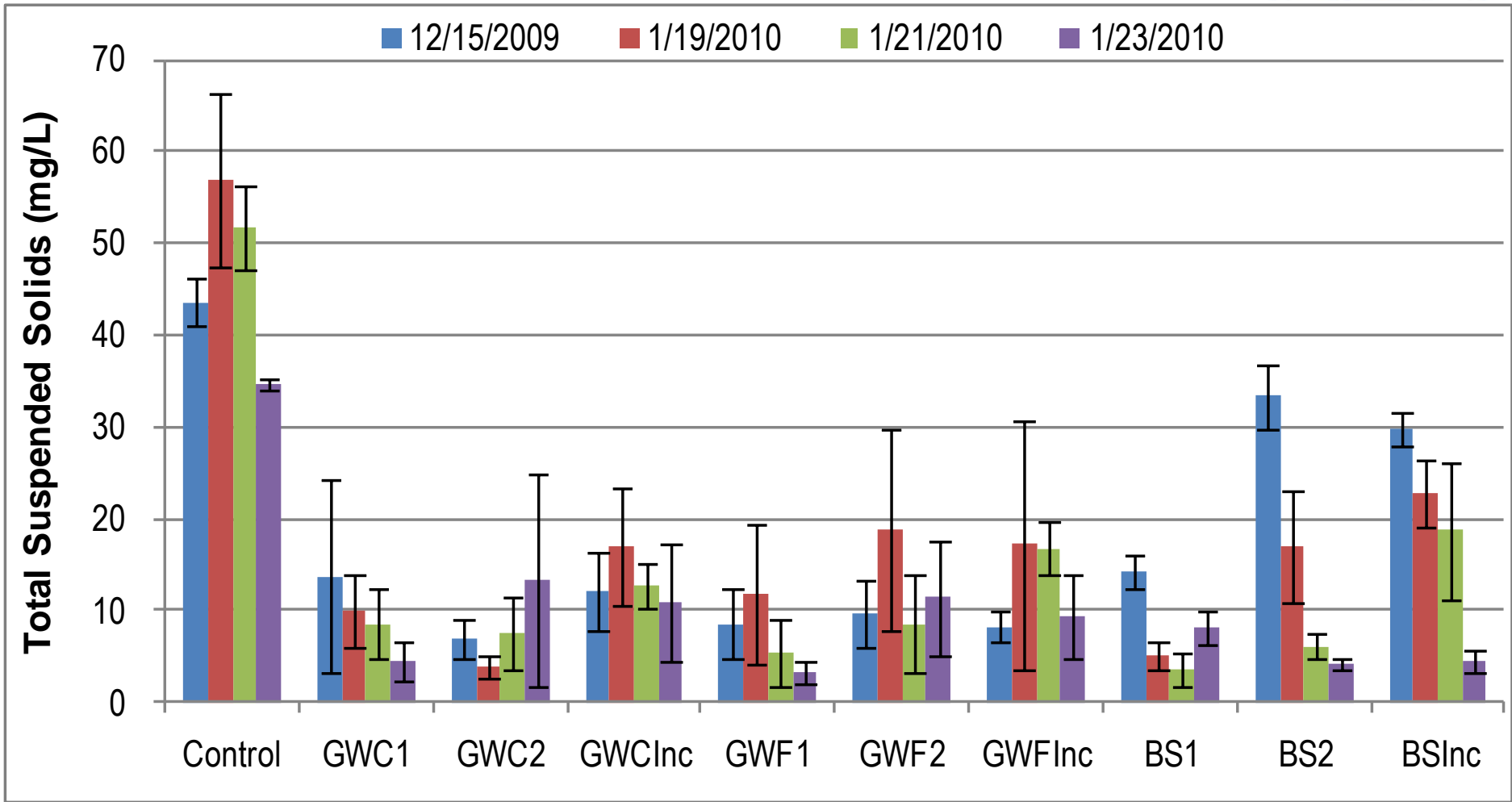


# pH



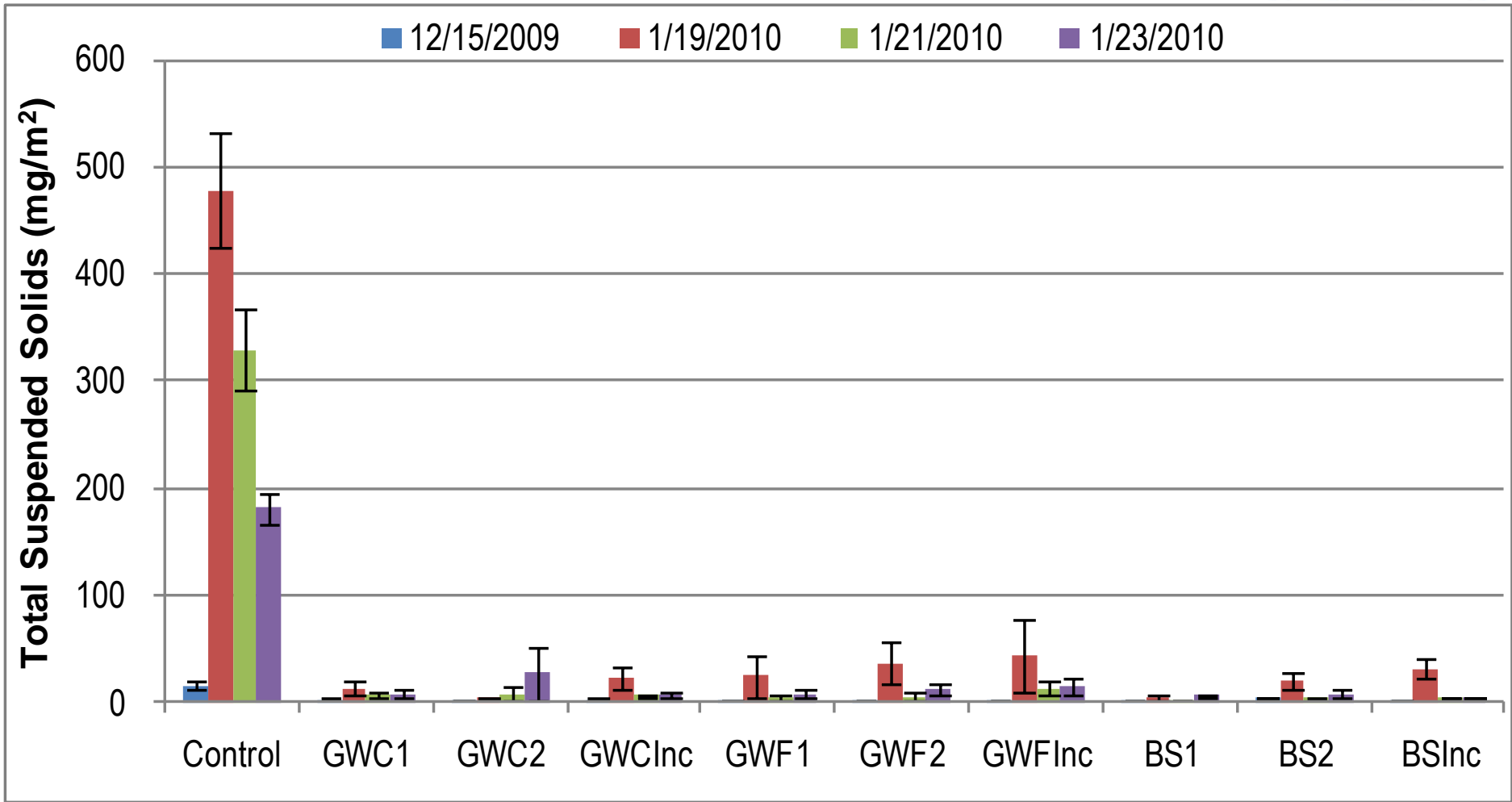


# Total Suspended Solids



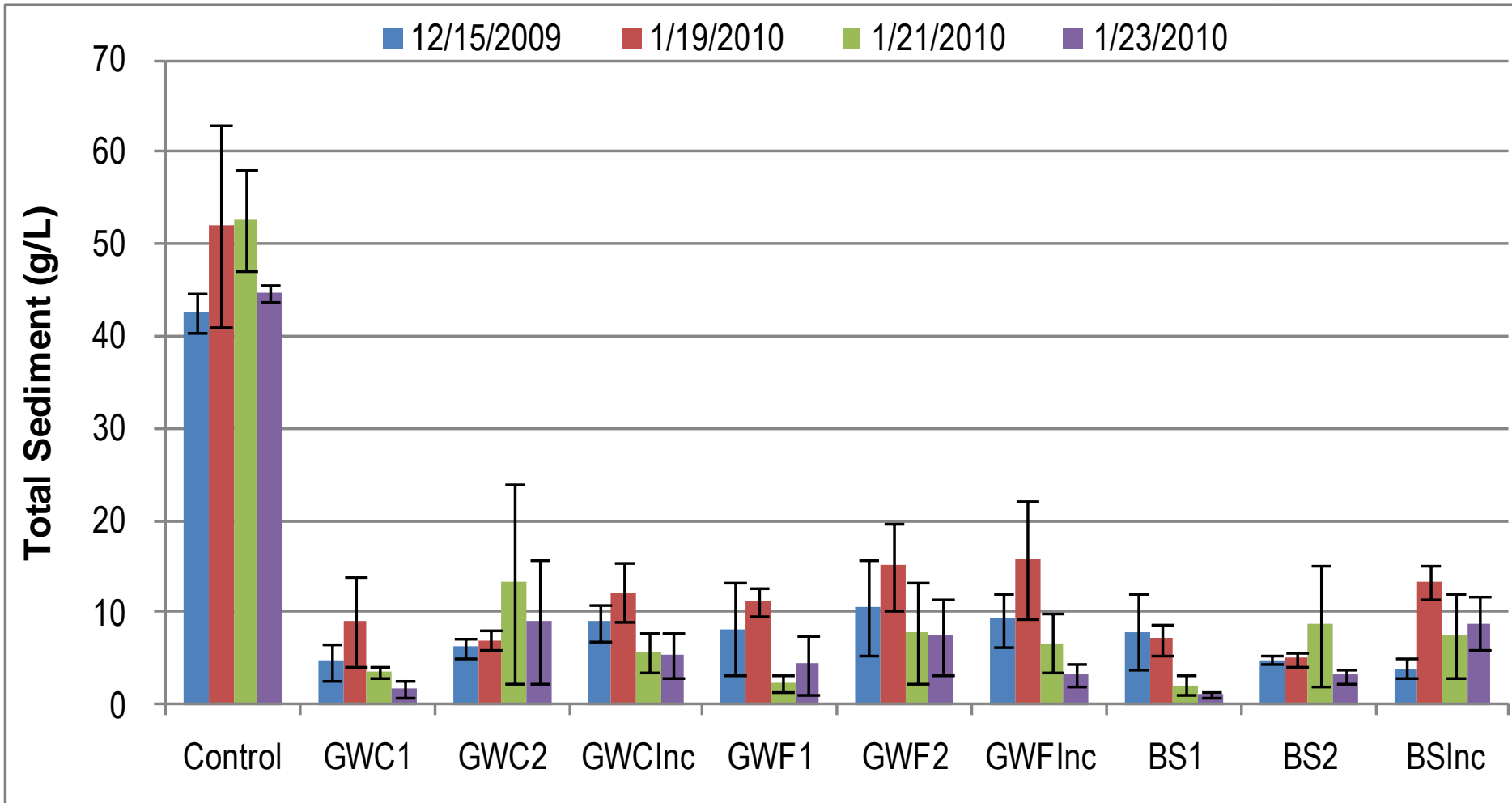


# Total Suspended Solids





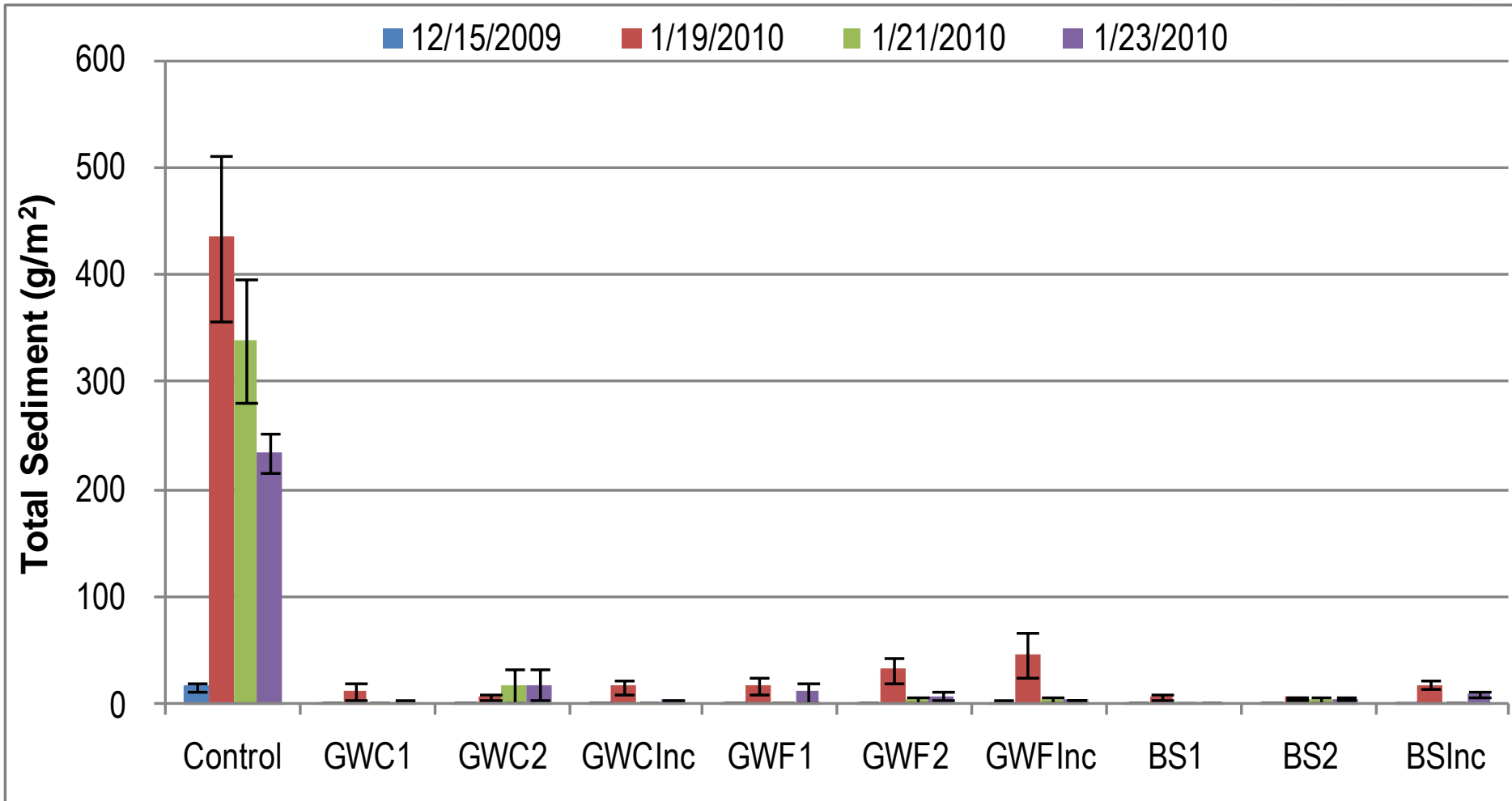
# Total Solids





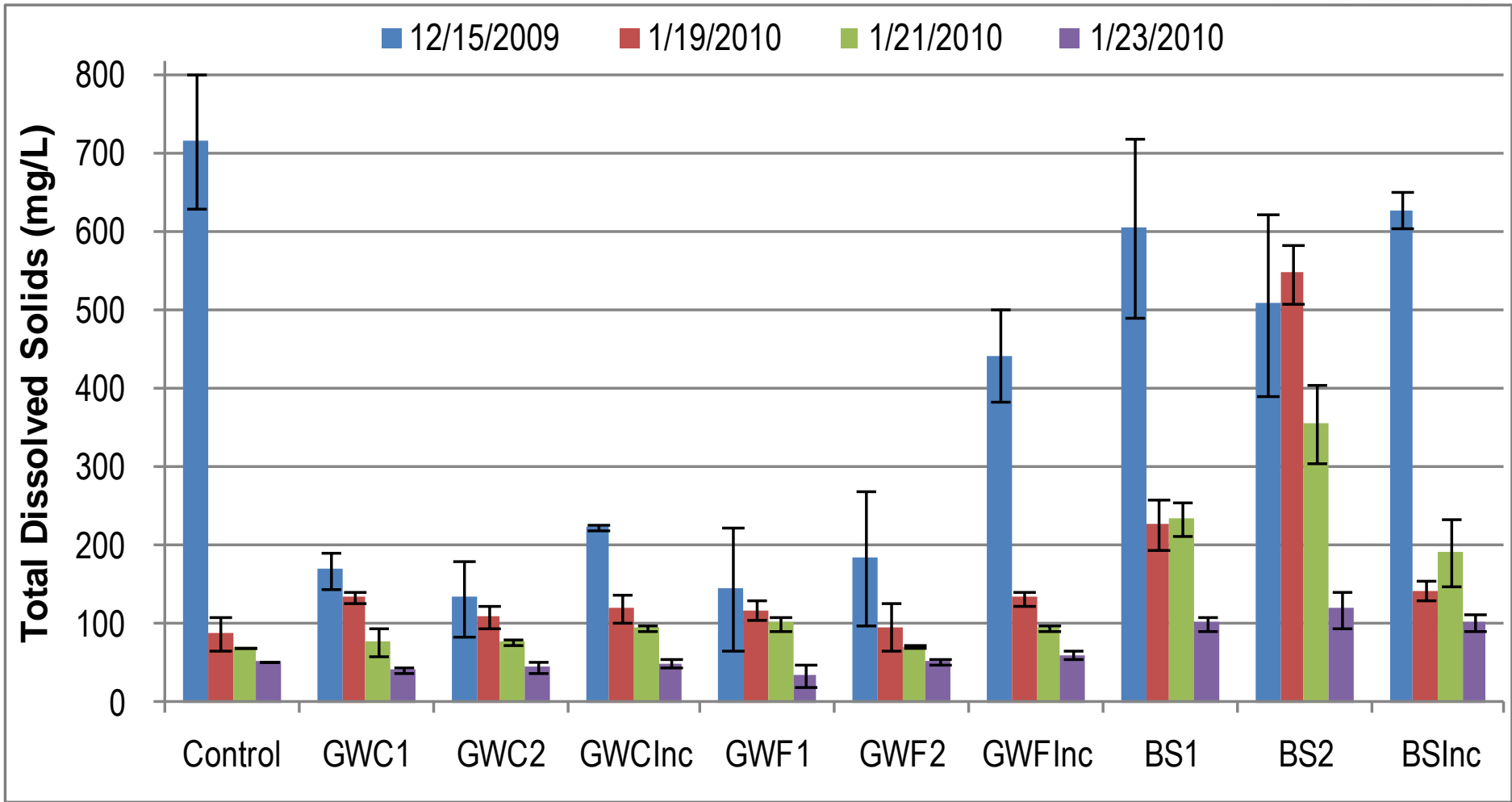


# Total Solids



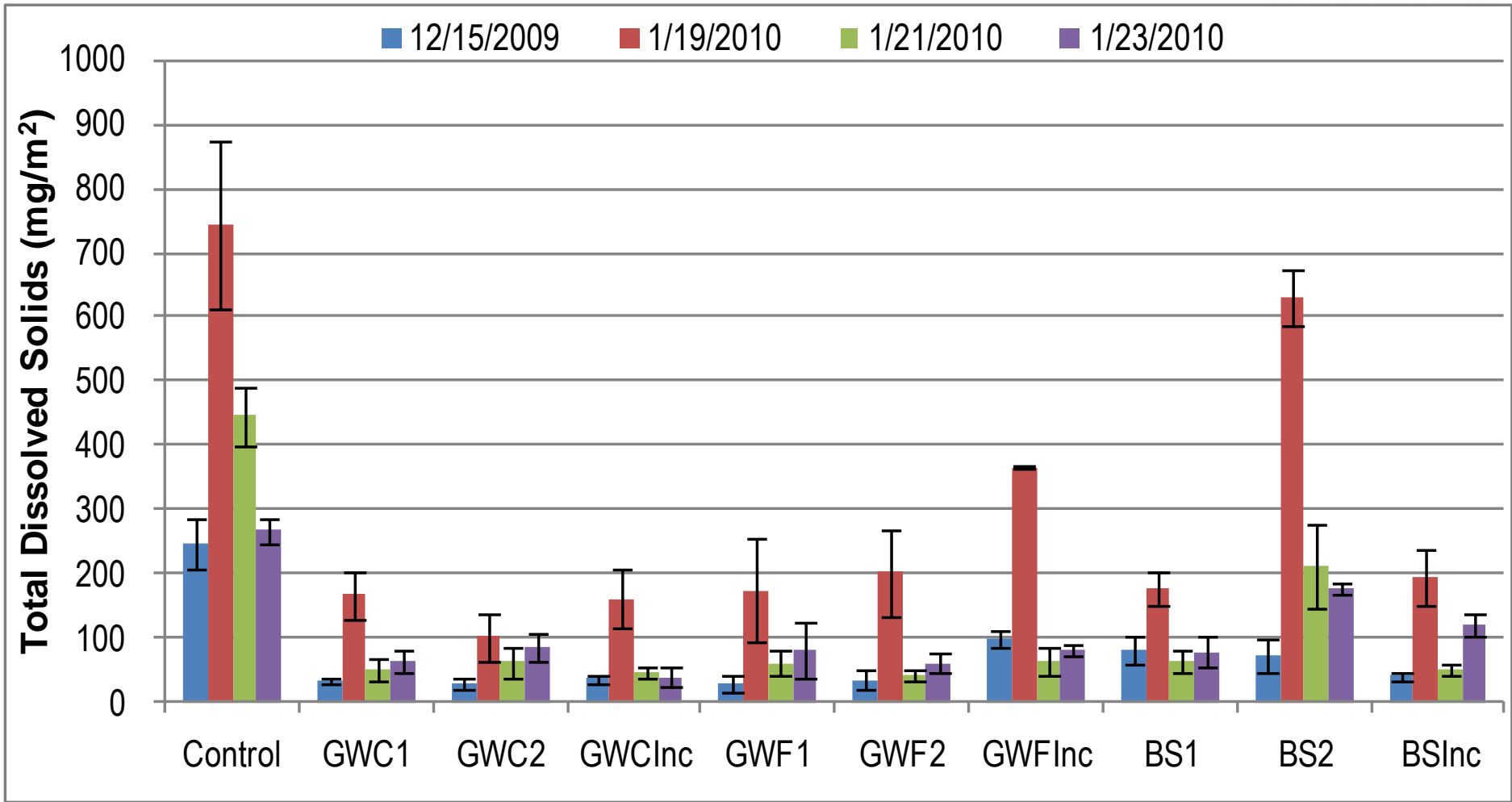


# Total Dissolved Solids



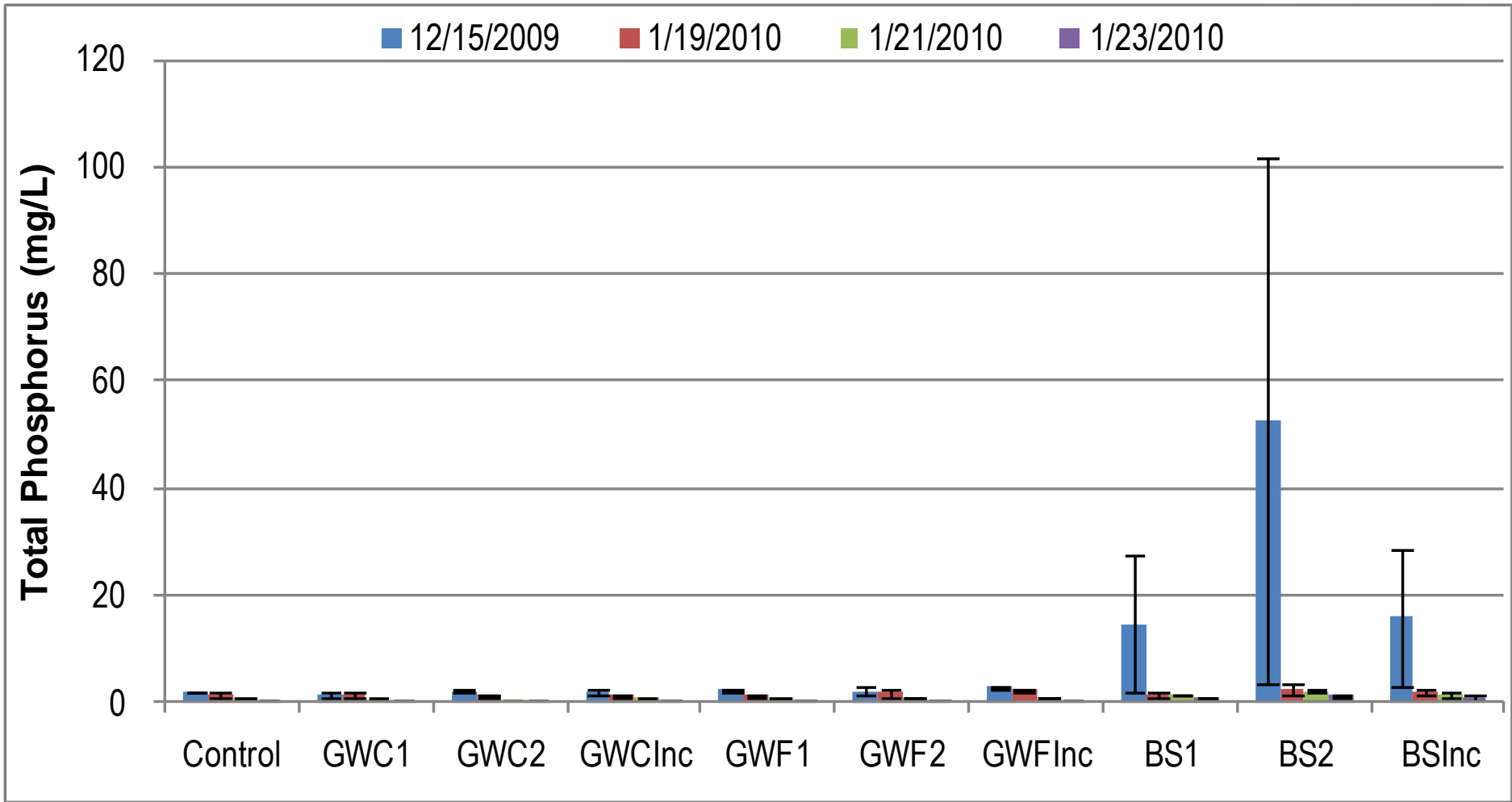


# Total Dissolved Solids



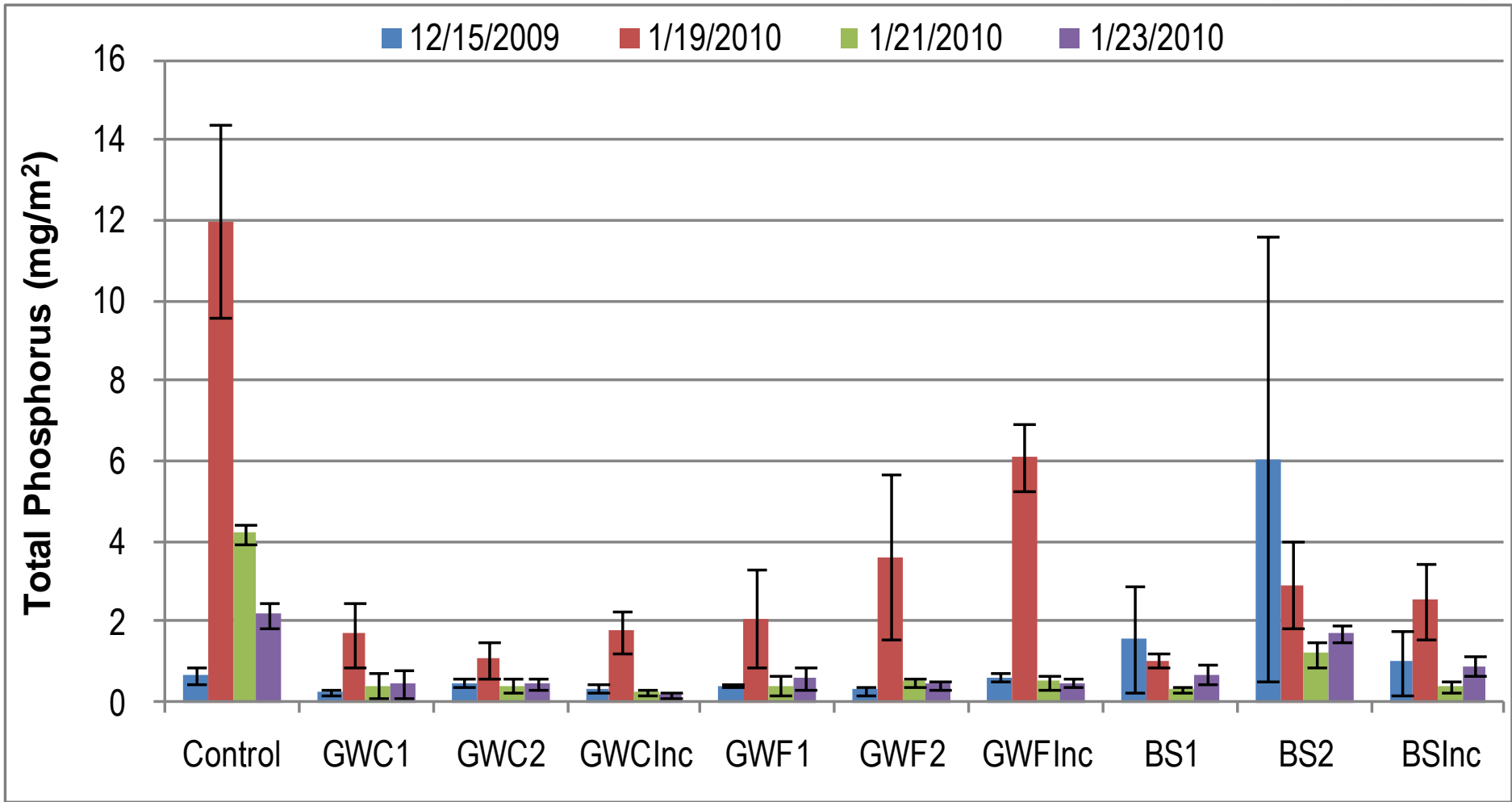


# Total Dissolved Phosphorus



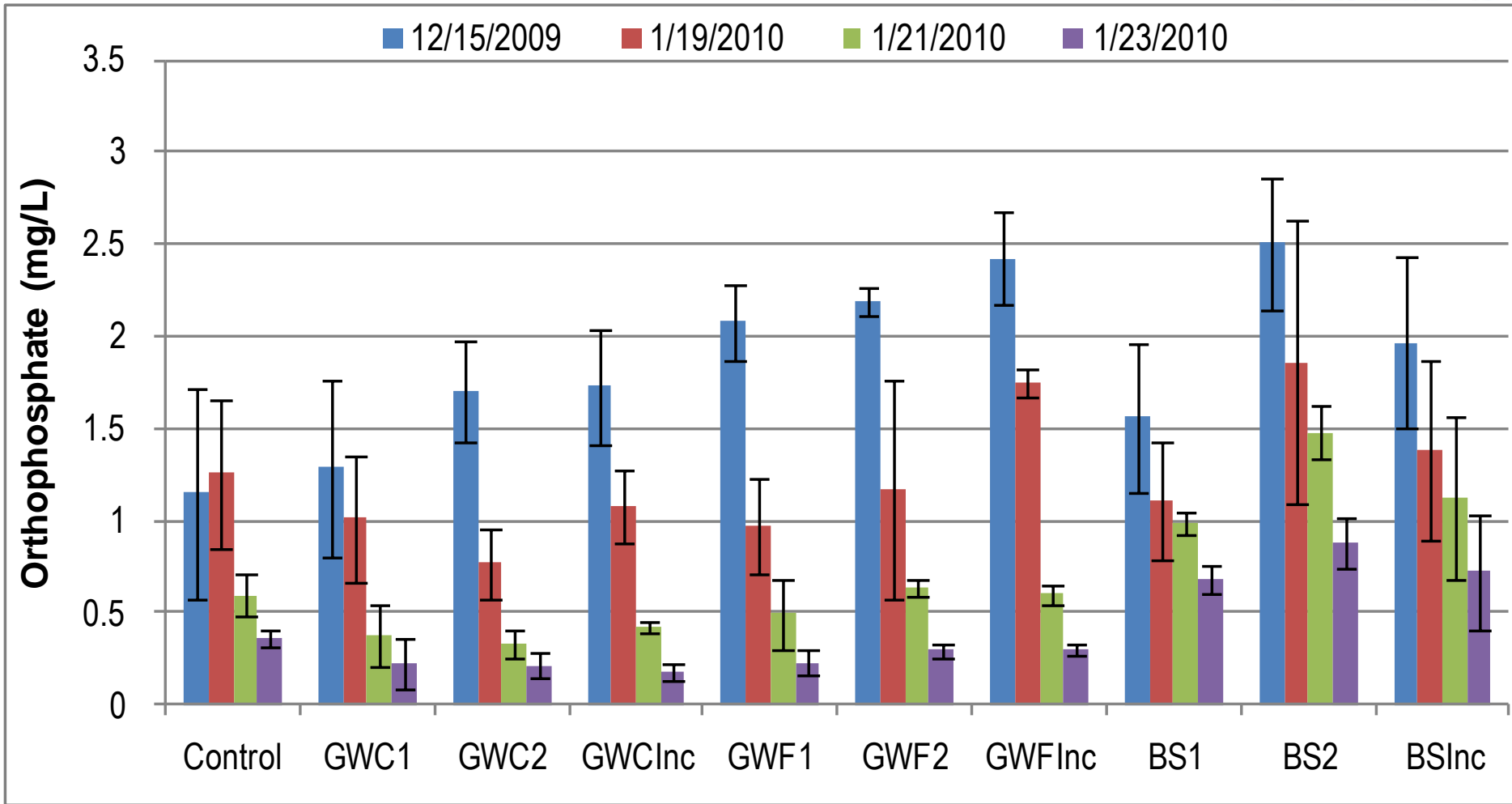


# Total Dissolved Phosphorus



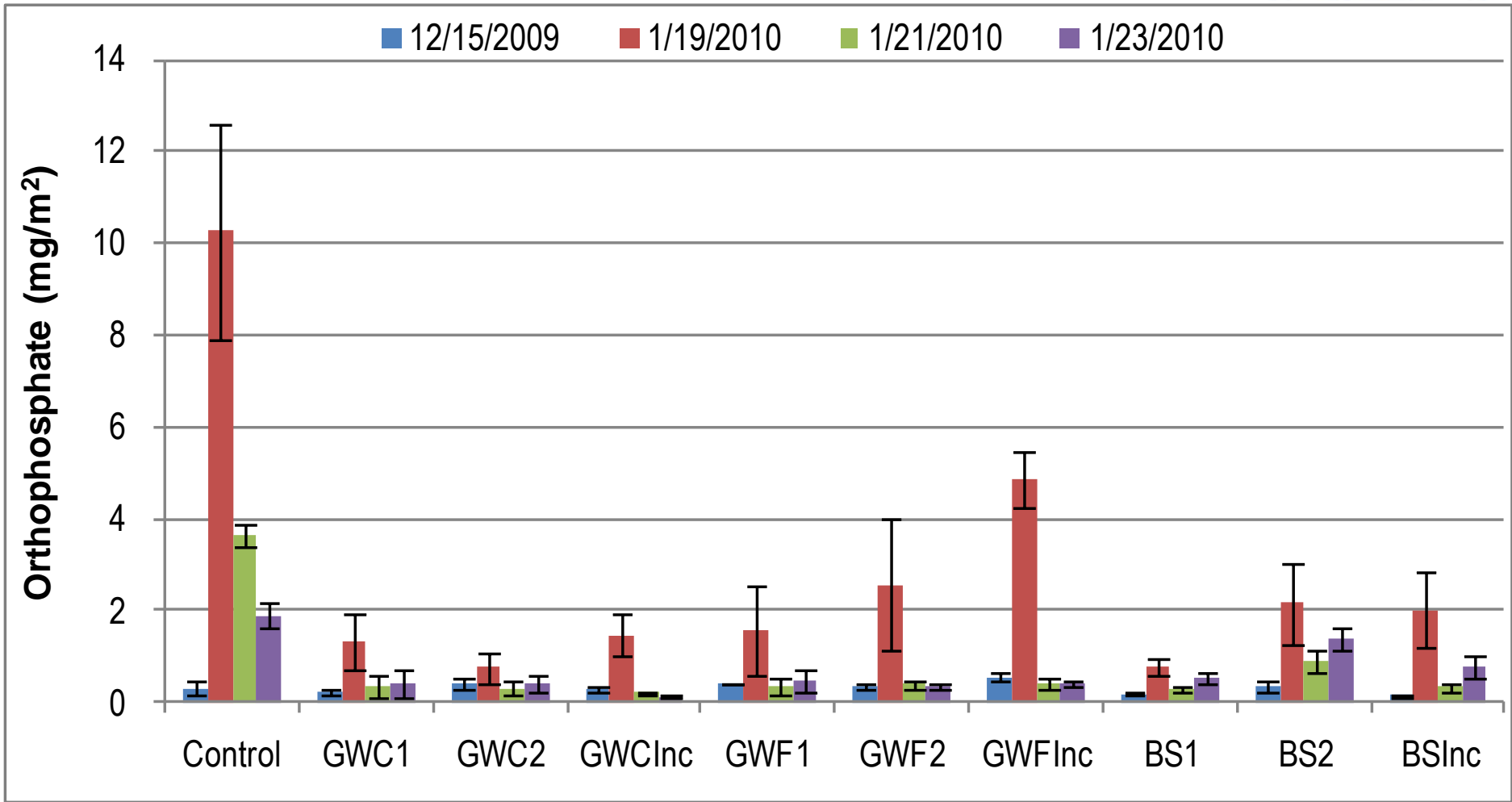


# Orthophosphate



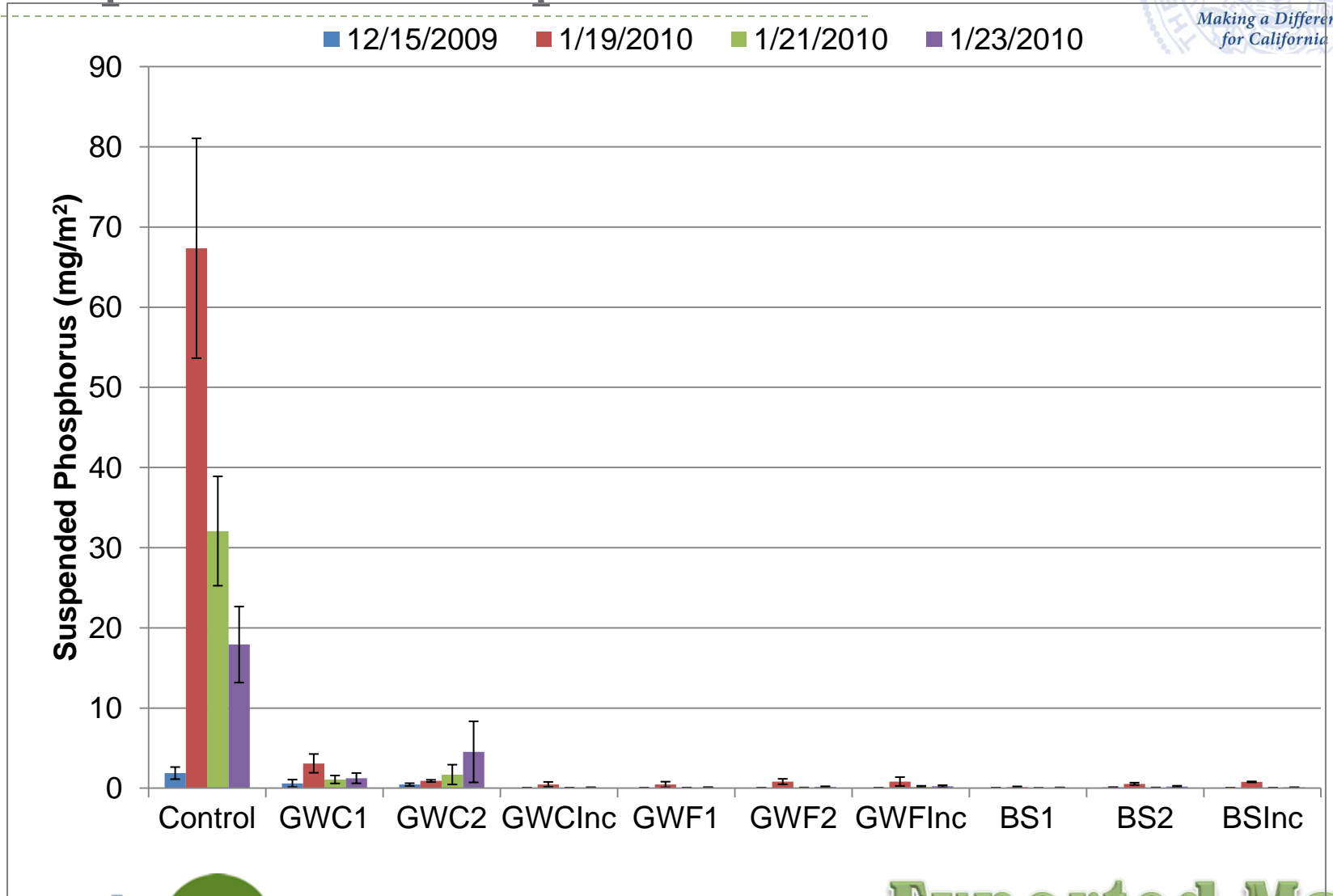


# Orthophosphate





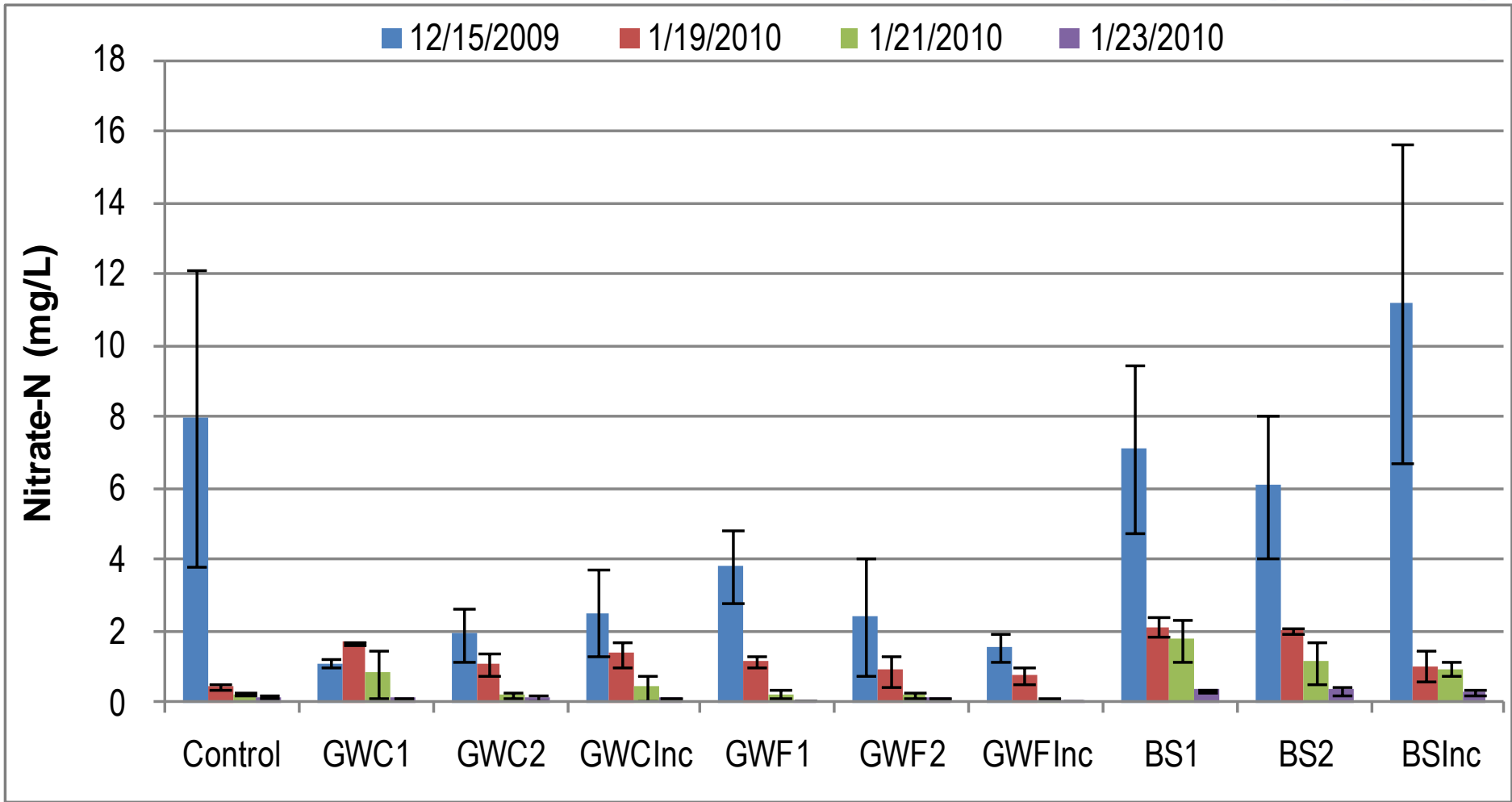
# Suspended Phosphorus





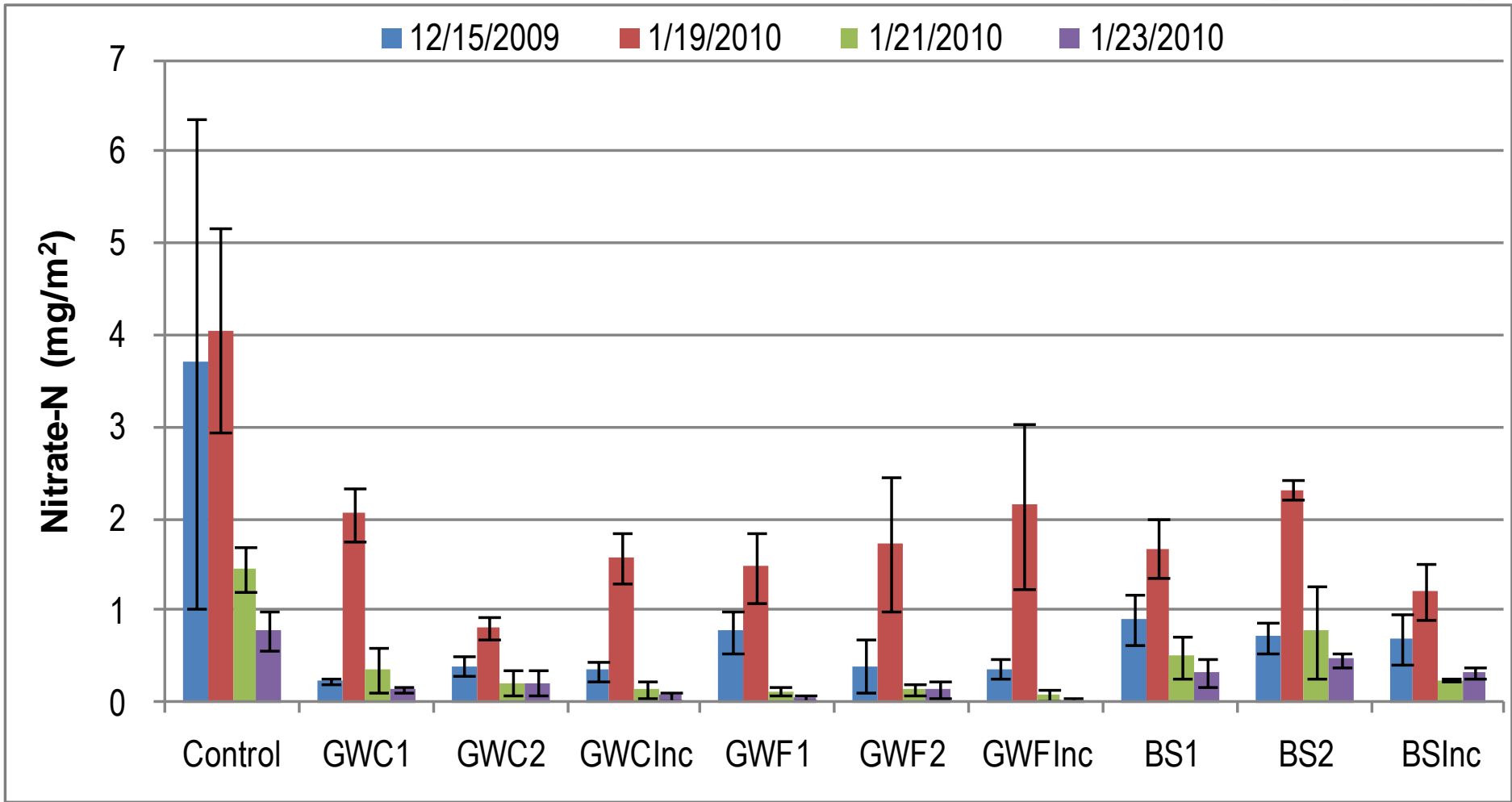


# Nitrate-nitrogen



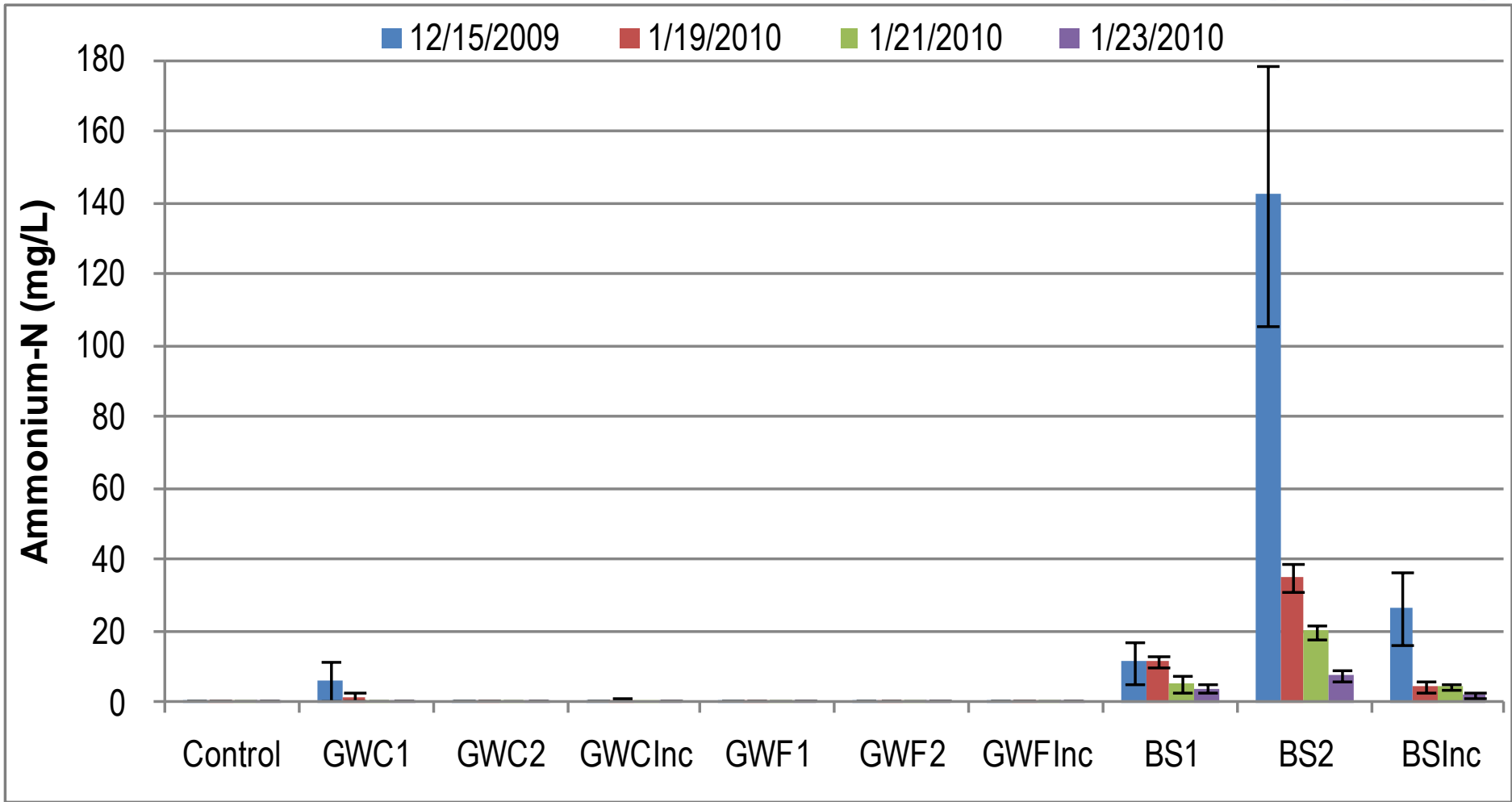


# Nitrate-nitrogen



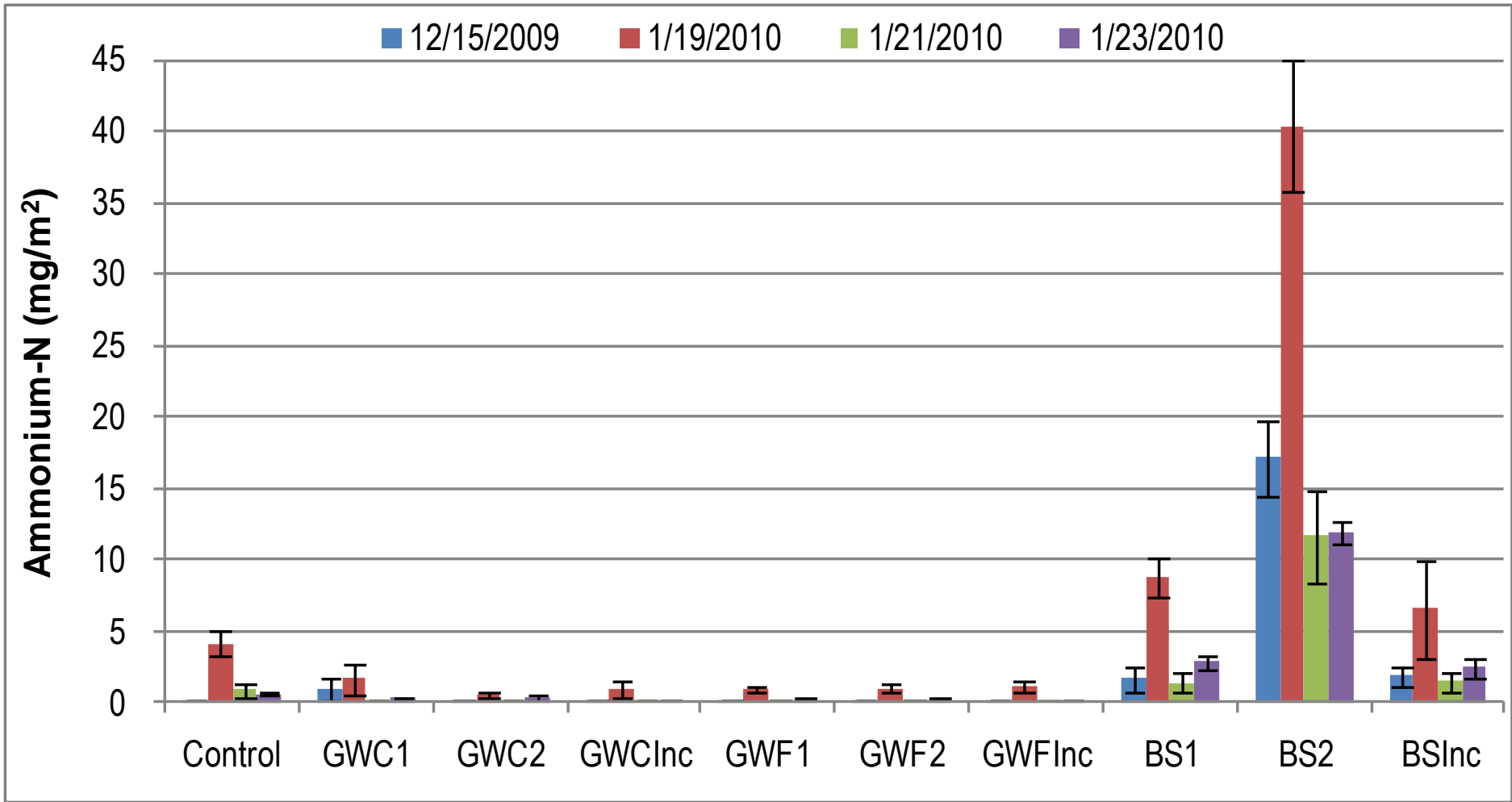


# Ammonium-nitrogen





# Ammonium-nitrogen





# Dissolved Metals

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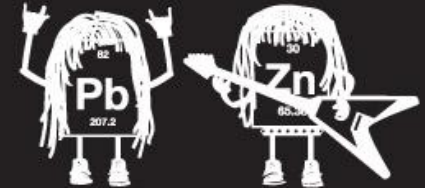
- ▶ Lead, and mercury were not detected during the study.
- ▶ Arsenic and selenium were detected rarely.
- ▶ Copper, molybdenum, nickel, and zinc were all present, though at low levels.
- ▶ Cadmium and chromium were initially present, though not always observed, particularly in runoff from the biosolids co-compost mulch plots.
- ▶ By the last two storms, concentrations were generally below detection limits, although BS2, with its higher sediment losses, did register more detectable values.
- ▶ As expected, biosolids co-composts yielded more metals than either of the greenwaste composts.



# Adsorbed Metals

- ▶ Arsenic, selenium, and molybdenum were not detected.
- ▶ Cadmium was present at low levels, higher in the two biosolids compost treatments.
  - ▶ No comparison with control possible
- ▶ Chromium, copper, lead, nickel, and zinc were all significantly higher in suspended sediments from the control treatments

HEAVY METALS



Exported Mass



# Conclusions

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- ▶ Compost mulches effectively reduce runoff pollution
- ▶ Runoff is reduced
  - ▶ Absorb water
  - ▶ Protect the soil
  - ▶ Promote infiltration
- ▶ Mass loads of pollutants are greatly reduced
- ▶ 1 inch was as effective as 2 inches and retained more pollutants
- ▶ Incorporation is unnecessary



# Construction

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Photo: Simon Wong Engineering





# Seed Mixes

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## ▶ Seed Mix 1

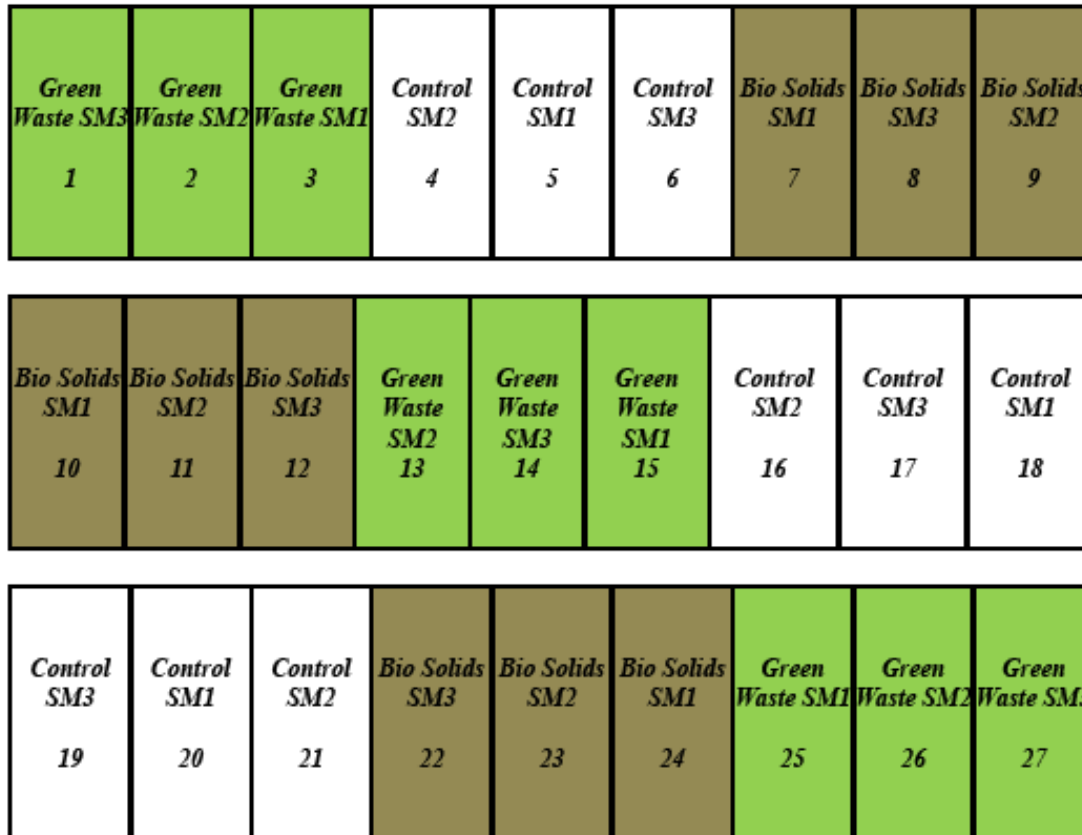
- ▶ *Bromus carinatus* "Cucamonga" (Cucamonga Brome)
- ▶ *Trifolium tridentatum* (Tomcat Clover)
- ▶ *Vulpia microstachys* (Small Fescue)

## ▶ Seed Mix 2

- ▶ *Artemisia californica* (California Sagebrush)
- ▶ *Atriplex canescens* (Four-wing Saltbrush)
- ▶ *Baccharis sarothroides* (Broom Baccharis)
- ▶ *Encelia actonii* (Acton Bush Encelia)
- ▶ *Eriogonum fasciculatum* (Hairy Yerba Santa)
- ▶ *Eriogonum fasciculatum* (California Buckwheat)
- ▶ *Eriophyllum confertiflorum* (Golden Yarrow)
- ▶ *Eschscholzia californica* (California Poppy)
- ▶ *Isomeris arborea* (Bladderpod)
- ▶ *Lasthenia glabrata* (Goldfields)
- ▶ *Lotus scoparius* (Deerweed)
- ▶ *Lupinus succulentus* (Arroyo Lupine)
- ▶ *Salvia apiana* (White Sage)
- ▶ *Salvia mellifera* (Black Sage)
- ▶ *Vulpia microstachys* (Small Fescue)



# Split-Plot Design Layout



## Materials

- ▶ Greenwaste compost
- ▶ Biosolids compost
- ▶ No compost

## Rates

- ▶ 1 inch
- ▶ 2 inches
- ▶ 2 inches incorporated

SM1- Seed Mix type-1  
SM2- Seed Mix type-2  
SM3- Seed Mix type-3 (no actual seed mix)

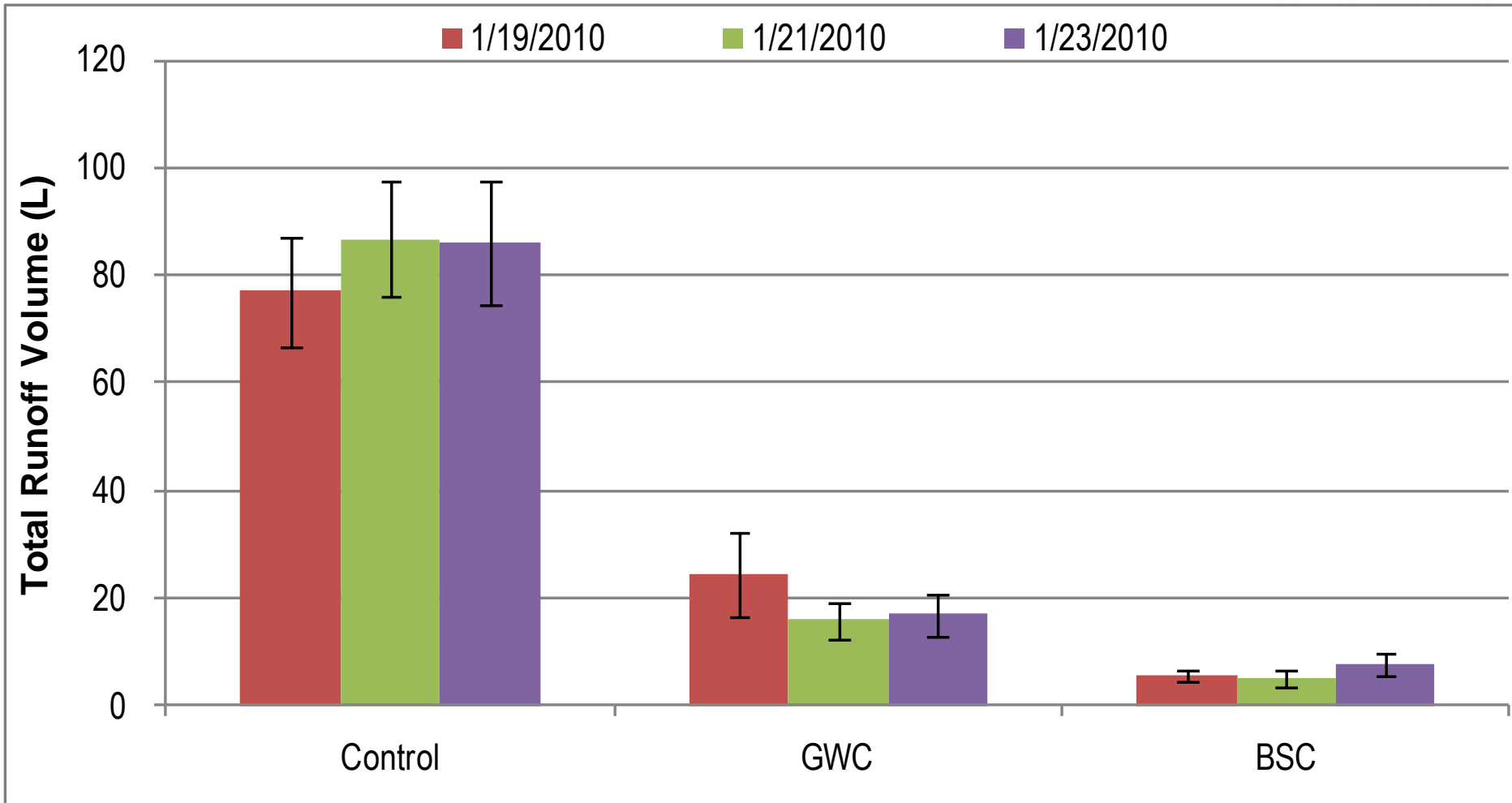
4:1 slope

SM1 Seeded at 64 lb/acre

SM2 Seeded at 92 lb/acre

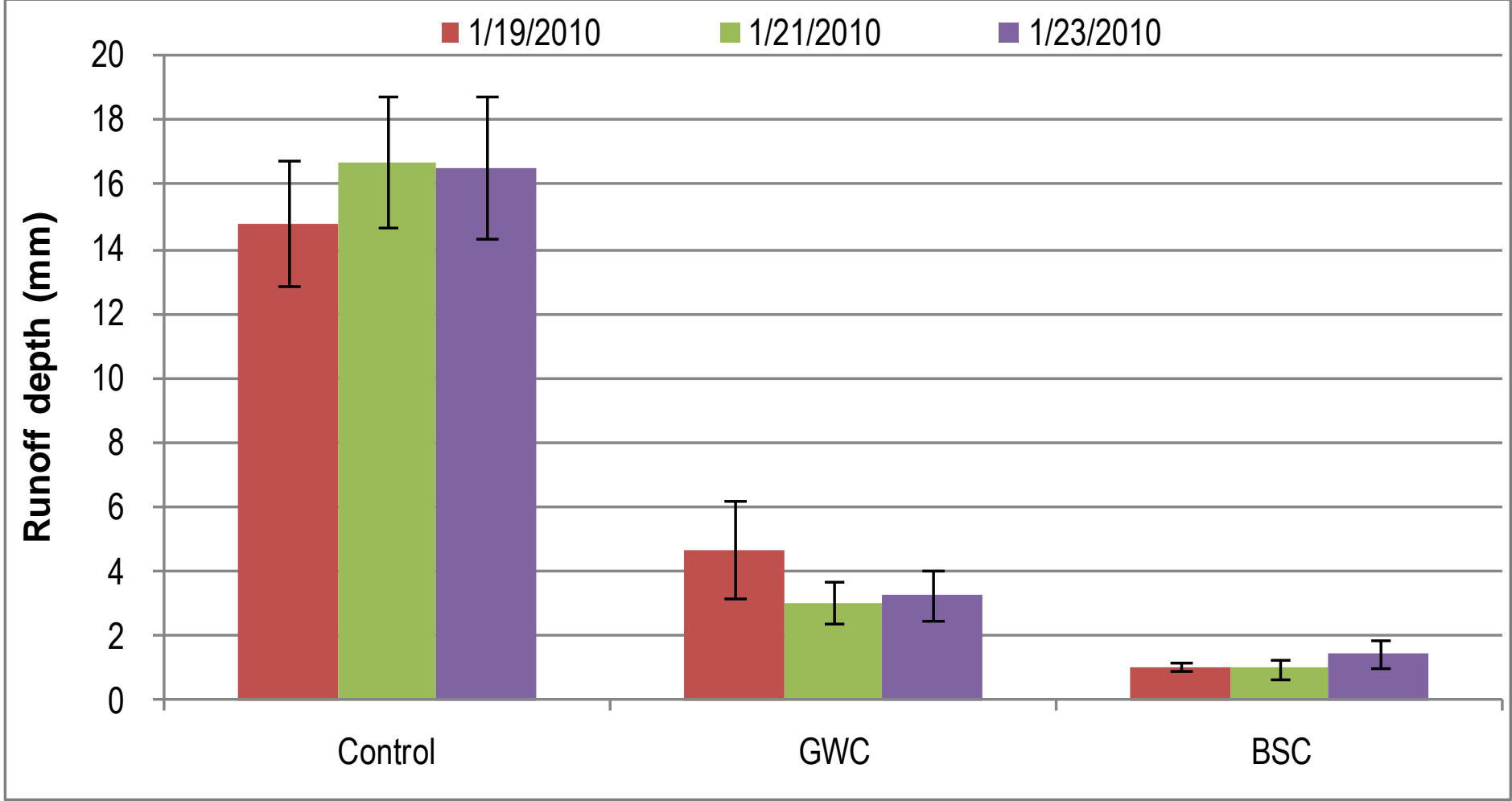


# Total Runoff Volume



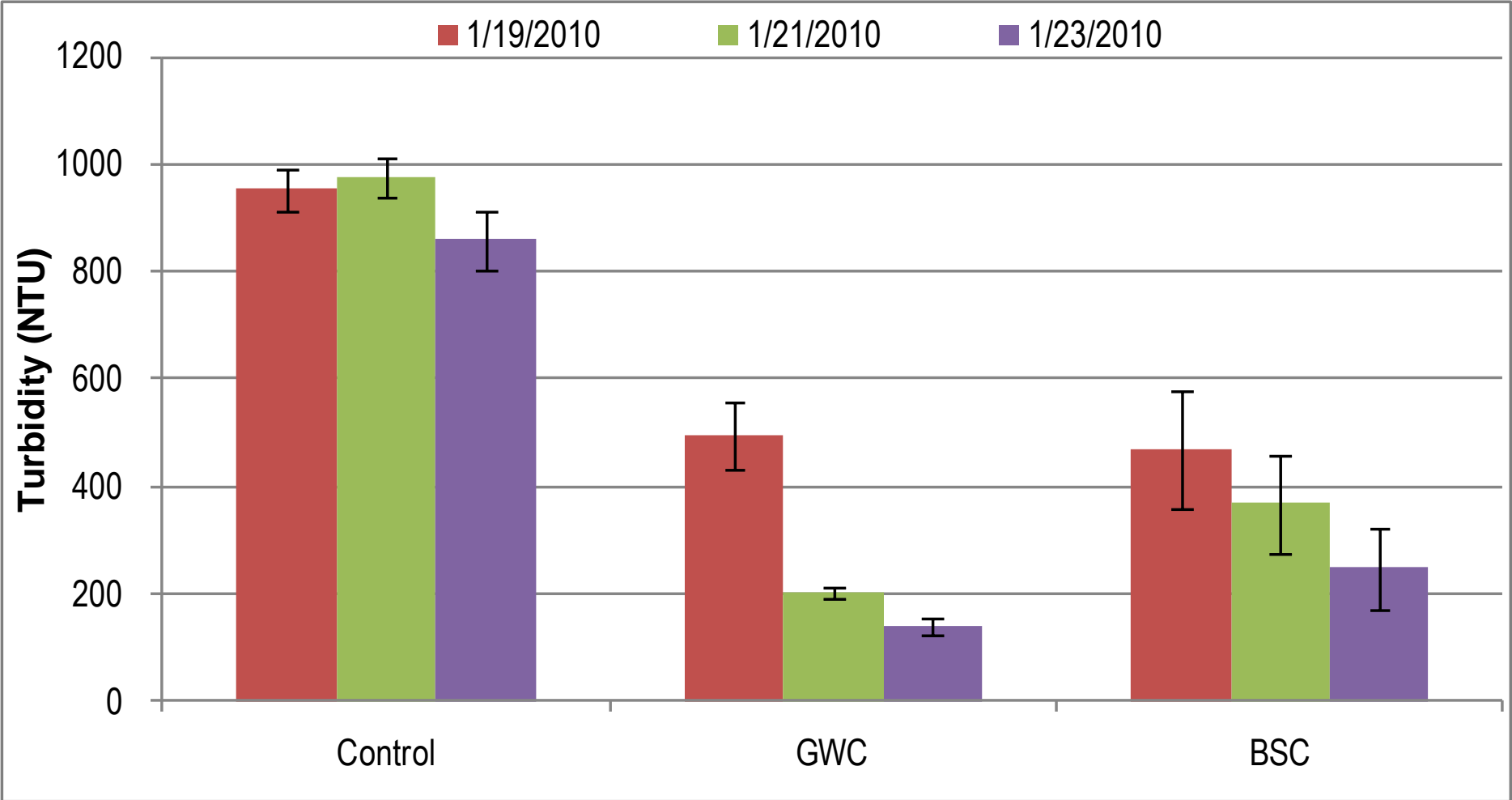


# Total Runoff Depth



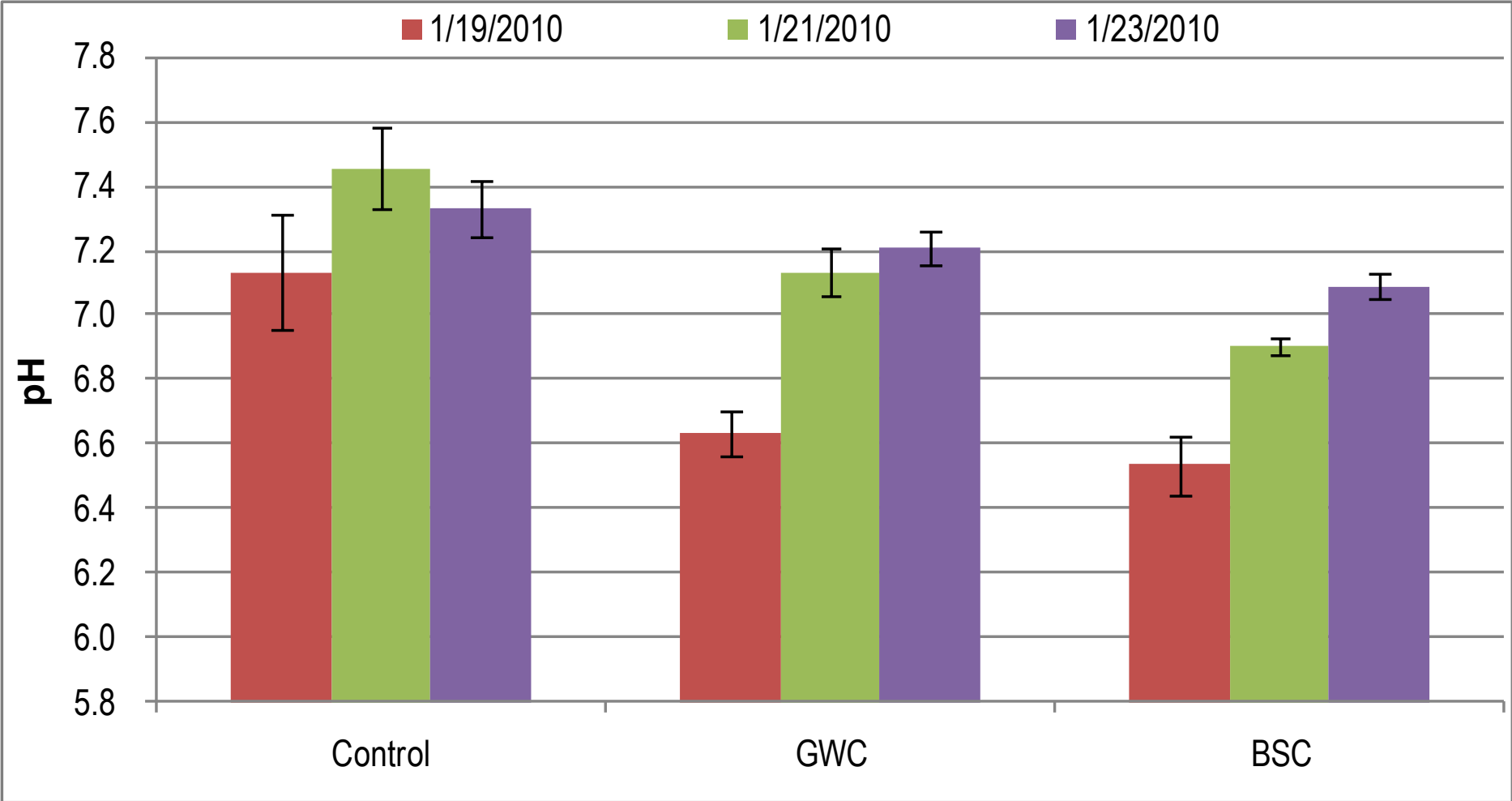


# Turbidity



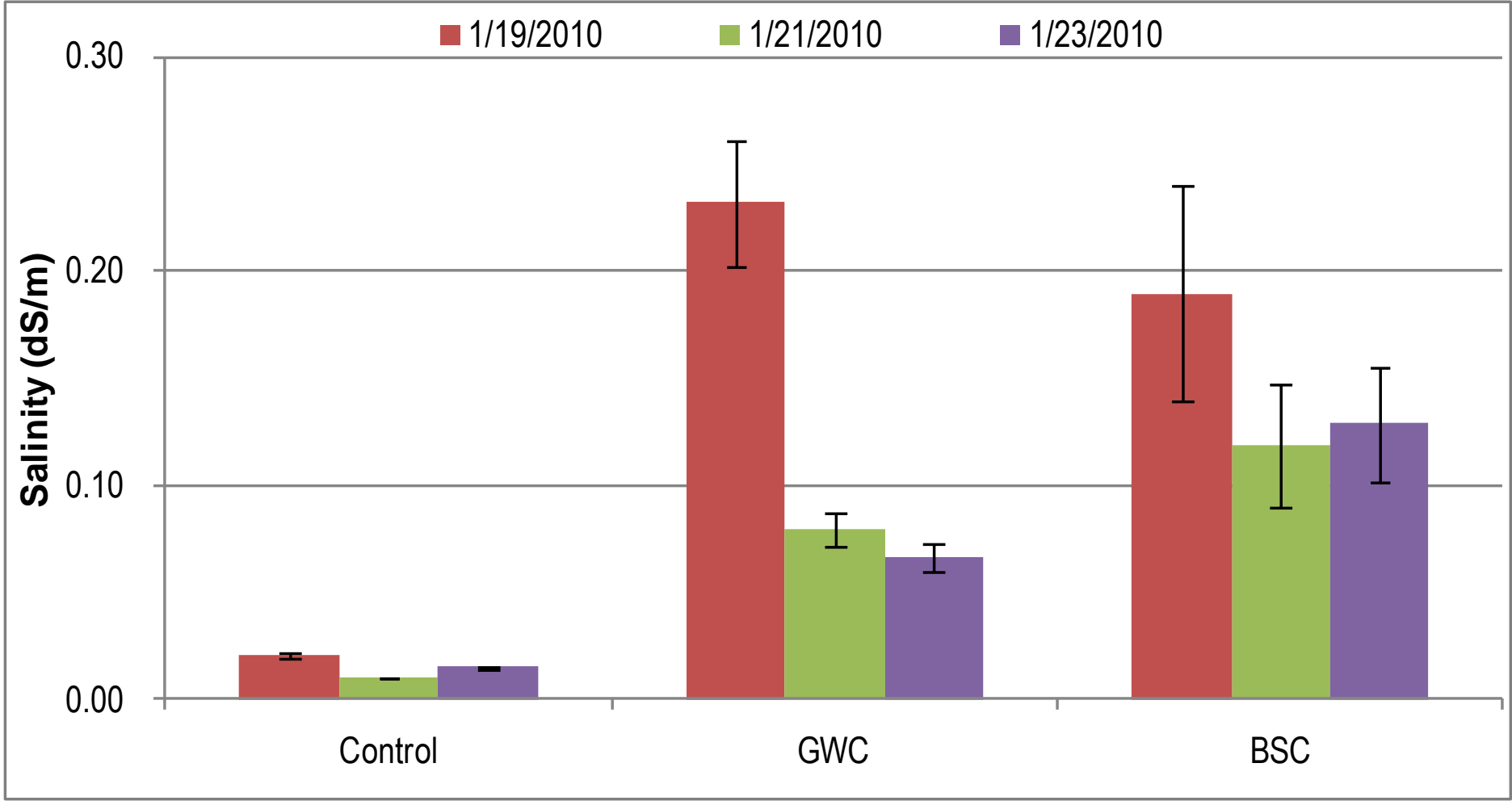


# pH



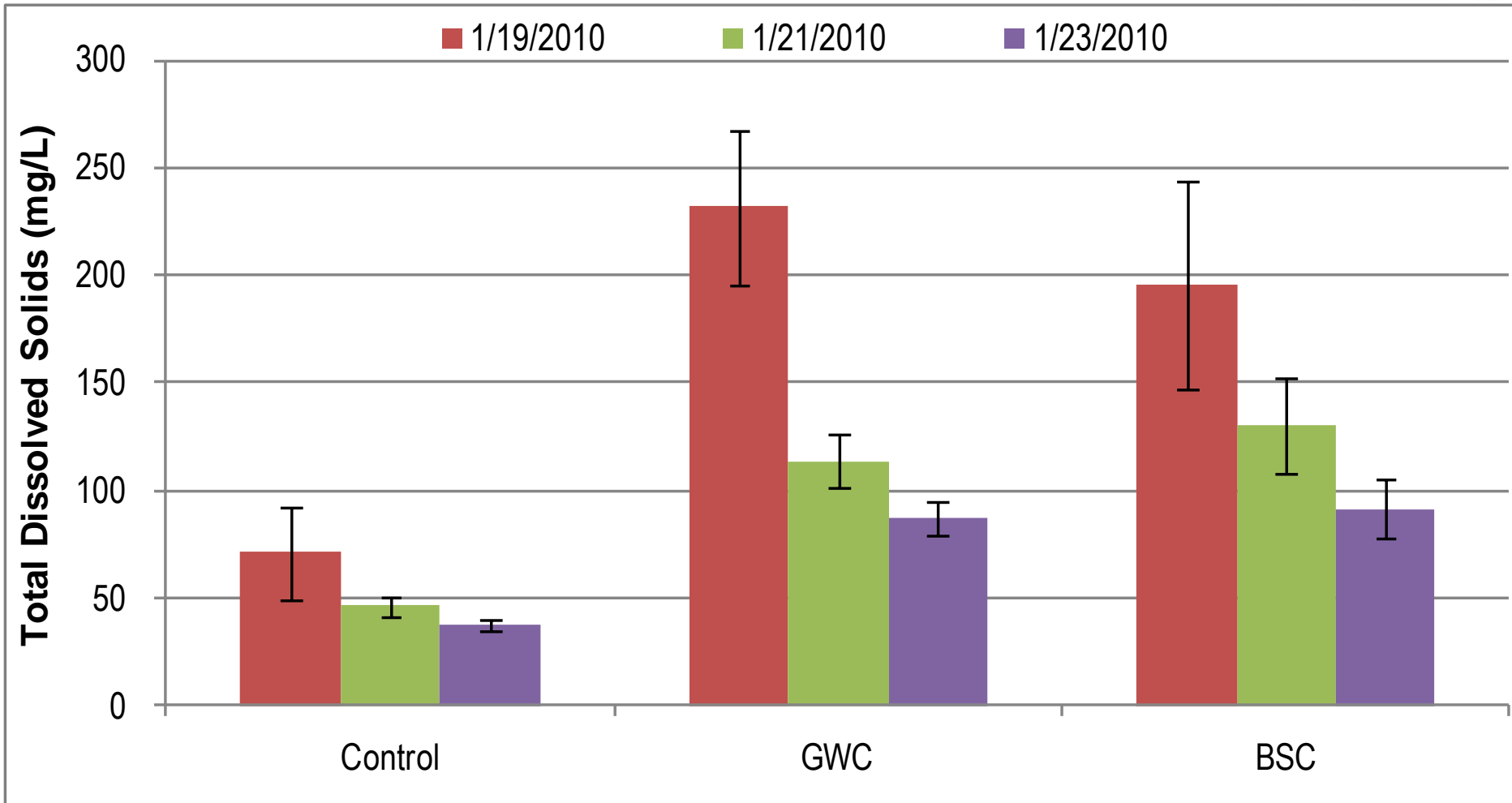


# Salinity





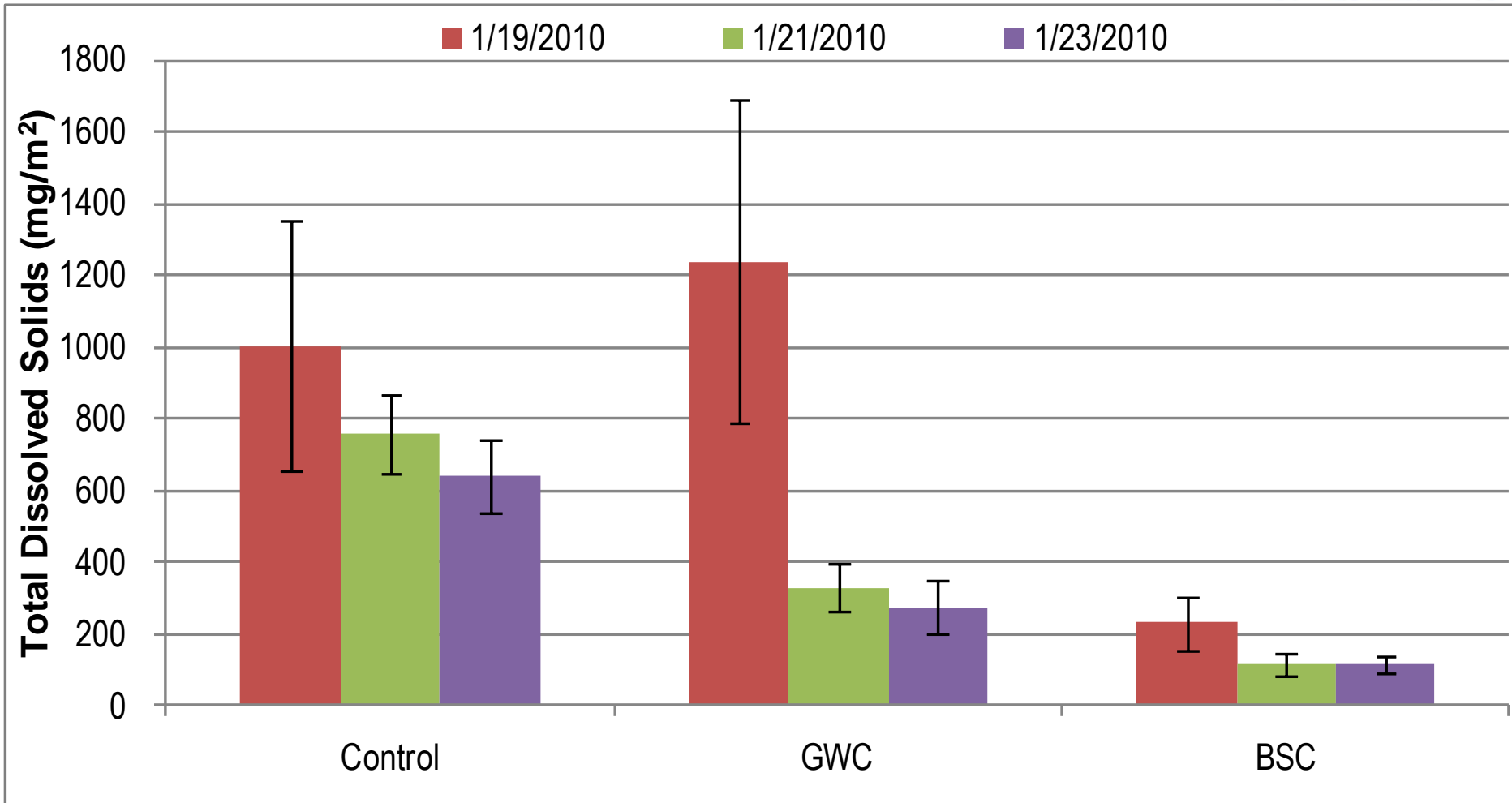
# Total Dissolved Solids





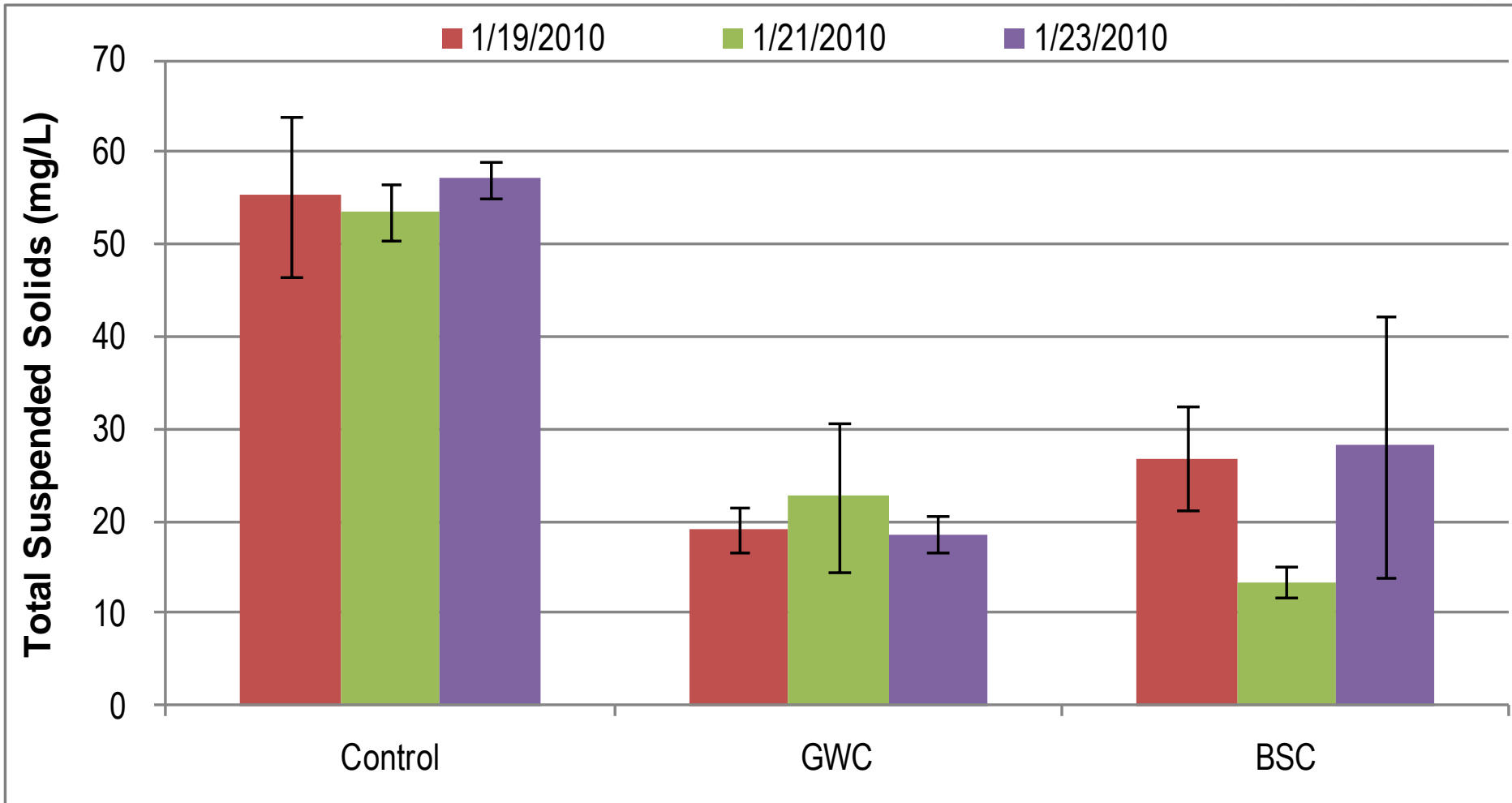


# Total Dissolved Solids



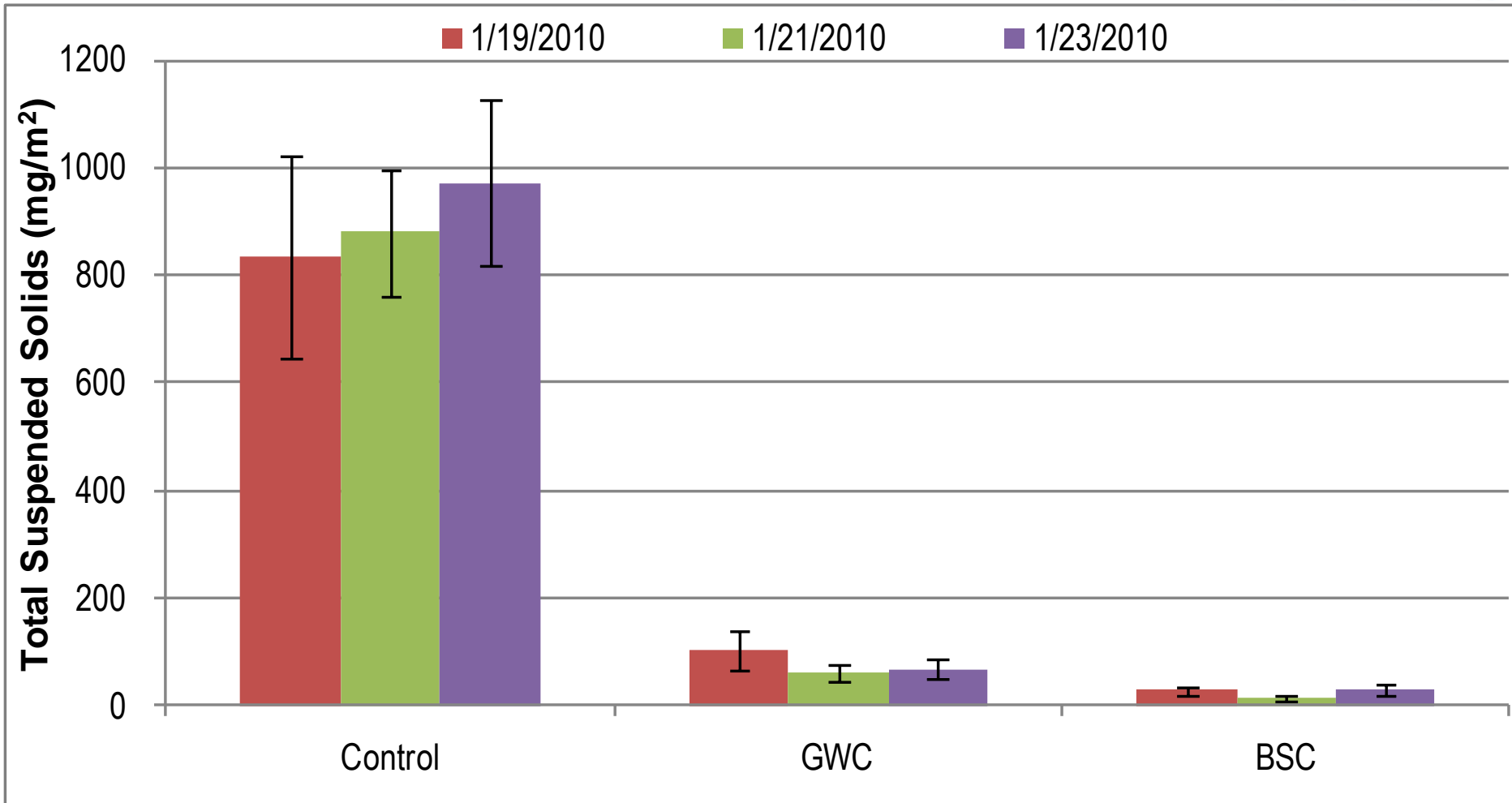


# Total Suspended Solids



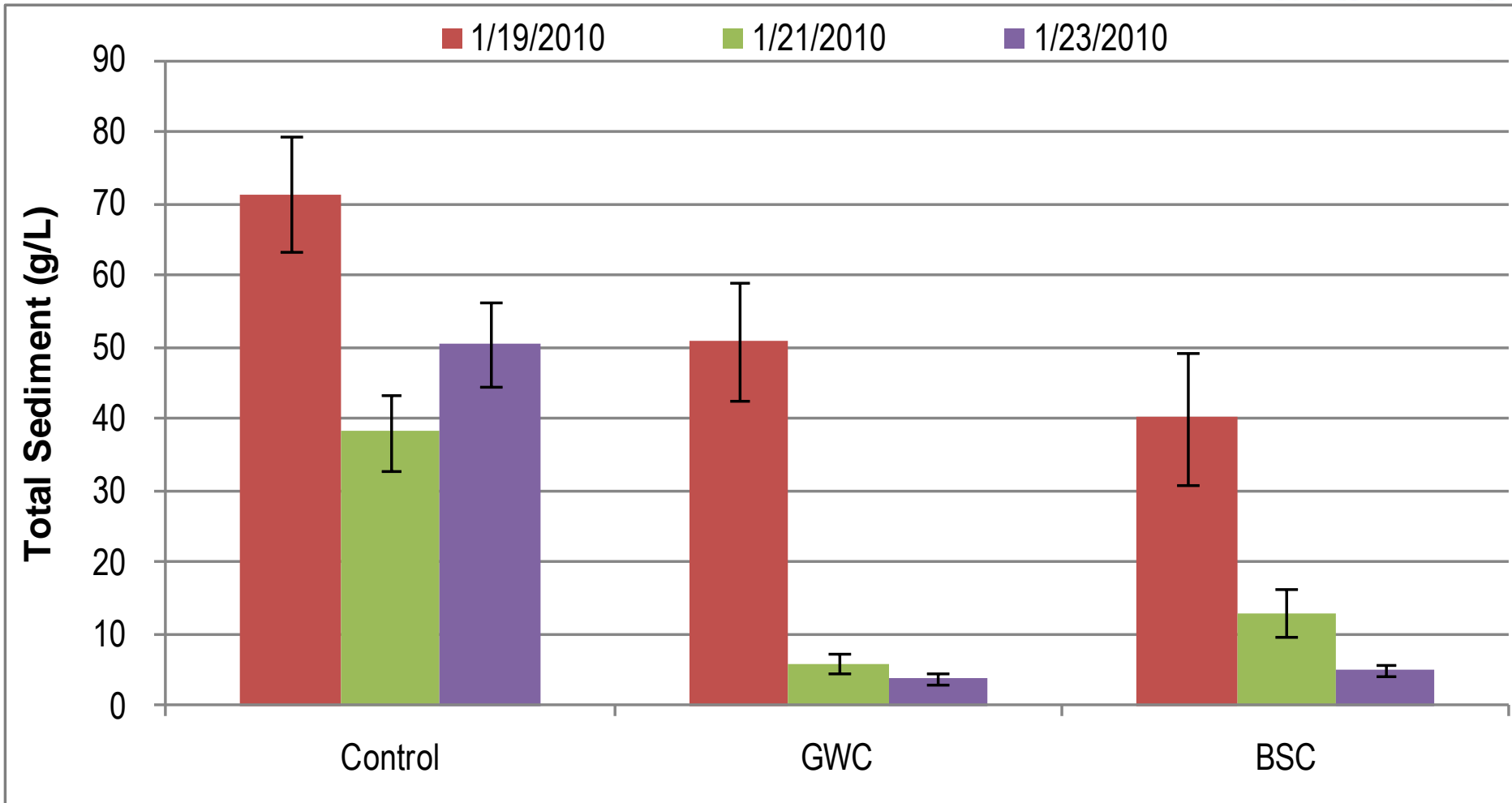


# Total Suspended Solids



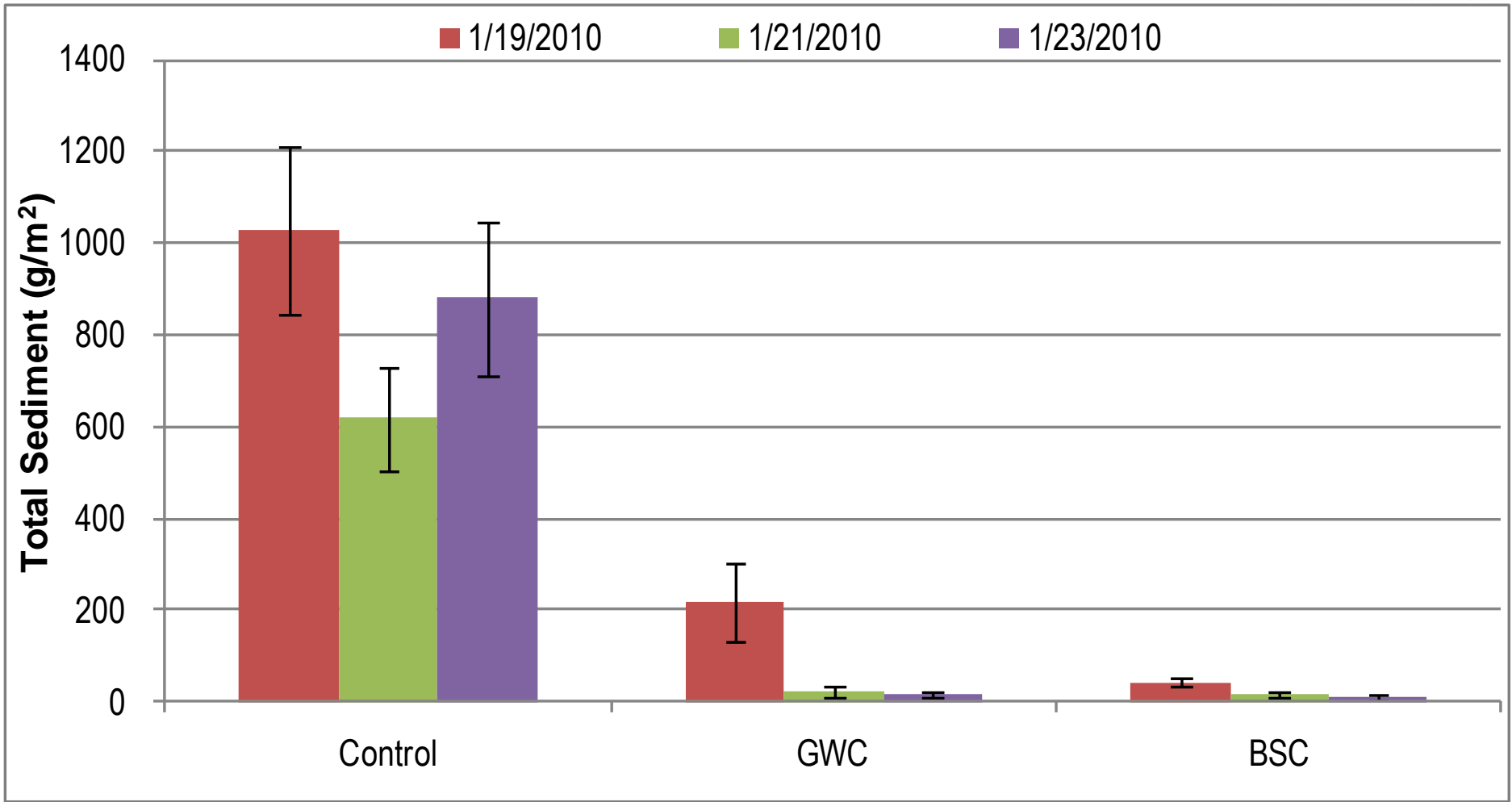


# Total Solids



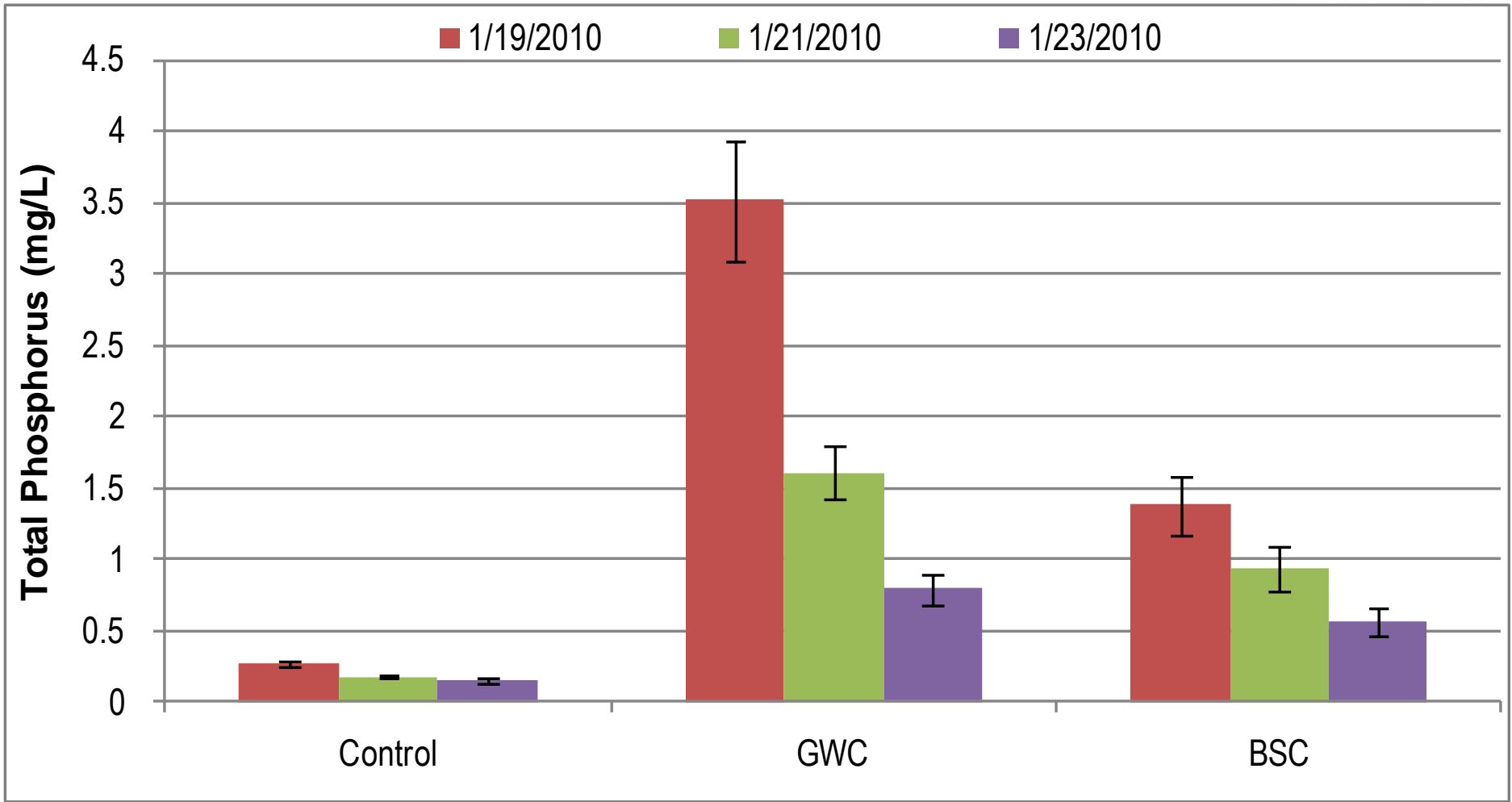


# Total Solids



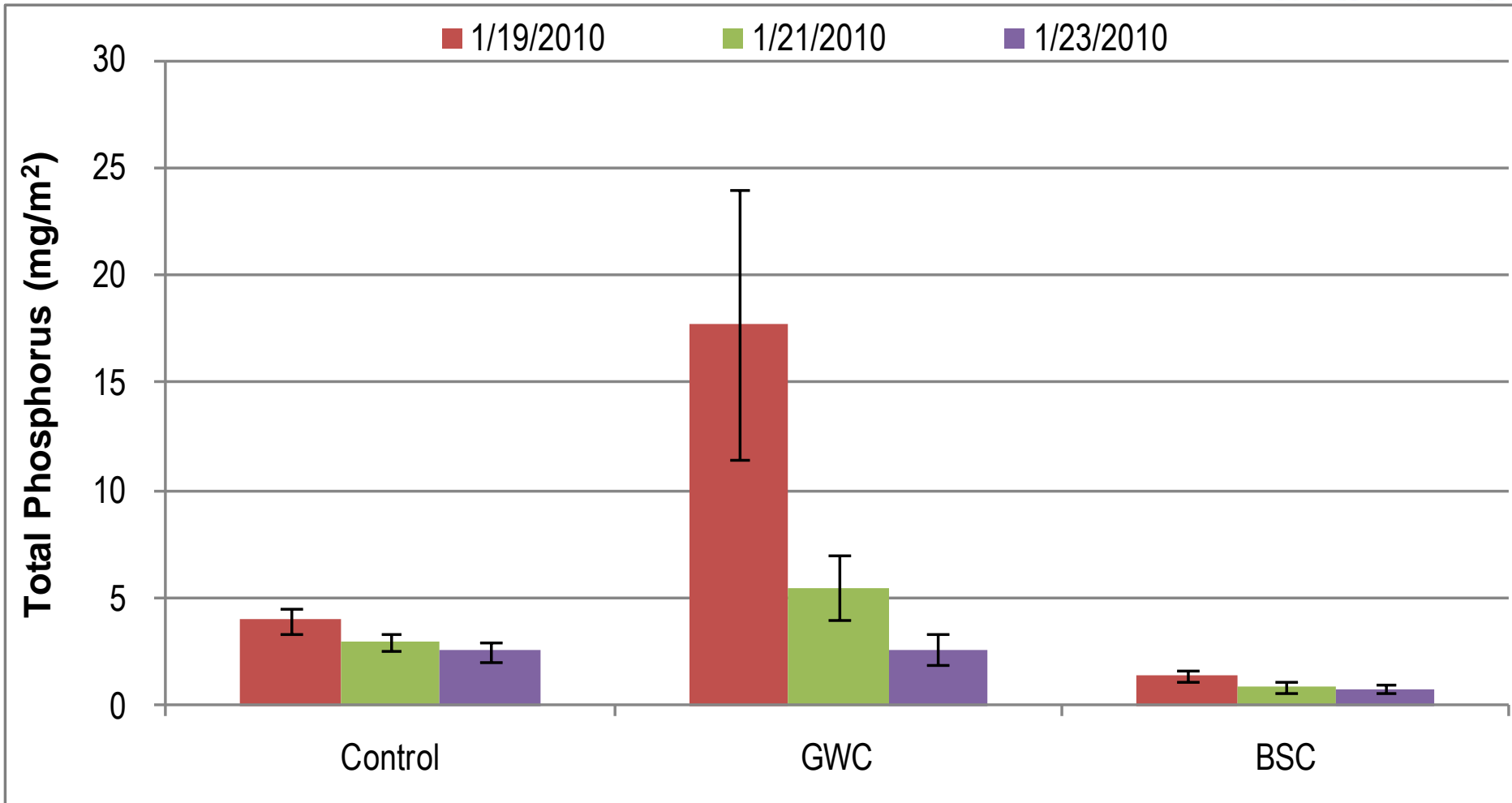


# Total Phosphorus



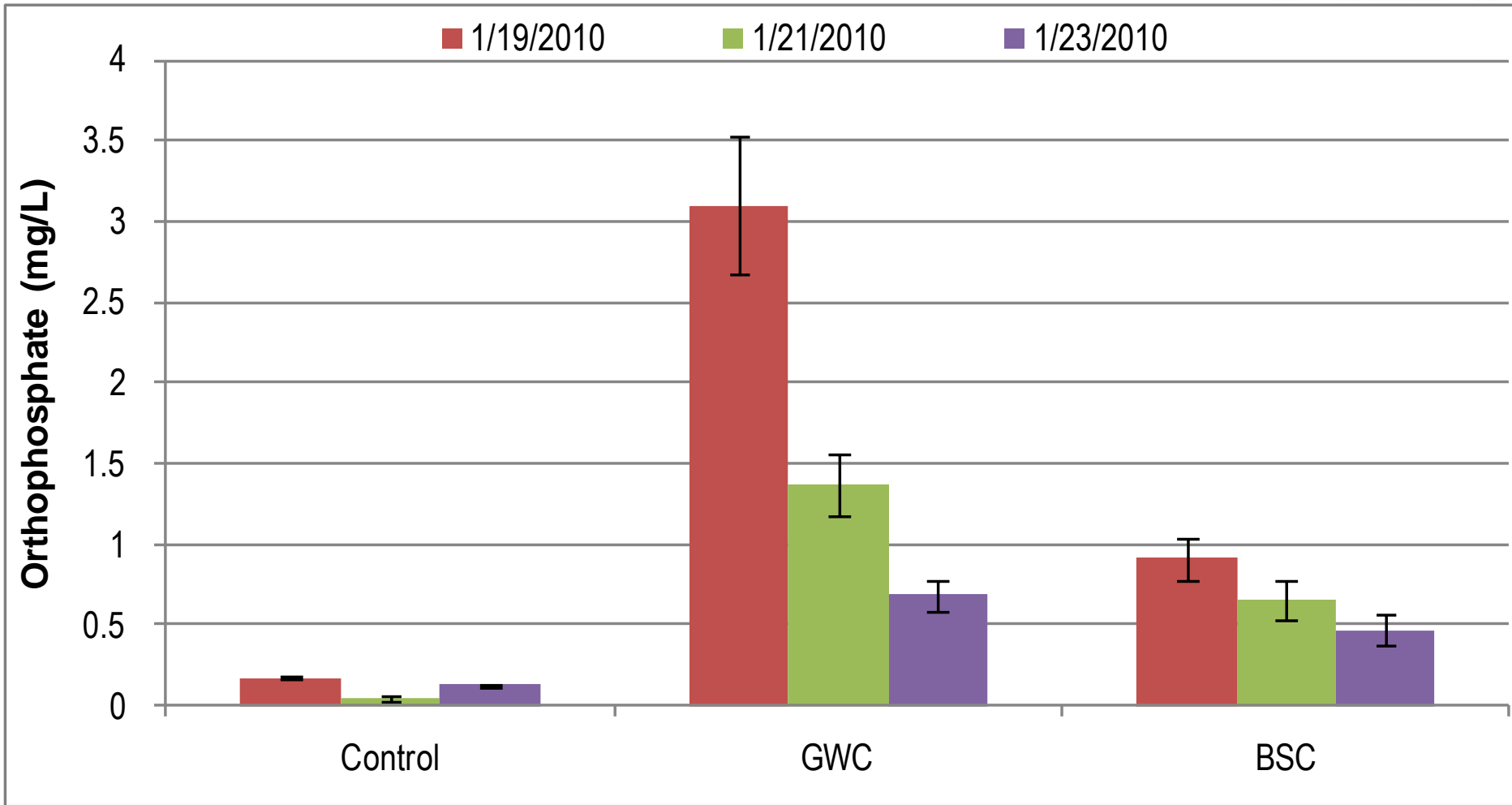


# Total Phosphorus





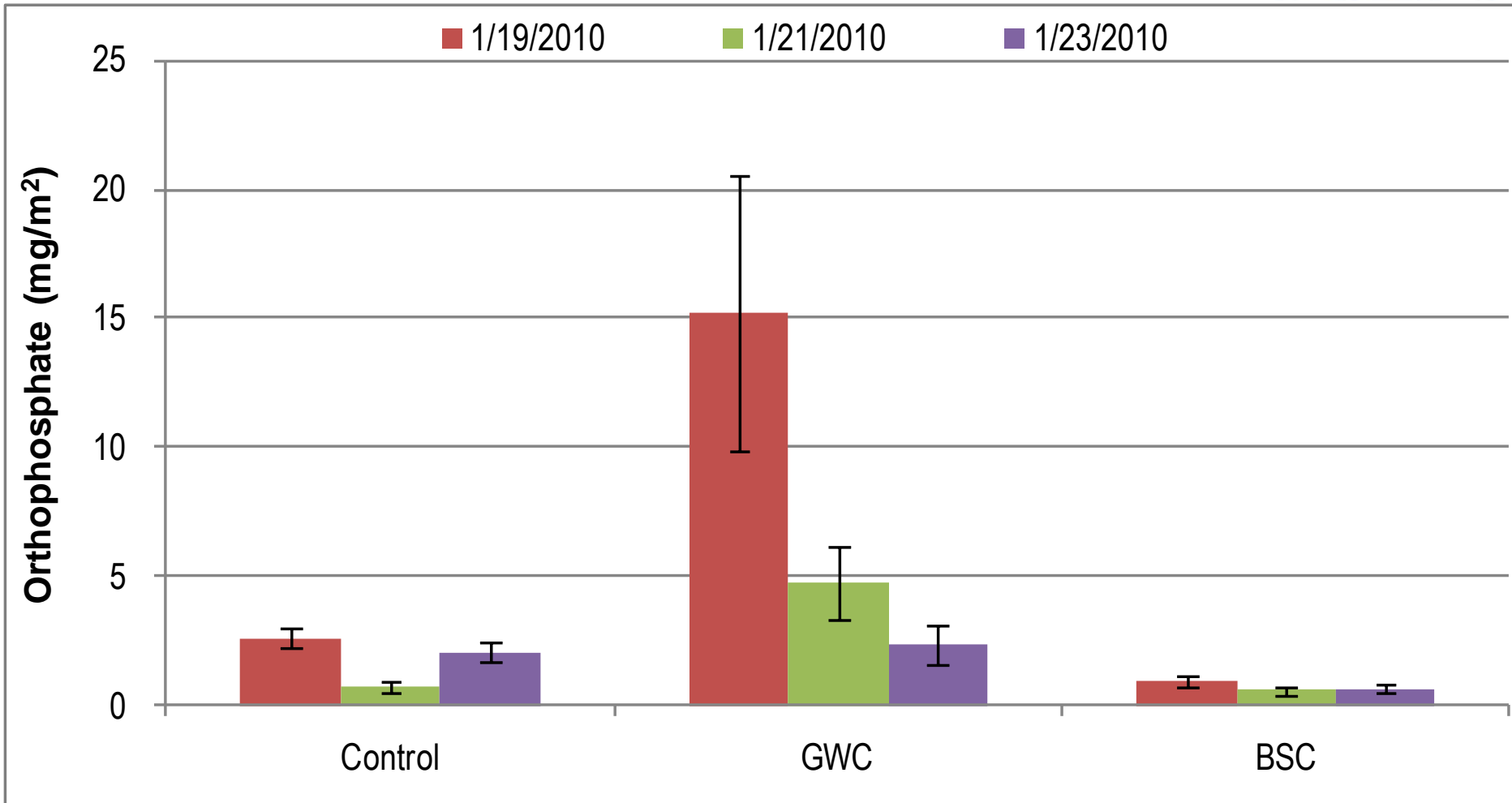
# Orthophosphate





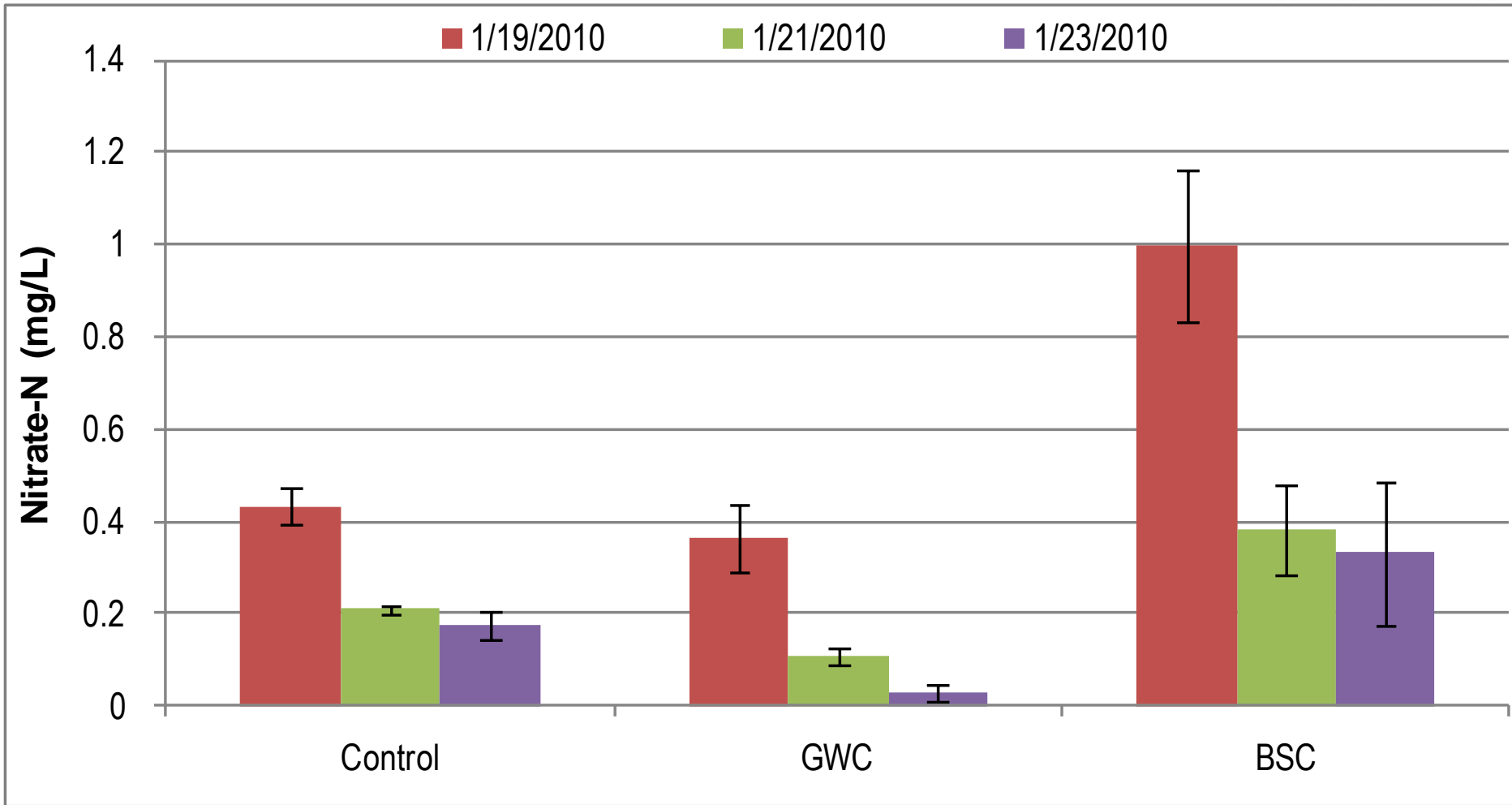


# Orthophosphate



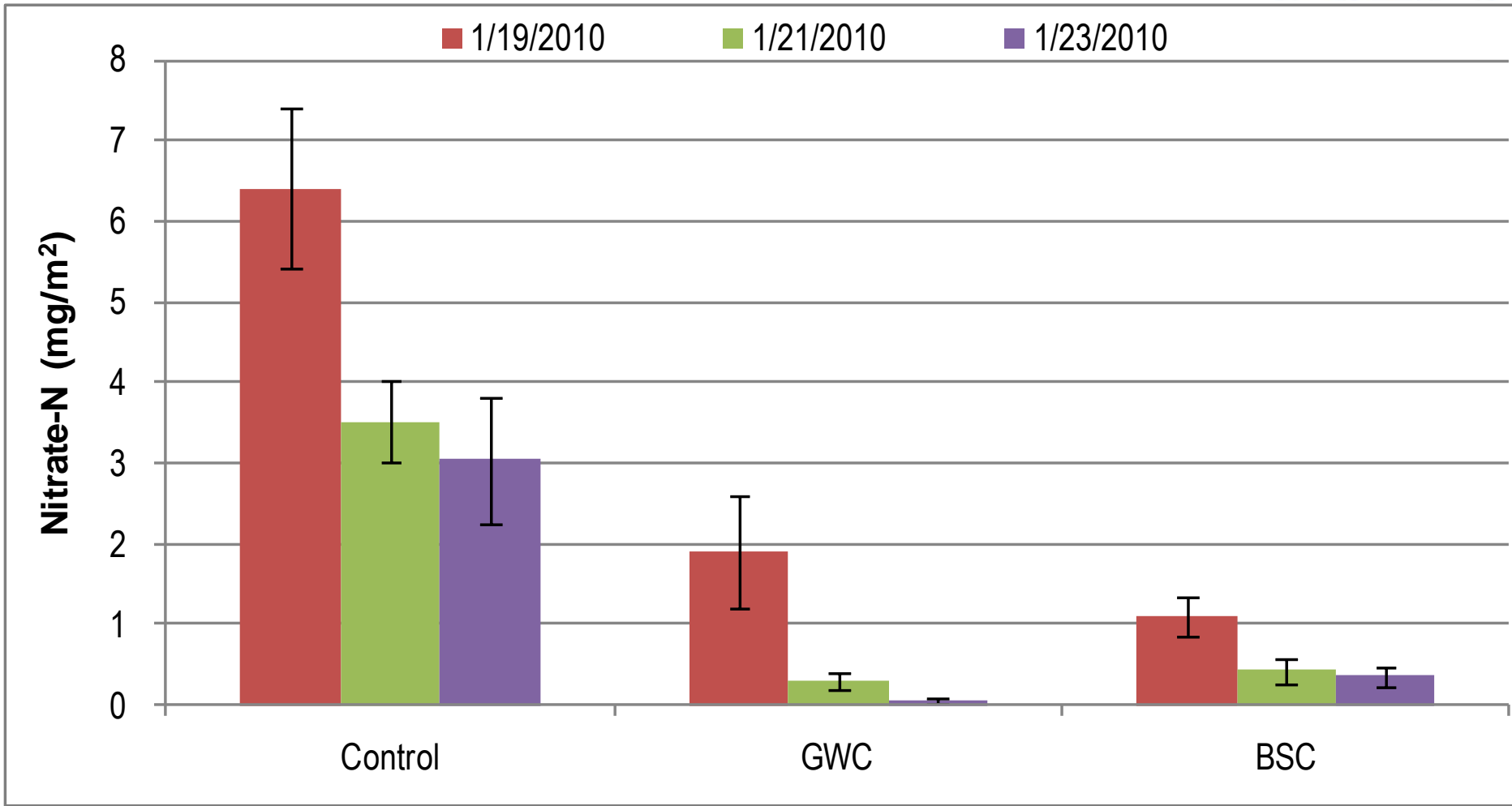


# Nitrate-nitrogen



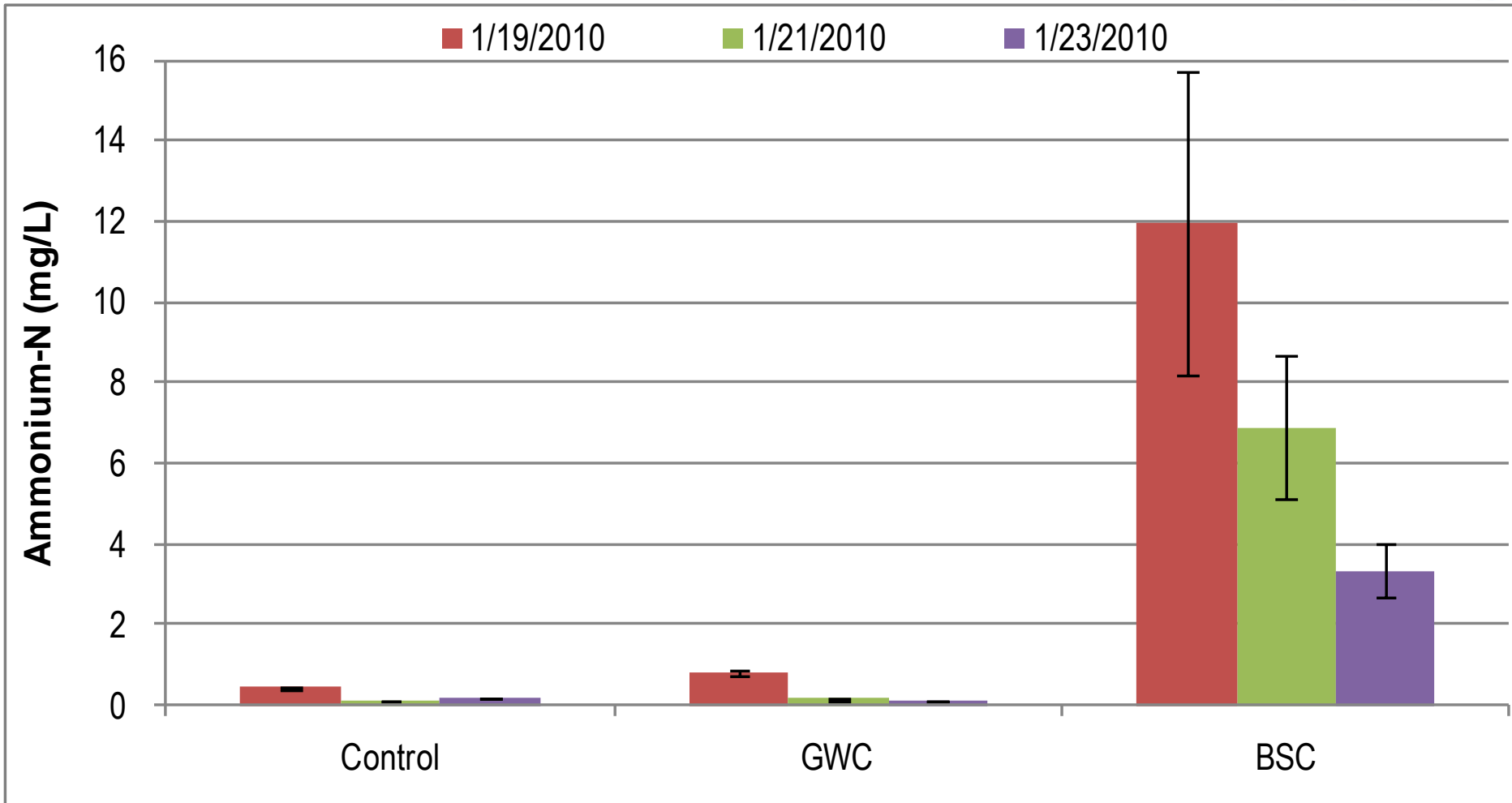


# Nitrate-nitrogen



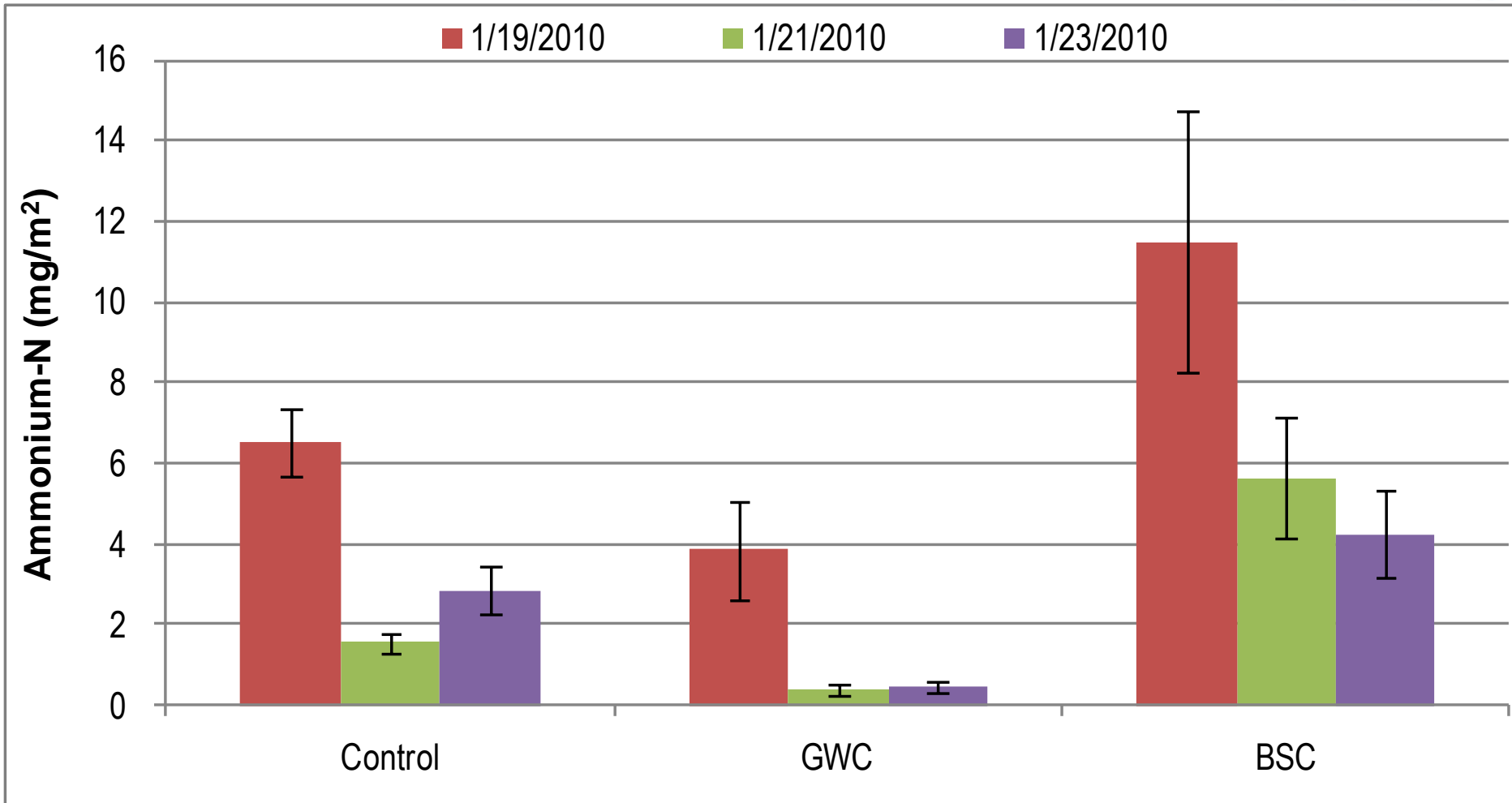


# Ammonium-nitrogen



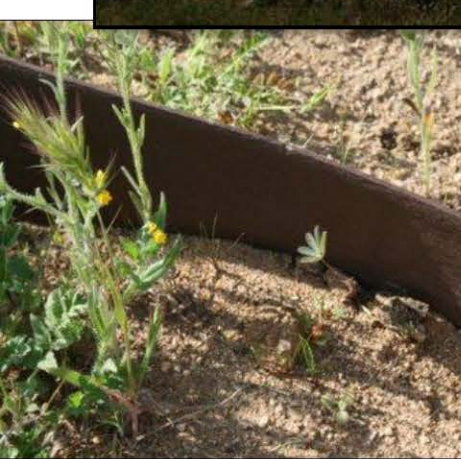


# Ammonium-nitrogen





# Vegetation



Andrew Sanders  
March 26, 2010

# University of California

## Agriculture and Natural Resources



# Using Compost to Improve Post-fire Water Quality

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