The Drazin (Moore-Penrose) inverses of these a-matrices, which are functionally analogous to the inverse b-matrices described below Eq. (21) of arXiv:1812.02675:

Matrix for spin-0 sector:

$$\left(\begin{array}{ccccccc}
-\frac{36k^2}{a_0(16+3k^2)^2} & \frac{4\sqrt{3}}{16a_0+3a_0k^2} & \frac{2i\sqrt{6}k}{16a_0+3a_0k^2} & -\frac{72ik}{a_0(16+3k^2)^2} & \frac{8ik(19+3k^2)}{a_0(16+3k^2)^2} & -\frac{4i\sqrt{2}k(10+3k^2)}{a_0(16+3k^2)^2} & 0 \\
\frac{4\sqrt{3}}{16a_0+3a_0k^2} & \frac{4}{a_0k^2} & \frac{2i\sqrt{2}}{a_0k} & \frac{8i\sqrt{3}}{16a_0k+3a_0k^3} & -\frac{8i}{\sqrt{3}(16a_0k+3a_0k^3)} & -\frac{8i\sqrt{\frac{2}{3}}}{16a_0k+3a_0k^3} & 0 \\
-\frac{2i\sqrt{6}k}{16a_0+3a_0k^2} & -\frac{2i\sqrt{2}}{a_0k} & 0 & \frac{4\sqrt{6}}{16a_0+3a_0k^2} & -\frac{4\sqrt{\frac{2}{3}}}{16a_0+3a_0k^2} & -\frac{8}{\sqrt{3}(16a_0+3a_0k^2)} & 0 \\
\frac{72ik}{a_0(16+3k^2)^2} & -\frac{8i\sqrt{3}}{16a_0k+3a_0k^3} & \frac{4\sqrt{6}}{16a_0+3a_0k^2} & -\frac{144}{a_0(16+3k^2)^2} & \frac{16(19+3k^2)}{a_0(16+3k^2)^2} & -\frac{8\sqrt{2}(10+3k^2)}{a_0(16+3k^2)^2} & 0 \\
-\frac{8ik(19+3k^2)}{a_0(16+3k^2)^2} & \frac{8i}{\sqrt{3}(16a_0k+3a_0k^3)} & -\frac{4\sqrt{\frac{2}{3}}}{16a_0+3a_0k^2} & \frac{16(19+3k^2)}{a_0(16+3k^2)^2} & -\frac{16(35+6k^2)}{3a_0(16+3k^2)^2} & -\frac{8\sqrt{2}(22+3k^2)}{3a_0(16+3k^2)^2} & 0 \\
\frac{4i\sqrt{2}k(10+3k^2)}{a_0(16+3k^2)^2} & \frac{8i\sqrt{\frac{2}{3}}}{16a_0k+3a_0k^3} & -\frac{8}{\sqrt{3}(16a_0+3a_0k^2)} & -\frac{8\sqrt{2}(10+3k^2)}{a_0(16+3k^2)^2} & -\frac{8\sqrt{2}(22+3k^2)}{3a_0(16+3k^2)^2} & \frac{32(13+3k^2)}{3a_0(16+3k^2)^2} & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & -\frac{2}{a_0}
\end{array}\right)$$

Matrix for spin-1 sector:

$$\left(\begin{array}{cccccccccc}
0 & -\frac{2\sqrt{2}}{a_0} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-\frac{2\sqrt{2}}{a_0} & \frac{2}{a_0+2c_8k^2} & \frac{4\sqrt{2}c_8k^2}{a_0^2+2a_0c_8k^2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \frac{4\sqrt{2}c_8k^2}{a_0^2+2a_0c_8k^2} & \frac{4}{a_0+2c_8k^2} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{2k^2}{a_0(2+k^2)^2} & \frac{2i\sqrt{2}k}{2a_0+a_0k^2} & \frac{ik(4+k^2)}{a_0(2+k^2)^2} & -\frac{i\sqrt{\frac{2}{3}}k(4+3k^2)}{a_0(2+k^2)^2} & 0 & -\frac{ik(8+3k^2)}{\sqrt{3}a_0(2+k^2)^2} & 0 \\
0 & 0 & 0 & -\frac{2i\sqrt{2}k}{2a_0+a_0k^2} & 0 & \frac{\sqrt{2}(4+k^2)}{a_0(2+k^2)} & -\frac{2k^2}{\sqrt{3}(2a_0+a_0k^2)} & 0 & \frac{\sqrt{\frac{2}{3}}k^2}{2a_0+a_0k^2} & 0 \\
0 & 0 & 0 & -\frac{ik(4+k^2)}{a_0(2+k^2)^2} & \frac{\sqrt{2}(4+k^2)}{a_0(2+k^2)} & \frac{(4+k^2)^2}{2a_0(2+k^2)^2} & -\frac{8+8k^2+k^4}{\sqrt{6}a_0(2+k^2)^2} & -\frac{\sqrt{\frac{10}{3}}}{a_0} & \frac{-16-4k^2+k^4}{2\sqrt{3}a_0(2+k^2)^2} & -\frac{2\sqrt{\frac{2}{3}}}{a_0} \\
0 & 0 & 0 & \frac{i\sqrt{\frac{2}{3}}k(4+3k^2)}{a_0(2+k^2)^2} & -\frac{2k^2}{\sqrt{3}(2a_0+a_0k^2)} & -\frac{8+8k^2+k^4}{\sqrt{6}a_0(2+k^2)^2} & \frac{1}{6}\left(\frac{1}{c_8k^2}+\frac{2(-16-8k^2+k^4)}{a_0(2+k^2)^2}\right) & \frac{\sqrt{5}(a_0+4c_8k^2)}{6a_0c_8k^2} & \frac{\frac{1}{c_8k^2}+\frac{-1-\frac{4}{(2+k^2)^2}}{a_0}}{3\sqrt{2}} & \frac{1}{3}\left(\frac{4}{a_0}+\frac{1}{c_8k^2}\right) \\
0 & 0 & 0 & 0 & 0 & -\frac{\sqrt{\frac{10}{3}}}{a_0} & \frac{\sqrt{5}(a_0+4c_8k^2)}{6a_0c_8k^2} & \frac{4}{3a_0}+\frac{5}{6c_8k^2} & \frac{\sqrt{\frac{5}{2}}(a_0-2c_8k^2)}{3a_0c_8k^2} & \frac{\sqrt{5}(a_0+4c_8k^2)}{3a_0c_8k^2} \\
0 & 0 & 0 & \frac{ik(8+3k^2)}{\sqrt{3}a_0(2+k^2)^2} & \frac{\sqrt{\frac{2}{3}}k^2}{2a_0+a_0k^2} & \frac{-16-4k^2+k^4}{2\sqrt{3}a_0(2+k^2)^2} & \frac{\frac{1}{c_8k^2}+\frac{-1-\frac{4}{(2+k^2)^2}}{a_0}}{3\sqrt{2}} & \frac{\sqrt{\frac{5}{2}}(a_0-2c_8k^2)}{3a_0c_8k^2} & \frac{1}{6}\left(\frac{2}{c_8k^2}+\frac{32+16k^2+k^4}{a_0(2+k^2)^2}\right) & \frac{\sqrt{2}(a_0-2c_8k^2)}{3a_0c_8k^2} \\
0 & 0 & 0 & 0 & 0 & -\frac{2\sqrt{\frac{2}{3}}}{a_0} & \frac{1}{3}\left(\frac{4}{a_0}+\frac{1}{c_8k^2}\right) & \frac{\sqrt{5}(a_0+4c_8k^2)}{3a_0c_8k^2} & \frac{\sqrt{2}(a_0-2c_8k^2)}{3a_0c_8k^2} & \frac{2}{3}\left(\frac{10}{a_0}+\frac{1}{c_8k^2}\right)
\end{array}\right)$$

Matrix for spin-2 sector:

$$\left(\begin{array}{cccccc}
-\frac{8}{a_0k^2} & -\frac{4i\sqrt{2}}{a_0k} & \frac{4i}{\sqrt{3}a_0k} & \frac{4i\sqrt{\frac{2}{3}}}{a_0k} & 0 & 0 \\
\frac{4i\sqrt{2}}{a_0k} & 0 & \frac{2\sqrt{\frac{2}{3}}}{a_0} & \frac{4}{\sqrt{3}a_0} & 0 & 0 \\
-\frac{4i}{\sqrt{3}a_0k} & \frac{2\sqrt{\frac{2}{3}}}{a_0} & -\frac{8}{3a_0} & -\frac{2\sqrt{2}}{3a_0} & 0 & 0 \\
-\frac{4i\sqrt{\frac{2}{3}}}{a_0k} & \frac{4}{\sqrt{3}a_0} & -\frac{2\sqrt{2}}{3a_0} & \frac{8}{3a_0} & 0 & 0 \\
0 & 0 & 0 & 0 & \frac{4}{a_0} & 0 \\
0 & 0 & 0 & 0 & 0 & \frac{4}{a_0}
\end{array}\right)$$

Matrix for spin-3 sector:

$$\left(-\frac{2}{a_0}\right)$$