Appendix A: Supplementary Information 1: Focus group questions

Before the Gold King Mine Spill:

1. How were you using water from the San Juan River before the Gold King Mine Spill?
2. How often do you use the San Juan River water?
3. What were the ways you come into contact with sediments or soil near the San Juan River and how often?
4. Did you have health concerns related to the environmental impacts to the river? What were they? If so, please explain why? If not, why not?
Probes if these elements are not mentioned; ensure that a-f are all queried if not raised by the group in conversation
5. Were your concerns related to your contact with:
river soil or sediment
local well water
local crops,
local livestock
wild plants
wild game
living organisms in the river
Insects/pollinators
6. Did you have cultural concerns related to the San Juan River? If so, please explain why and how? If not, why not?
7. Did you think there were any long-term health concerns as a result of using the San Juan River? If so, please explain why? If not, why not?

After the Gold King Mine Spill:
8. Do you use the water from the San Juan River now after the spill?
9. How often do you use the San Juan River water?
10. What are the ways you come into contact with sediments or soil near the San Juan River and how often?
11. Do you have health concerns related to the Gold King Mine Spill? What are they? If so, please explain why? If not, why not?
Probes if these elements are not mentioned; ensure that a-f are all queried if not raised by the group in conversation
12. Is the health concern related to your contact with:
river soil or sediment
local well water
local crops,
local livestock
wild plants
wild game
living organisms in the river
Insects/pollinators
13. Do you have cultural concerns related to the Gold King Mine Spill? If so, please explain why and how? If not, why not?

14. Do you think there are any long-term health concerns as a result of the Gold King Mine spill? If so, please explain why? If not, why not?
15. Has the Gold King Mine Spill into the San Juan River impacted: You? If so, please explain how
Your family? If so, please explain how
Your livelihood? If so, please explain how
If not, why not?
16. How would people want to see the results from the exposure studies reported back? What would be most useful?

Into the Future:
17. What would you like to see for the San Juan River into the future?
18. How do you see your community using the San Juan River in 50 years? 100 years?

Appendix B: Supplementary Tables

Table S1. Summary of adults participating in dietary-related activities

Dietary related	N before	N after	Total % Change
Ate local crops irrigated with water from the San Juan River	43	21	-51.2
Drank tea made from wild plants that grow along the San Juan River or along the irrigation ditches	23	11	-52.2
Ate living fish or other organisms from the San Juan River	19	6	-68.4
Ate local livestock who drink from the San Juan River or along the irrigation ditches	18	14	-22.2
Ate food cooked with wooden sticks gathered along the San Juan River or along the irrigation	15	9	-40
Ate wild plants that grow along the San Juan River or along the irrigation ditches	14	7	-50
Ate food cooked underground along the San Juan River	14	8	-42.9
Ate food cooked in earthen stoves made with material gathered along the San Juan River	11	5	-54.5
Ate wild game that live along the San Juan River	8	4	-50

Table S2. Summary of adults participating in recreational activities

Recreational	**N before**	**N after**	**Total % Change**
Played in the San Juan River (e.g., swimming, diving)	27	3	-88.9
Played in or contacted mud, soil or sediment along the San Juan River	25	5	-80.0
Played in the irrigation ditches (e.g., swimming, diving)	13	5	-61.5

Table S3. Summary of adults participating in livelihood activities

Livelihood	**N before**	**N after**	**Total % Change**
Fished in the San Juan River	22	5	-77.3
Contacted water from the San Juan River while irrigating crops	18	2	-88.9
Butchered livestock that drank or grazed along the San Juan River	14	5	-64.3
Contacted water from the San Juan River while irrigating working with livestock	14	1	-92.9
Sheared sheep that drank or grazed along the San Juan River	11	6	-45.5
Butchered wild game that drank or grazed along the San Juan River	6	5	-16.7
Cooked with wooden sticks gathered along the San Juan River or along the irrigation ditches	9	5	-44.4
Washed clothes in the San Juan River	3	3	0

Table S4. Summary of adults participating in cultural and spiritual activities

Cultural & Spiritual	**N before**	**N after**	**Total % Change**
Prayed and put corn pollen that came from corn grown using the San Juan River water in mouth	13	1	-92.3
Gathered or worked with wild plants that grow along the San Juan River or along the irrigation ditches	12	11	-8.3
Made medicine or tea with plants gathered along the San Juan River	11	0	-100
Baptized others in the San Juan River	9	3	-66.7
Gathered greasewood stirring sticks (*idístsíín*) along the San Juan River	8	1	-87.5
Used greasewood stirring sticks (*idístsíín*) along the San Juan River to stir traditional foods	7	0	-100
Rolled in the snow along the San Juan River	5	1	-80
Dipped in the San Juan River after a sweat	4	1	-75
Drink the San Juan River water	4	2	-50
Spent time in *Taachee* (sweats) with steam from made San Juan River water	4	2	-50
Gathered plants from along the San Juan River for medicine or smudging	3	0	-100
Had mudbaths using mud from along the San Juan River	3	7	133.3
Put *Chii* (red earth found near the San Juan River) on face for prayers	1	0	-100
Smudged with plants gathered along the San Juan River	1	2	-100
Gathered reeds along the San Juan for ear piercing	0	4	400
Wore reed gathered along the San Juan River in your earlobes	0	1	100

Table S5. Summary of adults participating in arts and crafts activities

Arts and Crafts	N before	N after	Total % Change
Basket weaving (including gathering, drying, dying, and weaving with plants from along the San Juan River)	4	3	-25
Dying wool with natural plants gathered along the San Juan River	4	3	-25
Making earthen stoves with material gathered along the San Juan River	3	2	-33.3
Making cradle boards using with materials gathered along the river	2	1	-50
Sand painting (including gathering sand or laying down sand that was collected along the San Juan River)	1	0	-100
Making jewelry with natural materials gathered along the San Juan River	0	2	200
Pottery (including mixing, coiling, and firing clay gathered along the San Juan river)	0	0	0

Table S6. Summary of children participating in dietary-related activities

Dietary	N before	N after	Total % Change
Ate local crops irrigated with water from the San Juan River	12	6	-50.0
Ate local livestock who drink from the San Juan River or along the irrigation ditches	6	1	-83.3
Drank tea made from wild plants that grow along the San Juan River or along the irrigation ditches	5	2	-60.0
Ate living fish or other organisms from the San Juan River	4	1	-75.0
Ate food cooked underground along the San Juan River	3	1	-66.7
Ate food cooked with wooden sticks gathered along the San Juan River or along the irrigation	3	1	-66.7
Ate wild plants that grow along the San Juan River or along the irrigation ditches	2	0	-100.0
Ate food cooked in earthen stoves made with material gathered along the San Juan River	2	1	-50.0
Ate wild game that live along the San Juan River	1	0	-100.0

Table S7. Summary of children participating in recreational activities

Recreational	N before	N after	Total % Change
Played in or contacted mud, soil or sediment along the San Juan River	8	2	-75.0
Played in the San Juan River (e.g., swimming, diving)	7	2	-71.4
Played in the irrigation ditches (e.g., swimming, diving)	5	3	-40.0

Table S8. Summary of children participating in livelihood activities

Livelihood	N before	N after	Total % Change
Fished in the San Juan River	6	1	-83.3
Contacted water from the San Juan River while irrigating crops	5	2	-60.0
Butchered livestock that drank or grazed along the San Juan River	1	0	-100.0
Butchered wild game that drank or grazed along the San Juan River	1	0	-100.0
Sheared sheep that drank or grazed along the San Juan River	0	0	0.0
Cooked with wooden sticks gathered along the San Juan River or along the irrigation ditches	0	0	0.0
Washed clothes in the San Juan River	0	0	0.0
Contacted water from the San Juan River while irrigating working with livestock	0	0	0

Table S9. Summary of children participating in cultural and spiritual activities

Cultural and Spiritual	N before	N after	Total % Change
Prayed and put corn pollen that came from corn grown using the San Juan River water in mouth	1	0	-100
Gathered or worked with wild plants that grow along the San Juan River or along the irrigation ditches	0	0	0.0
Made medicine or tea with plants gathered along the San Juan River	0	0	0.0
Gathered greasewood stirring sticks (*idístsíín*) along the San Juan River	0	0	0.0
Used greasewood stirring sticks (*idístsíín*) along the San Juan River to stir traditional foods	0	0	0.0
Rolled in the snow along the San Juan River	1	0	0.0
Dipped in the San Juan River after a sweat	1	0	-100.0
Drink the San Juan River water	0	0	0.0
Spent time in *Taachee* (sweats) with steam from made San Juan River water	0	0	0.0
Gathered plants from along the San Juan River for medicine or smudging	0	0	0.0
Had mudbaths using mud from along the San Juan River	0	0	0.0
Put *Chii* (red earth found near the San Juan River) on face for prayers	0	0	0.0
Smudged with plants gathered along the San Juan River	0	0	0.0

Table S10. Summary of children participating in arts and crafts activities

Arts and Crafts	N before	N after	Total % Change
Basketweaving (including gathering, drying, dying, and weaving with plants from along the San Juan River)	0	0	0.0
Making cradle boards using with materials gathered along the river	0	0	0.0
Dying wool with natural plants gathered along the San Juan River	0	0	0.0
Making earthen stoves with material gathered along the San Juan River	0	0	0.0
Making jewelry with natural materials gathered along the San Juan River	0	0	0.0
Pottery (including mixing, coiling, and firing clay gathered along the San Juan river)	0	0	0.0
Sandpainting (including gathering sand or laying down sand that was collected along the San Juan River)	0	0	0.0

Table S11. Mean change in number of activities by participant study characteristics

Characteristic	All	Dietary	Livelihood	Recreational	Cultural	Arts
			mean (SD) [1]			
Age						
Adult	-4.0 (4.5)	-1.3 (1.9)	-0.9 (1.6)	-0.8 (1.2)	-0.9 1.5)	-0.03 (0.6)
Child	-2.1 (3.2)	-1.0 (1.9)	-0.4 (1.1)	-0.6 (1.1)	-0.1 (0.5)	-
Chapter						
Aneth	-4.4 (5.0)	-1.5 (2.5)	-1.0 (1.6)	-0.6 (1.0)	-1.3 (1.7)	0.0 (0.9)
Shiprock	-3.9 (3.7)	-1.6 (1.3)	-0.8 (1.5)	-1.2 (1.4)	-0.6 (0.9)	0.0 (0.0)
Upper Fruitland	-2.8 (4.2)	-0.8 (1.1)	-0.8 (1.6)	-0.7 (1.0)	-0.5 (1.4)	-0.1 (0.3)
Education						
Any College	-3.5 (3.6)	-1.1 (1.2)	-0.8 (1.5)	-0.7 (1.1)	-1.0 (1.5)	0.0 (0.0)
College	-4.9 (6.5)	-1.9 (2.4)	-1.7 (2.3)	-0.9 (1.2)	-0.7 (1.7)	0.0 (0.0)
High School/GED	-4.3 (4.4)	-1.6 (2.2)	-0.7 (1.4)	-0.8 (1.2)	-1.0 (1.6)	-0.2 (0.7)
Less than HS	-2.5 (3.4)	-0.6 (0.9)	-1.0 (1.3)	-1.0 (1.3)	-0.3 (0.6)	0.3 (0.9)
Income USD						
< 20, 000	-5.4 (5.5)	-1.8 (1.6)	-1.3 (1.8)	-1.3 (1.4)	-1.2 (1.8)	-0.0 (0.2)
20,0001 to 40,000	-3.9 (3.6)	-0.5 (2.0)	-1.2 (1.8)	-0.5 (0.8)	-1.5 (1.9)	-0.3 (0.9)
40,000 +	-3.0 (3.6)	-1.6 (2.0)	-0.6 (1.4)	-0.6 (1.0)	-0.4 (0.8)	0.1 (0.6)
Elections Tribal						
Yes	-3.7 (4.4)	-1.4 (1.8)	-0.9 (1.6)	-0.8 (1.1)	-0.7 (1.4)	0.0 (0.5)
No	-4.1 (4.3)	-0.7 (2.1)	-1.0 (1.1)	-0.9 (1.3)	-1.3 (1.7)	-0.3 (1.0)
Elections Federal						
Yes	-3.9 (3.2)	-1.6 (1.7)	-0.7 (1.3)	-0.9 (1.2)	-0.7 (1.2)	0.0 (0.0)
No	-3.6 (5.5)	-0.9 (2.0)	-1.1 (1.8)	-0.7 (1.1)	-1.0 (1.7)	-0.1 (0.8)
Elections State						
Yes	-3.9 (4.1)	-1.5 (1.7)	-0.9 (1.6)	-0.9 (1.2)	-0.7 (1.4)	0.0 (0.5)
No	-3.5 (5.0)	-0.8 (2.2)	-0.9 (1.5)	-0.7 (1.1)	-1.0 (1.6)	-0.2 (0.7)

1 There was significant difference in change in the number of activities by age of participant for the overall category and the cultural category, with adults having a greater decrease in the number of activities compared to children (Kruskal-Wallis test)

Table S12. Mean change in frequency of activities (activities per week) by participant study characteristics

Characteristic	All	Dietary	Livelihood	Recreational	Cultural	Arts
			mean (SD)[1]			
Age						
Adult	-8.5 (15.0)	-3.6 (6.3)	-1.8 (3.6)	-1.7 (3.4)	-1.8 (3.6)	-0.1 (0.8)
Child	-2.4 (3.8)	-1.2 (3.0)	-0.4 (1.1)	-0.6 (1.3)	-0.2 (1.0)	-
Chapter						
Aneth	-11.6 (17.0)	-3.9 (7.5)	-2.8 (4.7)	-2.0 (4.1)	-2.5 (3.9)	-0.4 (1.3)
Shiprock	-7.6 (11.4)	-4.0 (6.1)	-1.7 (3.3)	-1.4 (3.0)	-0.5 (1.7)	0.0 (0.0)
Upper Fruitland	-5.5 (8.0)	-2.8 (4.8)	-0.7 (1.5)	-1.5 (2.7)	-0.6 (2.0)	-0.0 (0.0)
Education						
Any College	-10.2 (14.2)	-4.2 (6.4)	-2.0 (3.1)	-1.7 (3.7)	-2.4 (4.2)	0.0 (0.0)
College	-10.4 (15.2)	-4.0 (5.7)	-3.5 (5.9)	-1.8 (3.4)	-0.8 (2.3)	-0.3 (1.0)
High School/GED	-9.9 (14.4)	-4.1 (7.8)	-1.9 (3.7)	-2.3 (3.8)	-1.4 (2.6)	-0.3 (1.3)
Less than HS	-2.1 (2.9)	-1.4 (2.2)	-0.4 (1.2)	-0.4 (1.2)	0.0 (0.0)	0.0 (0.0)
Income USD						
< 20, 000	-5.4 (8.8)	-3.4 (5.1)	-0.5 (1.4)	-1.3 (2.4)	-0.3 (0.7)	0.0 (0.0)
20,0001 to 40,000	-9.0 (14.4)	-4.4 (7.3)	-1.4 (3.4)	-1.7 (3.1)	-1.5 (3.3)	0.0 (0.0)
40,000 +	-13.2(18.0)	-3.8 (8.3)	-3.2 (5.0)	-2.1 (4.5)	-3.6 (4.5)	-0.5 (1.8)
Elections Tribal						
Yes	-8.9 (13.9)	-3.9 (6.5)	-1.9 (3.8)	-1.7 (3.5)	-1.3 (3.0)	-0.1 (0.4)
No	-6.5 (7.8)	-1.5 (4.8)	-1.4 (2.5)	-1.1 (2.3)	-1.7 (2.9)	-0.7 (2.0)
Elections Federal						
Yes	-10.7 (15.8)	-4.6 (7.3)	-2.4 (4.4)	-2.0 (3.9)	-1.6 (3.2)	-0.1 (0.5)
No	-6.0 (8.7)	-2.4 (4.7)	-1.2 (2.4)	-1.3 (2.6)	-1.0 (2.7)	-0.2 (1.1)
Elections State						
Yes	-10.1 (14.9)	-4.4 (6.8)	-2.1 (4.1)	-2.0 (3.8)	-1.6 (3.4)	-0.1 (0.5)
No	-5.2 (7.8)	-1.9 (4.8)	-1.2 (2.3)	-1.0 (2.1)	-0.9 (2.1)	-0.3 (1.3)

1 There was a significant difference in change in the frequency of activities by age of participant for the overall category, cultural, and dietary category, with adults having a greater decrease in the number of activities compared to children (Kruskal-Wallis test).

Table S13. Change in duration of activities (minutes per day) by participant study characteristics

Characteristic	All	Livelihood	Recreational mean (SD)[1]	Cultural	Arts
Age					
Adult	-46.0 (88.1)	-18.1 (37.1)	-13.8 (31.8)	-12.6 (32.0)	-1.4 (8.0)
Child	-9.6 (20.5)	-3.1 (7.7)	-6.1 (13.6)	-3.1 (7.7)	-
Chapter					
Aneth	-79.3 (119.6)	-30.2 (47.6)	-19.7 (42.2)	-25.8 (44.7)	-3.6 (12.6)
Shiprock	-17.3 (47.9)	-8.3 (29.4)	-6.8 (18.1)	-2.2 (7.2)	0.0 (0.0)
Upper Fruitland	-30.2 (52.3)	-11.9 (22.9)	-12.7 (25.7)	-5.6 (19.7)	-0.0 (0.1)
Education					
Any College	-54.8 (105.6)	-17.9 (41.6)	-14.3 (36.3)	-22.6 (46.7)	0.0 (0.1)
College	-36.9 (76.2)	-20.1 (40.4)	-4.8 (9.6)	-7.6 (22.8)	-4.3 (12.8)
High School/GED	-61.8 (95.3)	-24.8 (40.1)	-21.8 (38.4)	-13.0 (27.1)	-2.2 (10.7)
Less than HS	-9.4 (31.0)	-4.8 (15.5)	-4.7 (15.5)	0.0 (0.0)	0.0 (0.0)
Income USD					
< 20, 000	-21.7 (54.0)	-6.5 (18.1)	-11.9 (27.1)	-3.2 (9.1)	0.0 (0.0)
20,0001 to 40,000	-50.2 (86.9)	-18.0 (33.5)	-16.4 (31.5)	-15.9 (38.8)	0.0 (0.1)
40,000 +	-86.4 (125.0)	-32.1 (48.1)	-18.3 (44.9)	-31.2 (45.1)	-4.7 (15.5)
Elections Tribal					
Yes	-44.0 (89.2)	-17.3 (37.3)	-14.0 (32.7)	-11.9 (32.4)	-0.7 (5.2)
No	-58.3 (85.4)	-23.4 (37.0)	-12.4 (26.8)	-16.8 (30.9)	-5.7 (17.1)
Elections Federal					
Yes	-52.6 (101.7)	-20.9 (41.1)	-16.8 (37.8)	-13.7 (31.5)	-1.2 (6.6)
No	-38.3 (70.0)	-14.9 (32.1)	-10.3 (23.1)	-11.4 (33.2)	-1.8 (9.6)
Elections State					
Yes	-51.3 (96.2)	-20.6 (40.6)	-15.4 (34.8)	-14.4 (35.8)	-0.9 (5.9)
No	-34.7 (68.4)	-13.0 (28.3)	-10.3 (24.3)	-8.9 (22.1)	-2.6 (11.5)

1 There were no significant differences in change in the duration of activities by participant study characteristics (Kruskal-Wallis test)

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Reporting Checklist

This checklist is used to ensure the quality, transparency, and reproducibility of published results. We require authors attest that these components have been considered and addressed.

Exposure Assessment Guiding Principle	**Yes/No/Not Applicable**
Has the method to estimate exposure been described clearly?	Yes
Has the exposure assessment method been validated/evaluated as a proxy for exposure and is its validity or agreement with other methods described?	Yes
Is the time period over which the exposure assessment method is considered to be a proxy for exposure appropriate for the research question?	Yes
If exposure is modeled or measured, were all critical potential routes and sources of exposure considered?	Yes
If exposure is modeled, how does it vary over space and time and are necessary historical data incorporated?	Not Applicable
If biomarkers are used as indicators of exposure, could the biomarker measurement have been affected by the outcome (i.e., reverse causality)?	Not Applicable
Are the strengths and weaknesses of the exposure approach detailed and discussed?	Yes