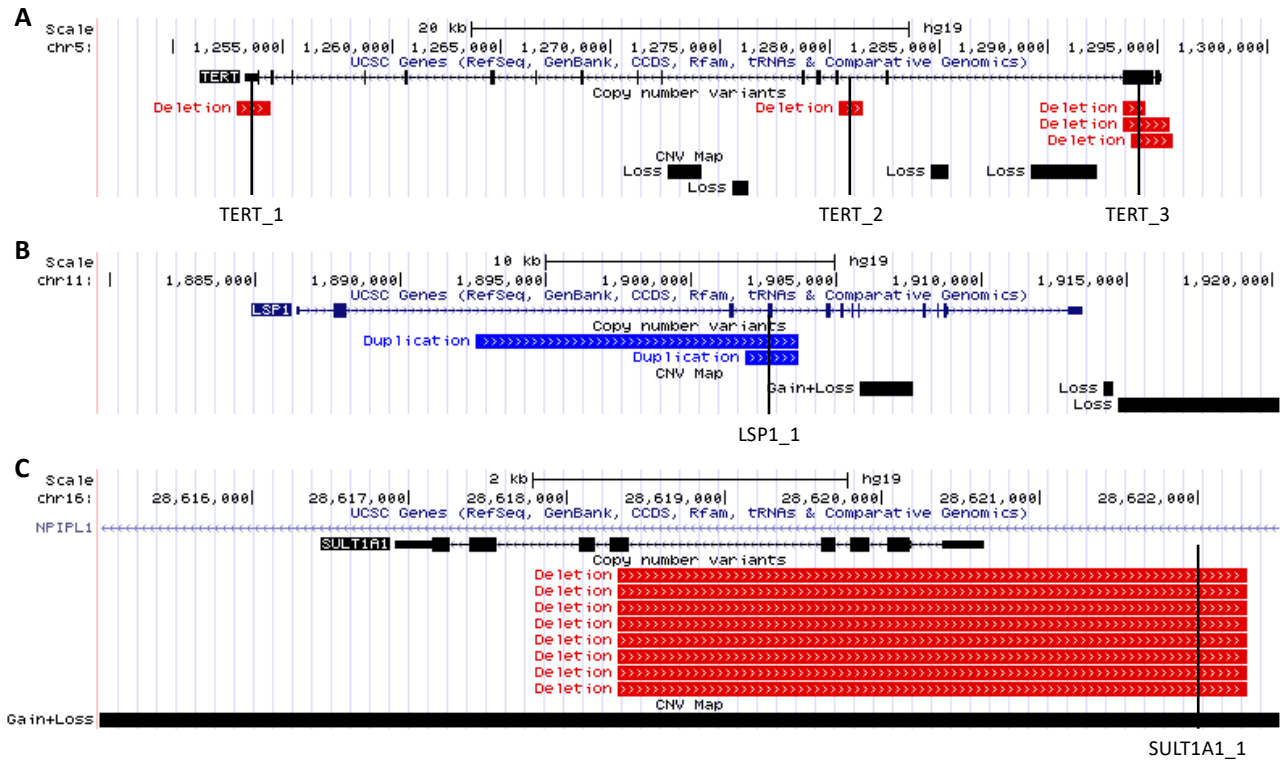


## SUPPLEMENTARY INFORMATION

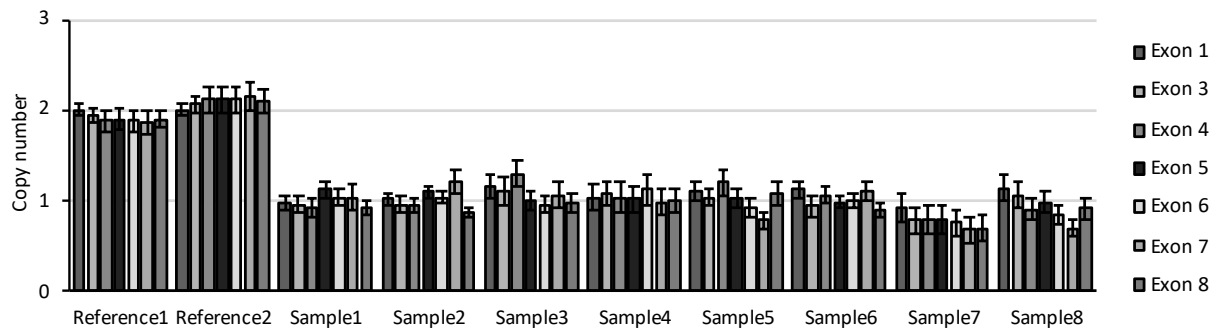
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## Supplementary Figure 1: Location of CNVs validated by TaqMan



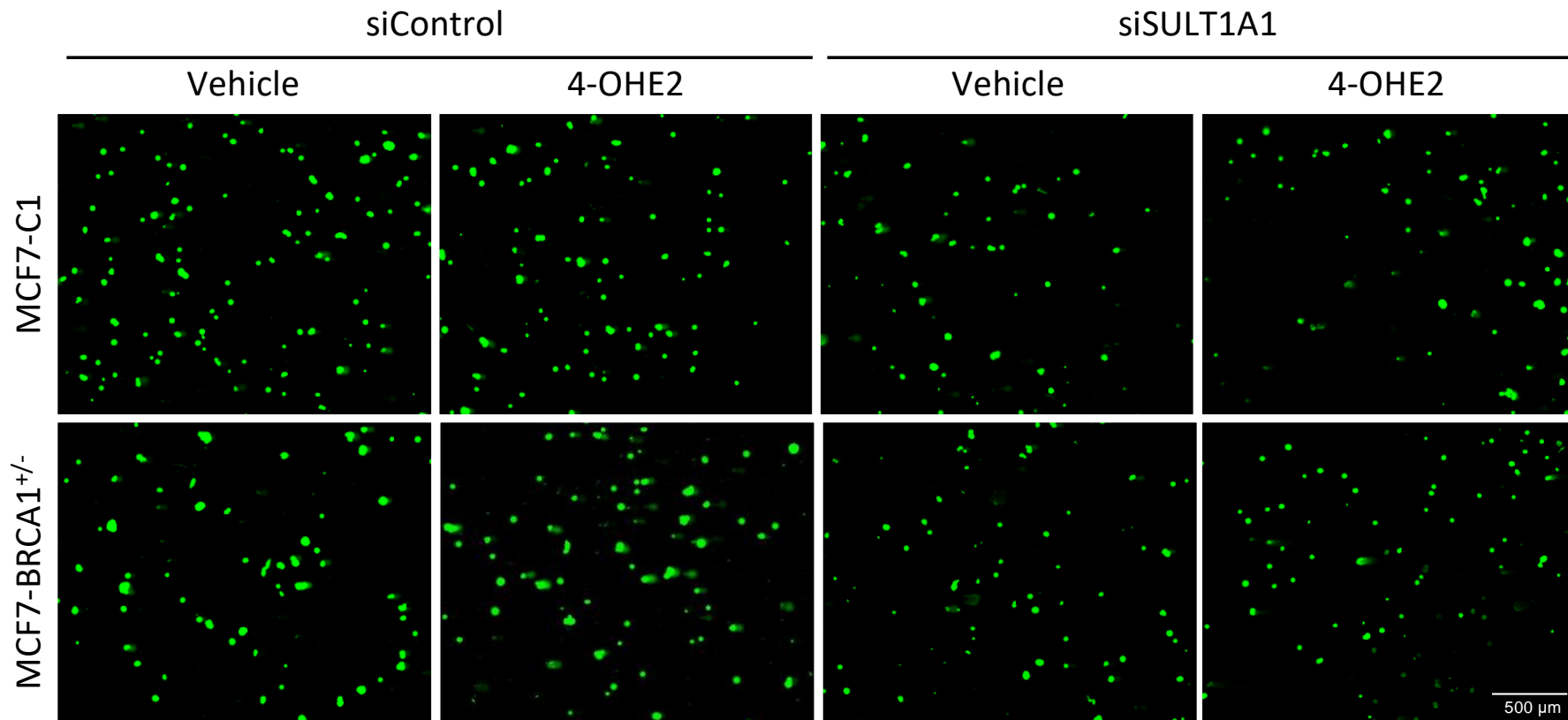
Location of copy number variants available for validation. Genomic view of the **a** *TERT*, **b** *LSP1*, and **c** *SULT1A1* gene loci. View showing UCSC RefSeq gene regions used for association analysis with predicted copy number deletions (red) and duplications (blue), and the Zarrei et al (2015) CNV map.

**Supplementary Figure 2: Validation of copy number deletions overlapping *SULT1A1* using multiplex ligation-dependent probe amplification**



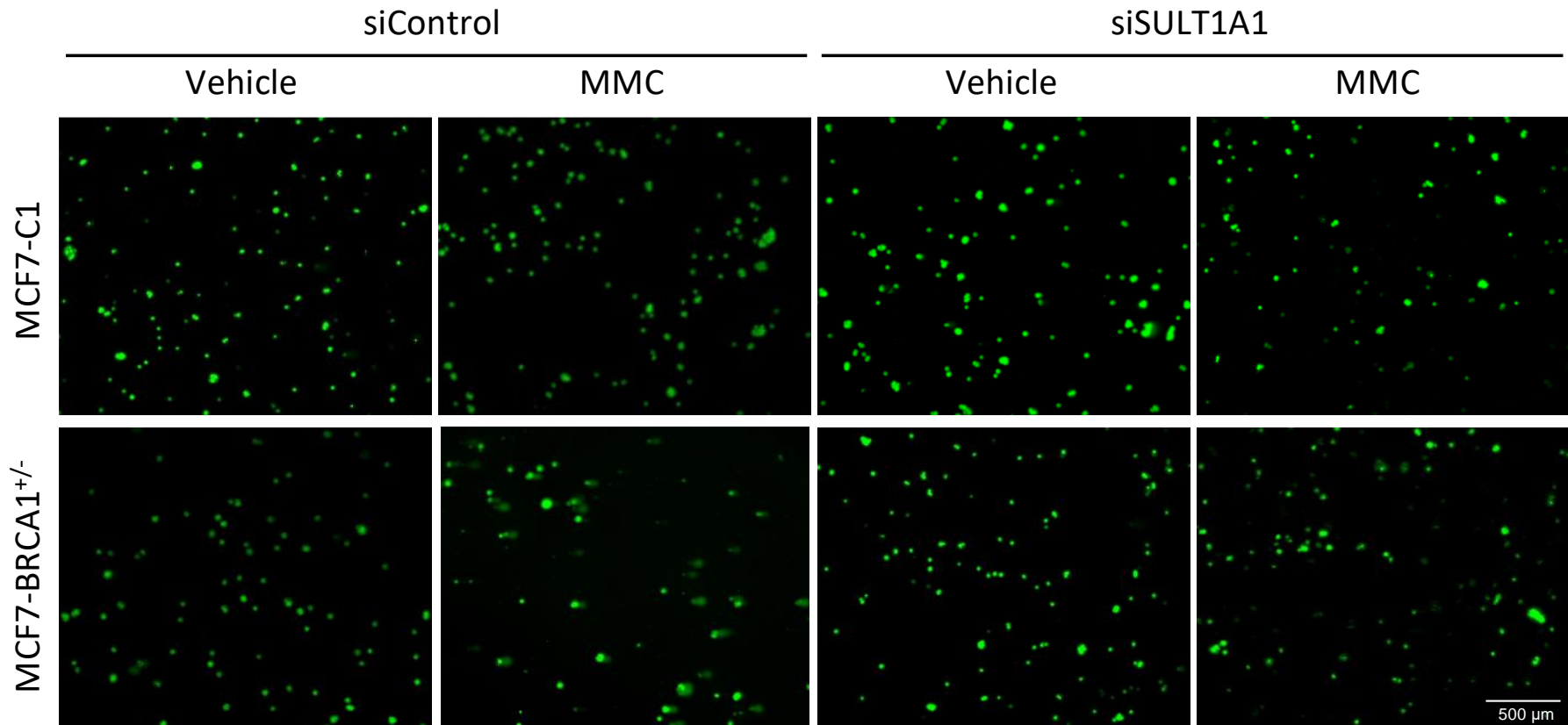
Validation of copy number deletions overlapping *SULT1A1* using multiplex ligation dependent probe amplification. Copy number of the eight exons of the *SULT1A1* reference transcript for eight samples, shown relative to two reference samples with known diploid copy number status.

Supplementary Figure 3: Representative images of comet assay for MCF7-C1 and MCF7-*BRCA1*<sup>+/-</sup> cells treated with 4-hydroxyestradiol



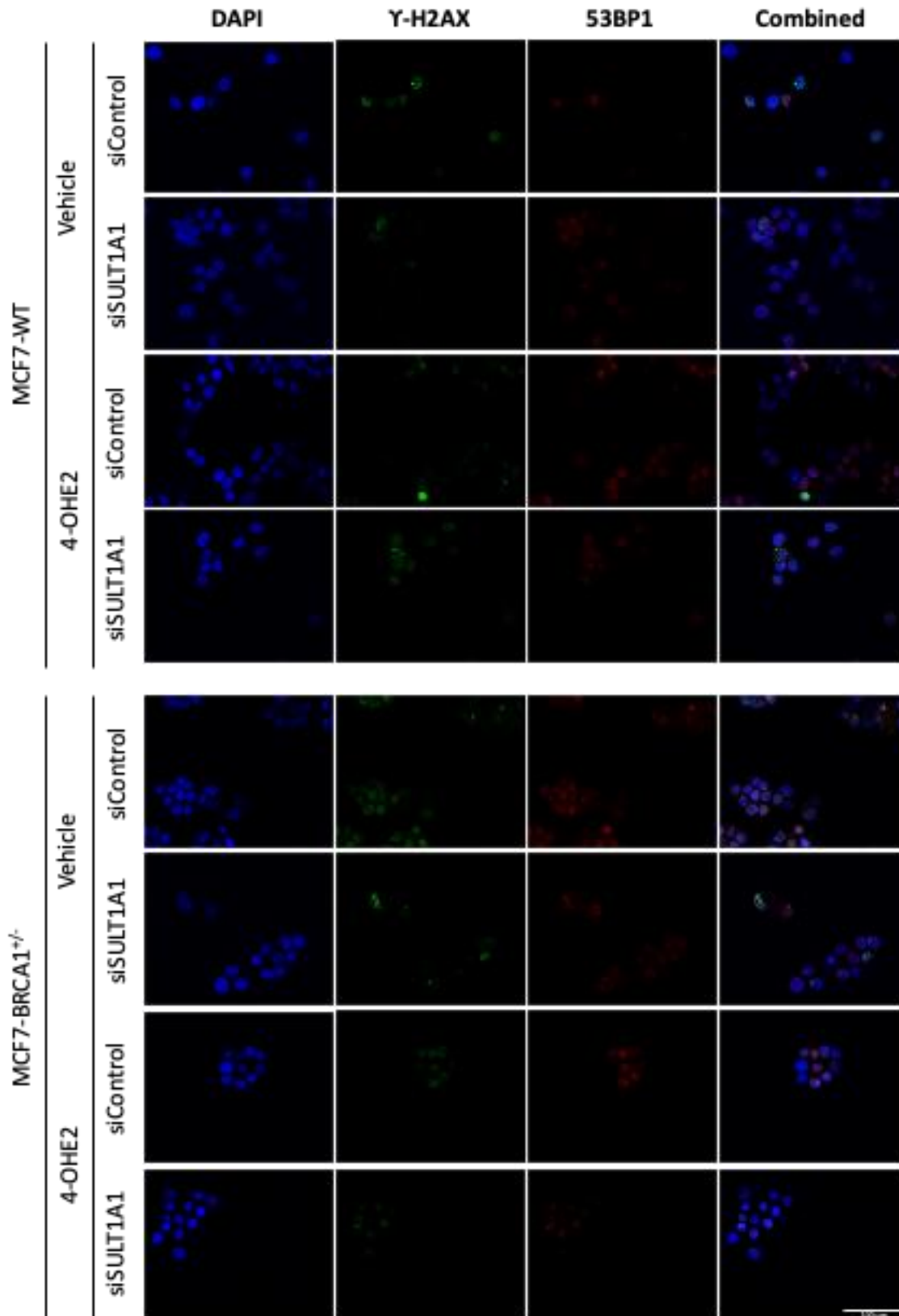
Representative images of comet assay for MCF7-C1 and MCF7-*BRCA1*<sup>+/-</sup> cells treated with 4-hydroxyestradiol. MCF7-C1 (top) and MCF7-*BRCA1*<sup>+/-</sup> cells (bottom) were transfected with either siControl (left) or siSULT1A1 (right) for 24 hours and treated, and then treated with either 1  $\mu$ m 4-hydroxyestradiol (4-OHE2) or the vehicle control for 3 hours. Cells were assayed 21 hours after removal of drug treatment. Images shown were taken at the 20x objective. Scale bar = 500 $\mu$ m.

Supplementary Figure 4: Representative images of comet assay for MCF7-C1 and MCF7-*BRCA1*<sup>+/-</sup> cells treated with Mitomycin C



Representative images of comet assay for MCF7-C1 and MCF7-*BRCA1*<sup>+/-</sup> cells treated with Mitomycin C. MCF7-C1 (top) and MCF7-*BRCA1*<sup>+/-</sup> cells (bottom) were transfected with either siControl (left) or siSULT1A1 (right) for 24 hours and treated, and then treated with either 10  $\mu$ m Mitomycin C (MMC) or the vehicle control for 3 hours. Cells were assayed 21 hours after removal of drug treatment. Images shown were taken at the 20x objective. Scale bar = 500 $\mu$ m.

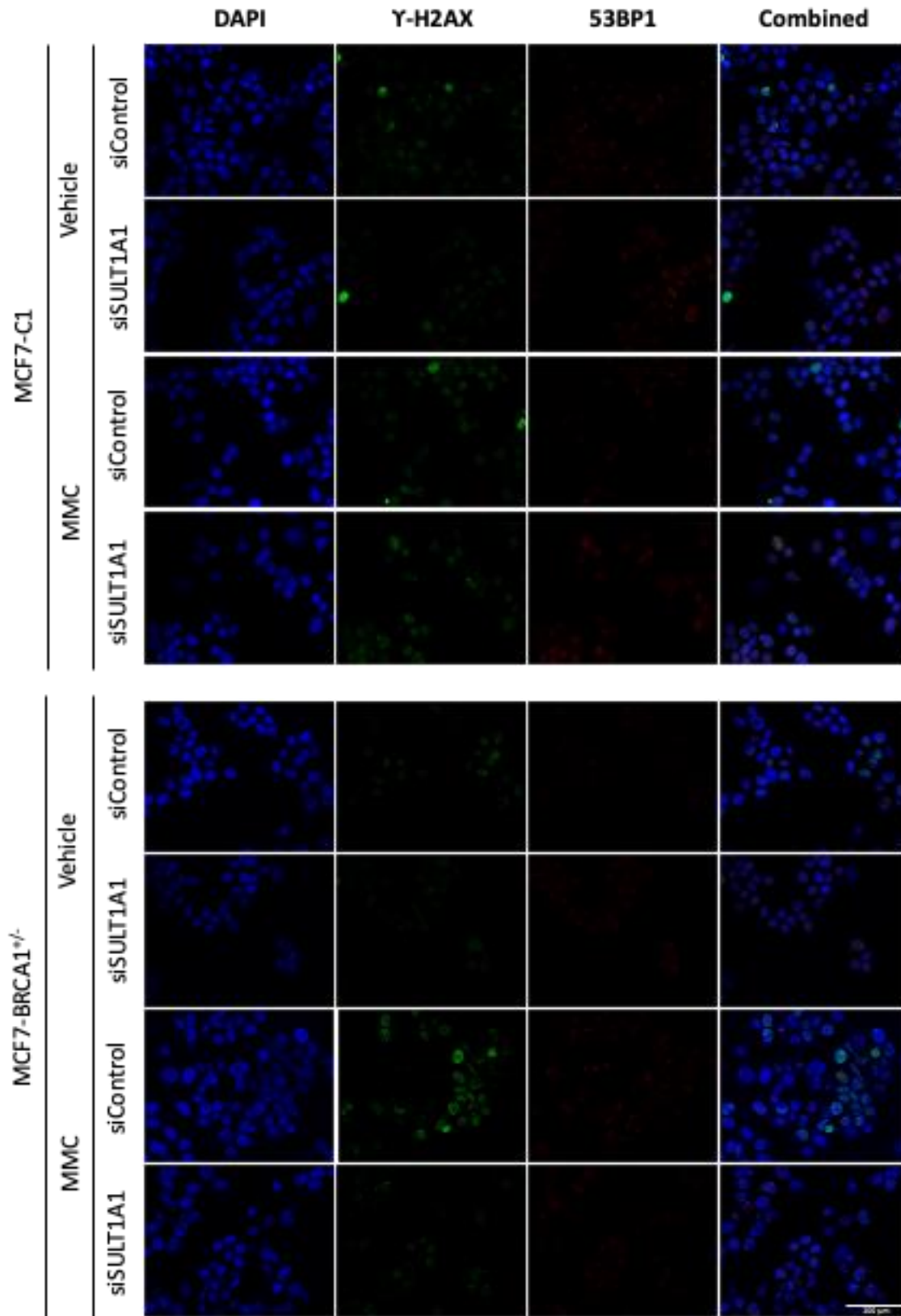
**Supplementary Figure 5: Representative immunocytochemistry images of transfected and MCF7-C1 and MCF7-*BRCA1*<sup>+/-</sup> cells treated with 4-hydroxyestradiol**



Representative images of immunoassayed MCF7-C1 (top) and MCF7-*BRCA1*<sup>+/-</sup> cells (bottom). Cells were transfected with either siSULT1A1 or siControl for 24 hours and treated with either 1 μm 4-hydroxyestradiol (4-OHE2) or the vehicle

control for 3 hours. Cells were immunostained with DAPI (blue) gamma-H2AX (green) and 53BP1 (red) 21 hours after removal of drug treatment. Images were taken at the 40x objective. Scale bar = 100 $\mu$ m.

Supplementary Figure 6: Representative immunocytochemistry images of transfected MCF7-C1 and MCF7-*BRCA1*<sup>+/-</sup> cells treated with Mitomycin C



Representative images of immunoassayed MCF7-C1 (top) and MCF7-*BRCA1*<sup>+/-</sup> cells (bottom). Cells were transfected with either siSULT1A1 or siControl for 24 hours and treated with either 10 μm Mitomycin C (MMC) or the vehicle



control for 3 hours. Cells were immunostained with DAPI (blue) gamma-H2AX (green) and 53BP1 (red) 21 hours after removal of drug treatment. Images were taken at the 40x objective. Scale bar = 100 $\mu$ m.

**Supplementary Figure 7: Quality control and filtering of study cohort**

