Gravel Budget Results

TRINITY RIVER RESTORATION PROGRAM
P.O. BOX 1300, WEAVERVILLE, CA
PHONE: 530-623-1800, FAX: 530-623-5944

Technical Report: TR-TRRP-2013-2

2012 Sediment Budget Update, Trinity River, Lewiston Dam to Douglas City, California

Prepared by:

David Gaeuman
Trinity River Restoration Program
Weaverville, California

November 2013

A sediment budget is an accounting of sediment fluxes into and out of one or more storage areas during one or more time periods

$$\Delta S_i = I_i + E_i$$

I = sediment inputs

E = sediment exports (outputs)

ΔS = change in sediment storage

Gravel Augmentation Objectives (TRFES and ROD)

"Annual Coarse Sediment Introduction"

Maintain coarse sediment supply and support process

Time Frame:

Present and future – 2004 to present

"Short-term Coarse Sediment Supplementation"

Mitigate for dam-induced deficit

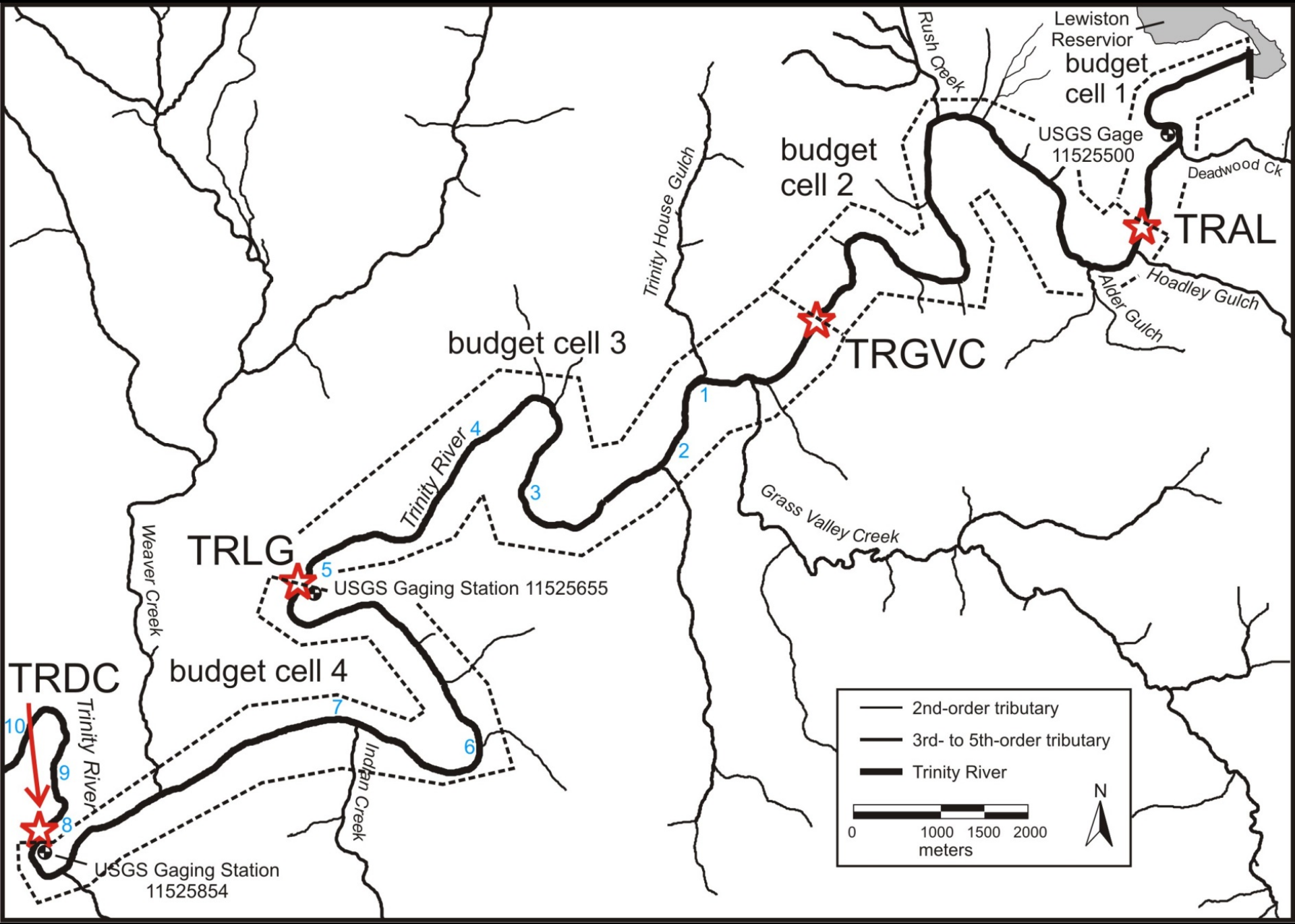
TRFES calls for 16,000 yds upstream from Rush Creek

Immediate increase in spawning and rearing habitat

Gravel Augmentation Objectives
(Coarse Sediment Management Plan, 2007)

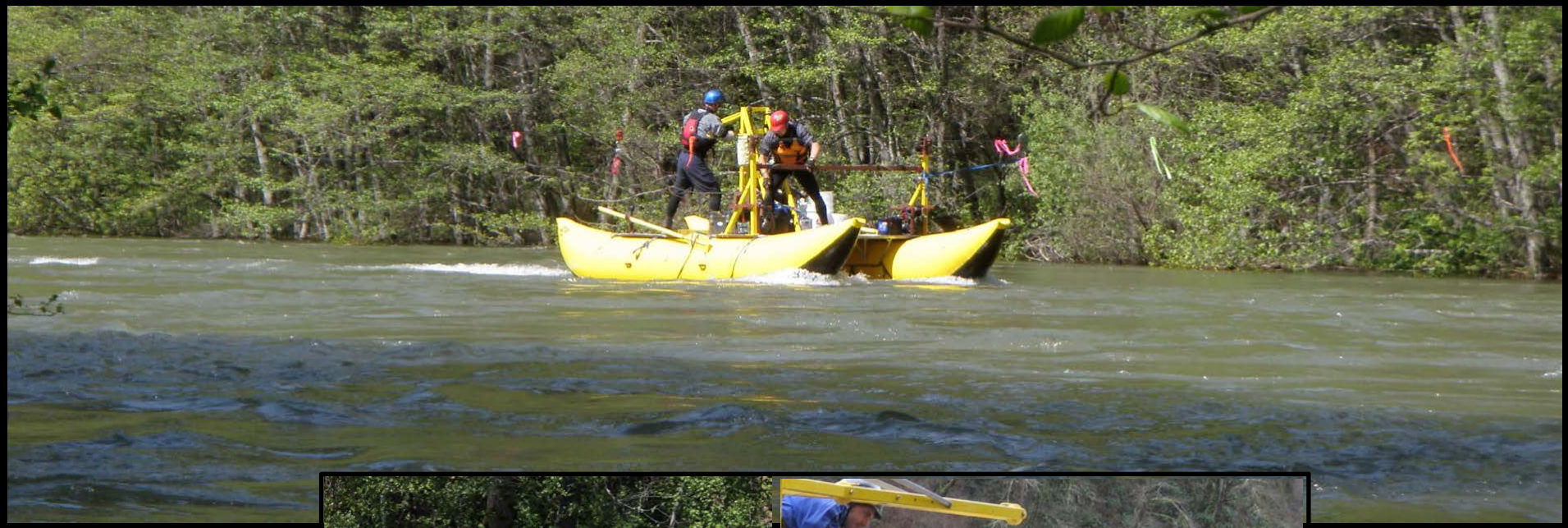
"The short-term strategy rapidly replenishes coarse sediment storage in the reach at multiple sites between Lewiston Dam and Indian Creek…"

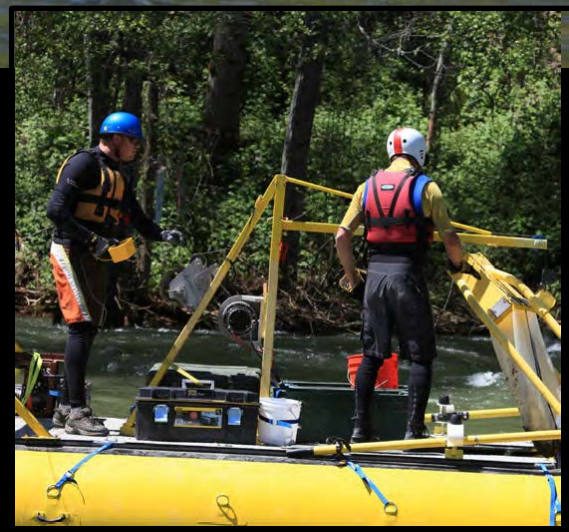
Identified 58 potential short-term augmentation sites, 39 of which are downstream from Rush Creek.

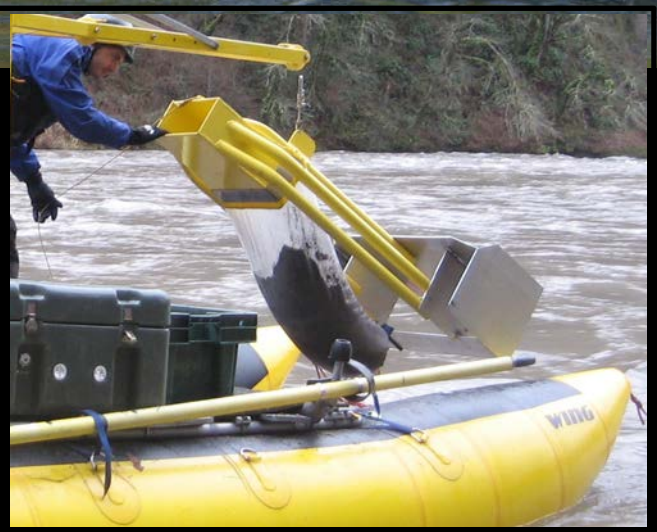

Lewiston Reservior
Rush Creek
budget cell 1
USGS Gage 11525500
Deadwood Ck
TRAL
Hoadley Gulch
Alder Gulch
Trinity House Gulch
budget cell 2
TRGVC
budget cell 3
Trinity River
Grass Valley Creek
Weaver Creek
TRLG
USGS Gaging Station 11525655
budget cell 4
TRDC
Trinity River
Indian Creek
USGS Gaging Station 11525854
1
2
3
4
5
6
7
8
9
10
2nd-order tributary
3rd- to 5th-order tributary
Trinity River
0
1000
1500
2000
meters
N

Contemporary Budget Exports

E_i = gravel transported out of budget cell





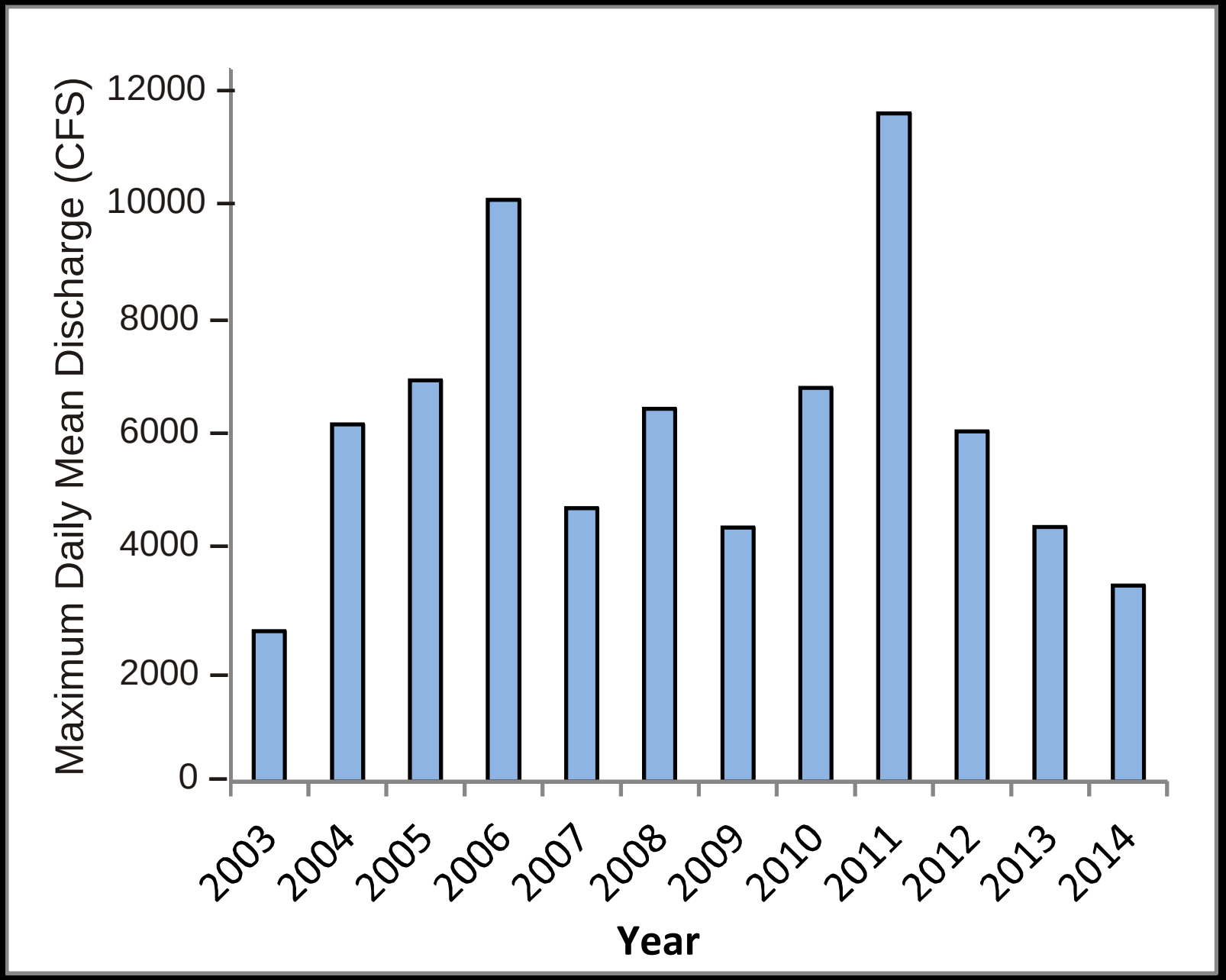


Contemporary budget inputs:

$I_i = E_{i-1}$ + gravel from tributaries

+ gravel augmentations

+ bank erosion (?)


Maximum Daily Mean Discharge (CFS)
12000
10000
8000
6000
4000
2000
0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year

Gravel Augmentation

Total mobile gravel augmented 2005 to 2015 – 70,400 tons

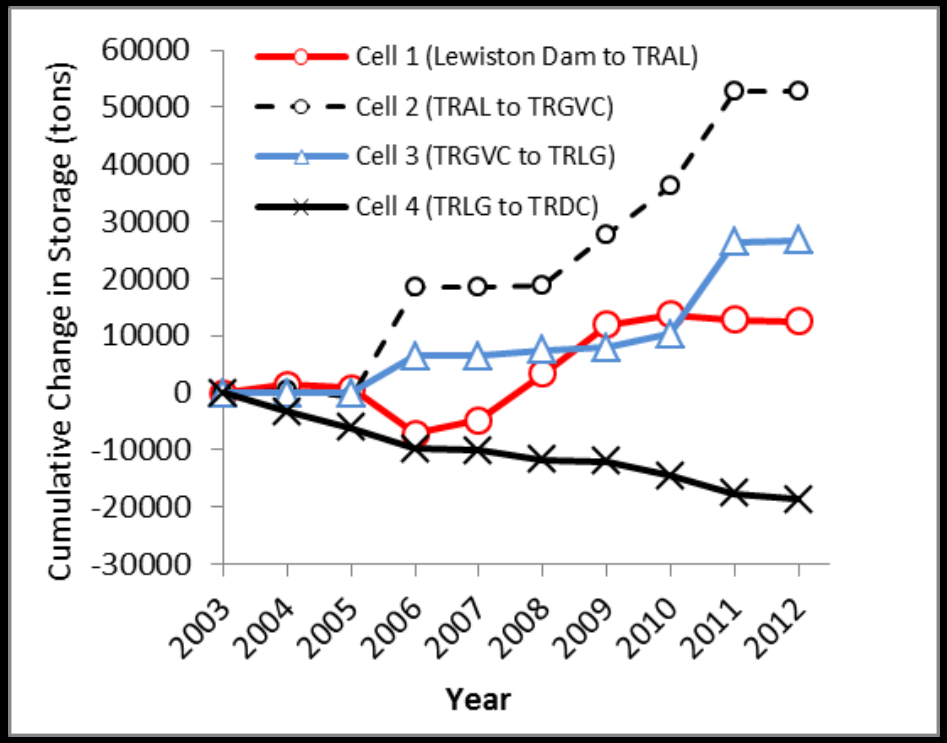
Table 1: Estimated coarse sediment (> 8 mm) loads passing the Trinity River sediment monitoring transects in 2004-2012 with ± uncertainty margins.

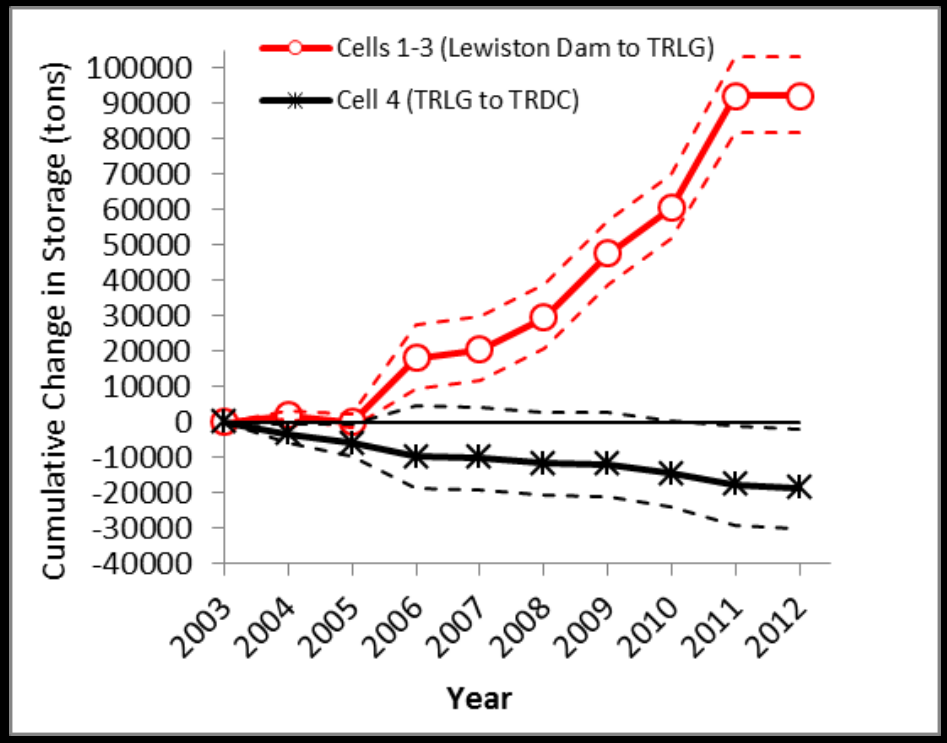
TRAL (Cell 1 exports)	2004 (tons)	2005 (tons)	2006 (tons)	2007 (tons)	2008 (tons)	2009 (tons)	2010 (tons)	2011 (tons)	2012 (tons)
Coarse Sediment (> 8 mm)	1700 ±850	531 ±265	8610 ±4305	93 ±46	863 ±431	260 ±130	550 ±275	6460 ±3230	222 ±111
TRGVC (Cell 2 exports)									
Coarse Sediment (> 8 mm)	1336 ±668	1789 ±895	4290 ±2145	71 ±35	1750 ±875	470 ±235	492 ±246	2250 ±1125	394 ±197
TRLG (Cell 3 exports)									
Coarse Sediment (> 8 mm)	1359 ± 680	1853 ±926	4350 ±2175	12 ±6	775 ±387	34 ±17	364 ±182	5930 ±2965	60 ±30
TRDC (Cell 4 exports)									
Coarse Sediment (> 8 mm)	4869 ±2435	5229 ±5229	15200 ±7600	297 ±149	2380 ±1190	634 ±317	1650 ±1670	13200 ±6600	1200 ±600

Table 11: Estimated inputs of coarse sediment (> 8 mm) to the Trinity River for 2004-2012.

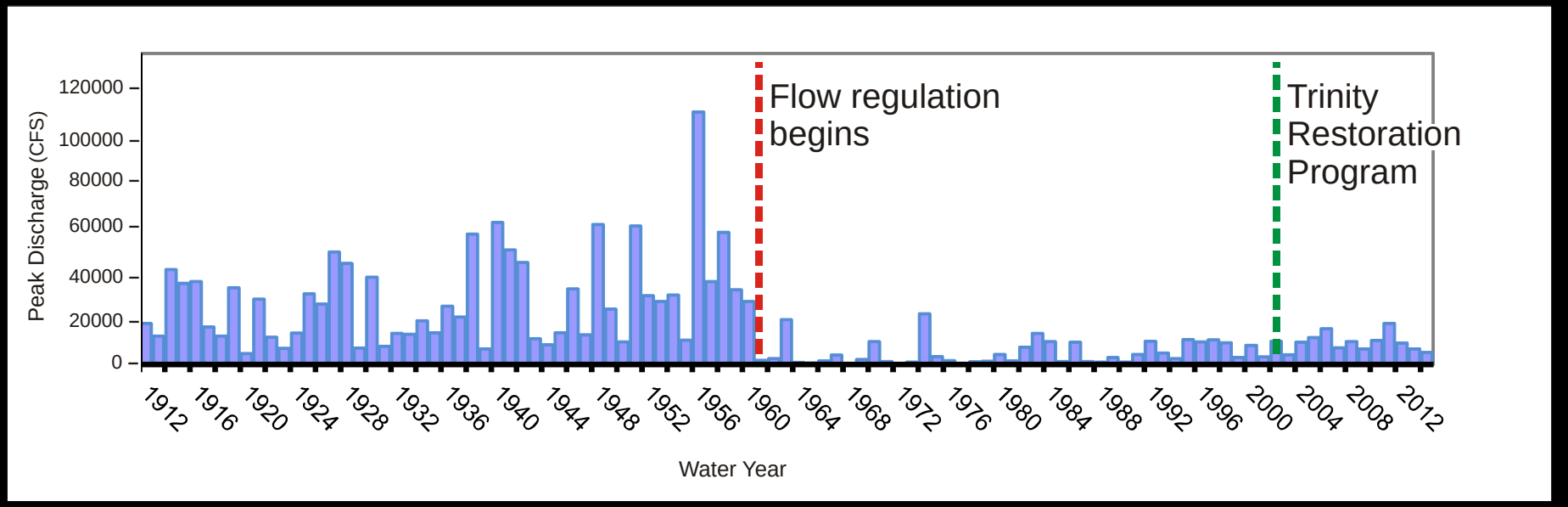
Cell 1 Coarse Sediment Inputs	2004 (tons)	2005 (tons)	2006 (tons)	2007 (tons)	2008 (tons)	2009 (tons)	2010 (tons)	2011 (tons)	2012 (tons)
Gravel Augmentation	3000 ±300	0	0	2432 ±243	9000 ±900	8800 ±880	2290 ±229	4740 ±474	0
Deadwood Creek	72 (F10)	1 (F10)	403 (F10)	1 (F10)	0	0	0	1 (F10)	6 (F10)
Bank Erosion	0	0	287 ±172	0	0	0	0	553 ±332	0
Cell 2 Coarse Sediment Inputs									
Coarse Sediment from Cell 1	1700 ±850	531 ±265	8610 ±4305	93 ±46	863 ±431	260 ±130	550 ±275	6460 ±3230	222 ±111
Gravel Augmentation	0	0	0	0	1000 ±100	9200 ±920	8625 ±863	6235 ±940	0
Rush Creek	171 (F2.2)	3 (F2.2)	960 ±480	1 (F2.2)	0	0	0	2 (F2.2)	14 (F2.2)
Bank Erosion	0	0	13998 ±5040	0	0	0	0	6045 ±2451	0
Cell 3 Coarse Sediment Inputs									
Coarse Sediment from Cell 2	1336 ±668	1789 ±895	4290 ±2145	71 ±35	1750 ±875	470 ±235	492 ±246	2250 ±1125	394 ±197
Gravel Augmentation	0	0	0	0	0	0	2200 ±220	8630 ±1715	0
Bank Erosion	0	0	6580 ±3948	0	0	0	0	11230 ±2343	±
Cell 4 Inputs									
Coarse Sediment from Cell 3	1359 ± 680	1853 ±926	4350 ±2175	12 ±6	775 ±387	34 ±17	364 ±182	5930 ±2965	60 ±30
Indian Creek	62 (F2.2)	166 (F2.2)	490 ±245	0	13 (F2.2)	81 (F2.2)	143 (F2.2)	78 (F2.2)	35 (F2.2)
Weaver/Reading Creek	149 (F10)	398 (F10)	1176 (F10)	0	31 (F10)	194 (F10)	343 (F10)	187 (F10)	84 (F10)
Bank Erosion	0	0	5453 ±3248	0	0	0	0	3838 ±2303	0

Storage Change Since 2003





Historical Budget
E_i and I_i are highly uncertain
(except for $I_i = 0$)



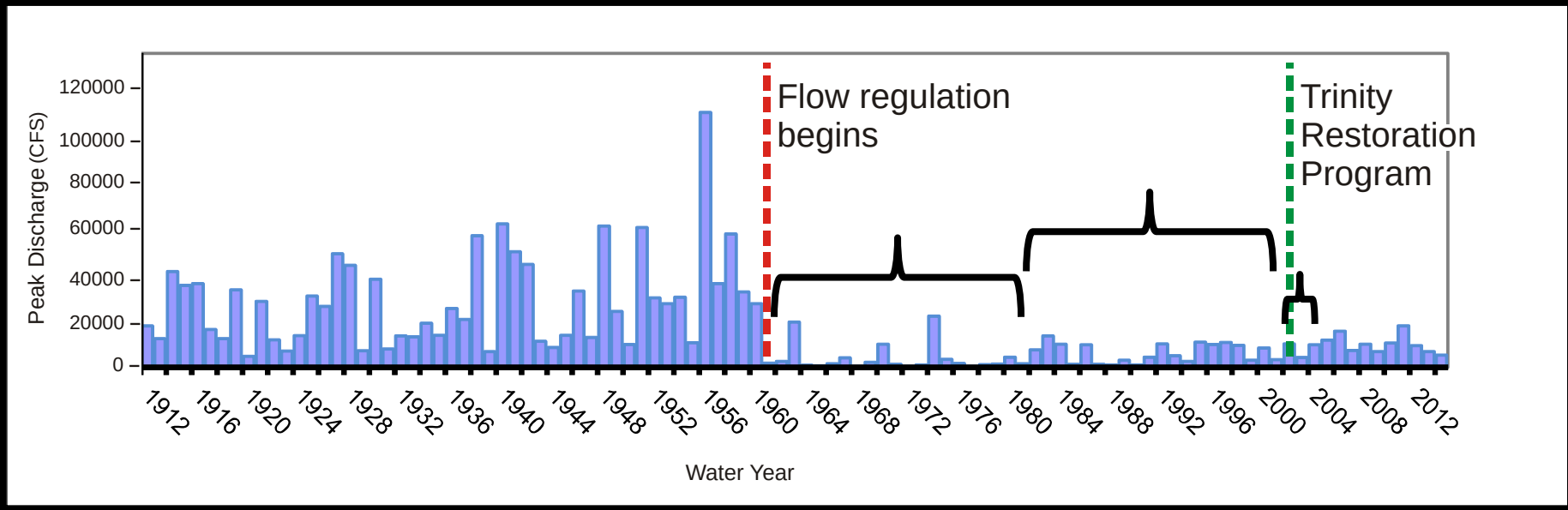
But flows were generally too small to transport large quantities of gravel

Historical Budget

1961-1980:
Fluxes assumed similar to WY2006 on basis of similar total number of days exceeding transport threshholds

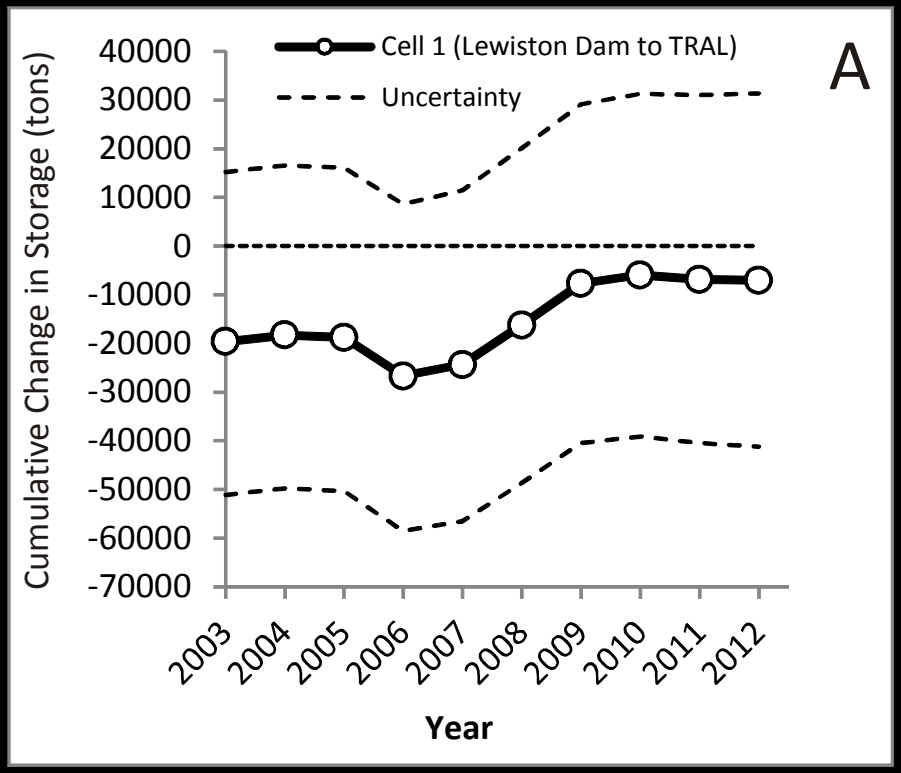
1981-2000:
Budget terms reported by Wilcock (2004), adjusted for augmentations and dredging.

2001-2003:
Fluxes assumed similar to similar WY types monitored after 2004.

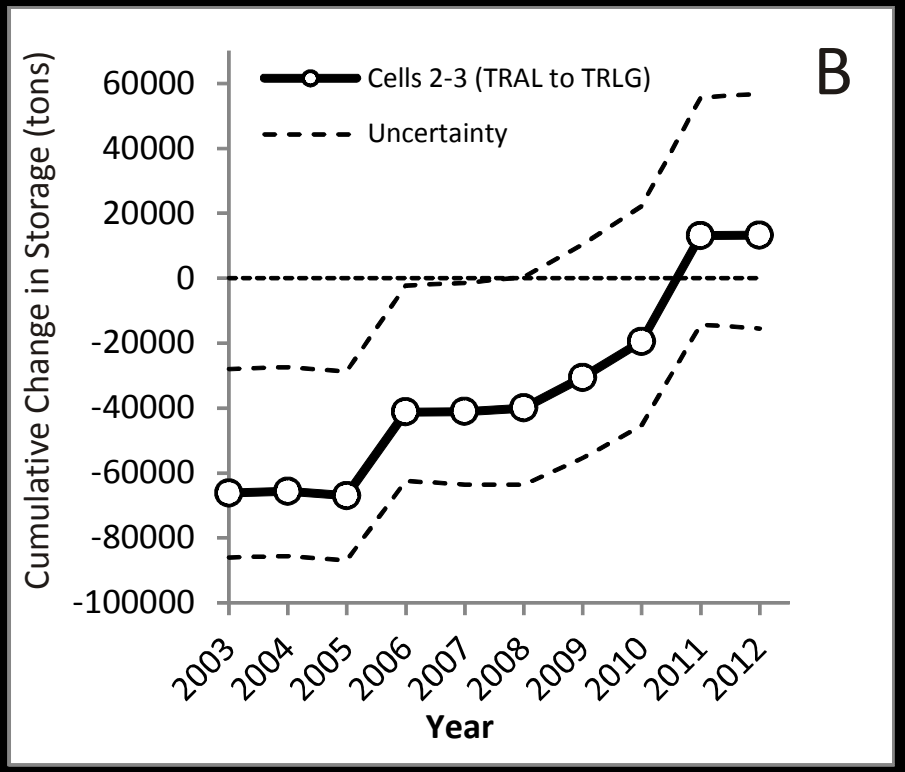


Recharge Storage: 2012 Budget

Cell 1: Less than 1.5 miles from dam

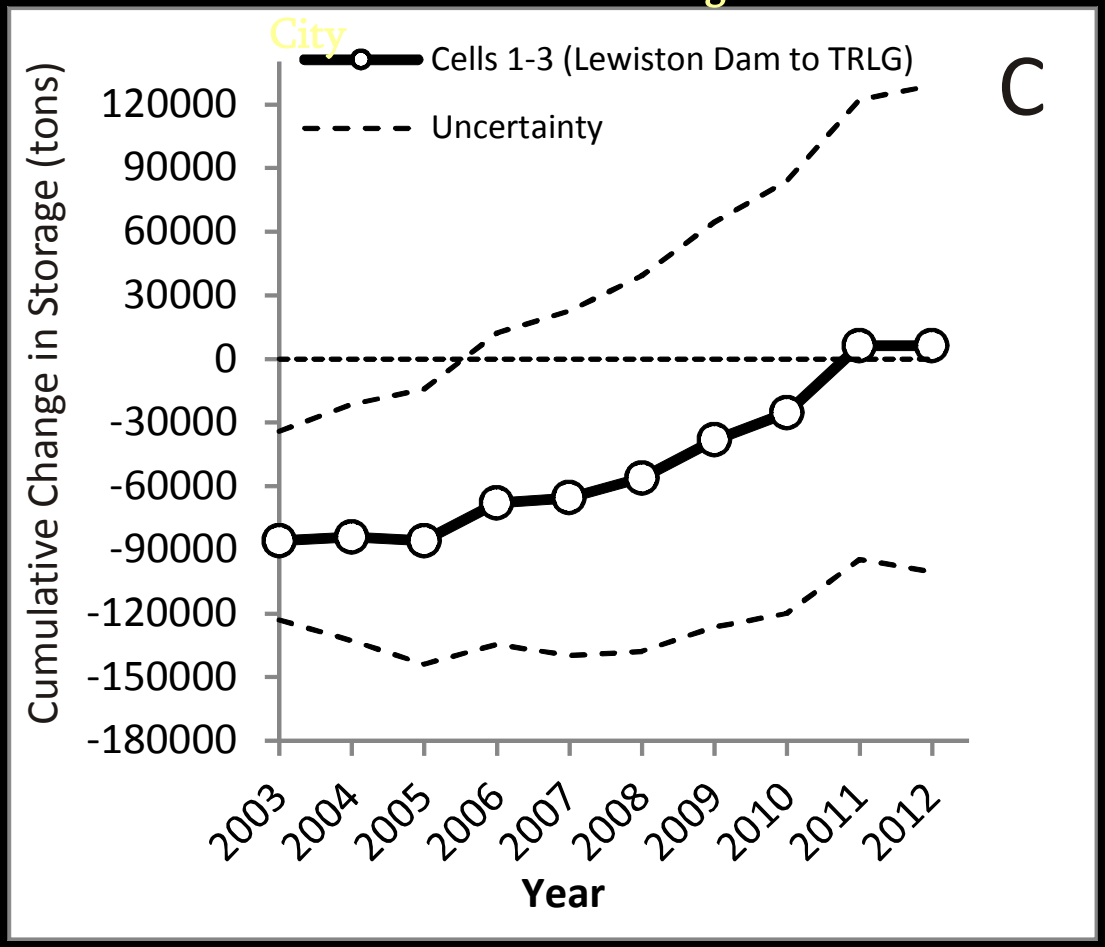


Cells 2 and 3: Above Indian Creek



Gaeuman, D. 2013. *2012 sediment budget update, Trinity River, Lewiston Dam to Douglas City, California*. Trinity River Restoration Program, Weaverville, CA, TRRP Technical Report TR-TRRP-2013-2, http://odp.trrp.net/Data/Documents/Details.aspx?document=2156

Recharge Storage: 2012 Budget



Gaeuman, D. 2013. *2012 sediment budget update, Trinity River, Lewiston Dam to Douglas City, California*. Trinity River Restoration Program, Weaverville, CA, TRRP Technical Report TR-TRRP-2013-2, http://odp.trrp.net/Data/Documents/Details.aspx?document=2156

Lessons Learned

Initial Assumption:

An increase in coarse sediment storage is needed to overcome a dam-induced coarse sediment deficit upstream from Rush Creek or Indian Creek.

Findings:

Coarse sediment storage levels upstream from Indian Creek may be similar to pre-dam levels. The existing budget cells are too large to identify reaches where local gravel deficits limit processes that create habitat.

Management Implications:

Focus coarse sediment management on long-term objectives rather than storage increases.