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July 10, 2024

Via Electronic Mail
Arizona Department of Environmental Quality (ADEQ)
Attention: Mr. Vimal Chauhan, Groundwater Protection
1110 West Washington Street
Phoenix, Arizona 85007
Email: chauhan.vimal@azdeq.gov

Re: Hermosa Project Tailing Storage Facility 1 (TSF1) Aquifer Protection Permit (APP) Significant Amendment Application LTF # 101257 ADEQ Comments – Consolidated Response

Dear Mr. Chauhan:

We have reviewed the comments compiled by the Arizona Department of Environmental Quality (ADEQ) in an April 5, 2024, Comprehensive Request for Additional Information.

In response to your request, we are providing a consolidated response addressing all of ADEQ's comments and requests. This response includes:

- A Technical Memorandum dated July 10, 2024, addressing all of ADEQ's comments and requests for additional information.
- Attachments A through H which provide additional information requested by ADEQ.
- Replacement pages for the APP application which was submitted on December 22, 2023.

Thank you for your consideration. Please contact Paul Nazaryk at (970) 903-1792 should you have any questions or concerns or require additional information.

South32 Hermosa Inc.,

Brent Musslewhite
Director, Environment and Permitting

South32 Hermosa Inc.
Aquifer Protection Permit (APP) Significant Amendment
Licensing Timeframe (LTF): 101257
July 10, 2024

South32 Technical Memorandum: Comprehensive Response to the April 4, 2024 Arizona Department of Environmental Quality (ADEQ) Comments and Comprehensive Request for Additional Information

South32 Hermosa Inc. (South32) submitted a significant amendment application for its Aquifer Protection Permit (APP) which was submitted on December 22, 2023. On April 5, 2024, the Arizona Department of Environmental Quality (ADEQ) formally submitted comments on the application including a "Comprehensive Request for Additional Information." South32 provided partial responses to ADEQ's comments, and its request as follows:

- A letter response from South32, dated April 18, 2024, which included an April 10, 2024 technical memorandum from NewFields along with referenced attachments and replacement pages.
- A letter response from South32, dated May 16, 2024, which included a May 16, 2024, technical memorandum from NewFields along with the referenced attachments and replacement pages.
- A letter response from South32, dated June 3, 2024, which included a May 31, 2024, technical memorandum from NewFields along with the referenced attachments and replacement pages.
- A letter response from South32, dated July 2, 2024, which included an attachment.

This document provides a comprehensive response to ADEQ's comments and requests. All numerical references to ADEQ comments refer to the numbering provided in the April 5, 2024, ADEQ comments and information request.

General Items

ADEQ Comment # 1: *ADEQ approves the closure and post closure cost submitted in the amendment application in the amount of $24,657,909. Submit a financial assurance mechanism, for the above closure and post-closure costs that complies with the requirements of A.A.C. R18-9-A203(B) prior to Grant. Note, the due date stated on page 5 of this letter is not applicable to this comment.*

South32 Response: No response necessary.

Engineering Items

Geotechnical

ADEQ Comment # 2: *On page 73 of the Hermosa APP PDF file, it is mentioned, 'If instability is identified, slope stabilization may be required. The site APP (No. P-512235) requires periodic inspections of tailing storage facility (TSF) slope conditions. Please provide the Geologic Hazards Assessment study for the site. In the absence of such a study, it would be considered CSI in the permit.*

***South32 Response*:** Geologic hazards are discussed in the following sections of the TSF1 Design Report (NewFields, 2024a).

- Section 2.1 (page 8) and Section 2.2 (page 8 – 9) discuss site conditions and geology, respectively.
- Drawing A025 shows a geologic plan view.
- Section 2.3 (page 9) discusses geologic hazards such as landslide threat, rockfall, near surface instability, and karst. Text was added to this section to provide additional discussion on these topics.
- Section 2.4 (pages 9 – 11) summarizes the seismic hazards assessment which is presented in Appendix B. Text was added to this section to address ADEQ comments 30 – 34 (reference ADEQ comments 30 – 34 for additional details).
- Section 2.5 (page 11) discusses surface conditions.
- Section 2.6 (pages 11 – 16) discusses climate including climate change.
- Section 2.7 (page 16 – 17) discusses historic workings at the site.
- Section 3.2 (pages 27) discusses subsurface conditions as well as expansive and collapsible soils. Text added to this section to specifically address expansive and collapsible soils.
- Section 9 (Stormwater Management) starting on page 84 discusses extreme storms that would result in flooding.

The information provided should be sufficient to allow ADEQ to issue the amended permit. If ADEQ requires additional confirmatory information, that information can be provided pursuant to a CSI included in the permit.

ADEQ Comment # 3: *Please consider a CSI to share the annual InSAR (Interferometric Synthetic Aperture Radar) data with ADEQ.*

South32 Response: South32 is willing to share an annual summary of InSAR monitoring data with ADEQ for permanent slopes associated with TSF1 (i.e., TSF Perimeter Road and permanent dry stack slopes). South32 Hermosa suggests that this summary be included in the Annual Report to be filed with ADEQ related to the construction of the TSF1 Expansion and waste rock placement (see ADEQ comment 12). The InSAR data will be truncated in areas where active filtered tailing placement is occurring.

ADEQ Comment # 4: *On page 85 of the Hermosa APP PDF file (page 17 of Attachment A, Hermosa Lined TSF Design Amendment), please include the various site investigations mentioned in Table 3.1 - GEOTECHNICAL INVESTIGATIONS SUMMARY TABLE.*

South32 Response: The location where the various geotechnical investigations can be referenced has been added to Table 3.1 of the TSF1 Design Report (NewFields, 2024a). In

instances where the information has previously been shared with ADEQ (i.e., in a previous submittal) a reference to the specific report, section, drawing, and/or appendix has been provided. For example, the following was added to the first row of Table 3.1:

> "Data can be referenced in the TSF Amended Design Report (NewFields, 2020b): Section 3.0 (summary), Drawing A070 (plan view), Appendix D.1.1 (borehole and test pit logs) and Appendix D.2.1 (lab data)."

For the February 2022 geotechnical investigation data, the ConeTec report is included in Attachment A to this memorandum.

ADEQ Comment # 5: *On page 98 of the Hermosa APP PDF file, please provide the report for Large Scale Direct Shear Interface Shear Strength testing for the liner.*

South32 Response: See Appendix D.5.3 of the TSF1 Design Report included in the December 21, 2023 application (Clear Creek Associates, 2023) for the large-scale direct shear interface shear strength testing results for the liner.

ADEQ Comment # 6: *On pages 129 and 185 of the Hermosa APP PDF file, kindly provide the existing instrumentation data. According to drawing A222, only two VW piezometers are planned for installation on the south side. Please include additional VW piezometers around the perimeter of the future dry stack to confirm the phreatic line during operation to match with drawing A262 Page 193. Ensure that the data matches the stability analysis and provide the triggering water level for each piezometer, whether installed or planned, on the TSF.*

South32 Response: Vibrating wire piezometer (VWP) data is provided in Attachment B of this technical memorandum as histograms for the existing TSF VWPs P1 through P4. A negative piezometer reading (negative pressure head) is a result of no phreatic surface.

Six additional VWPs located around the perimeter have been added to existing Drawing A222 (TSF1 Instrumentation Plan View). An additional Drawing A223 (TSF1 Instrumentation Layout Data) was created to show the approximate locations of future VWPs including northing, easting, and elevation. A trigger level for P7 through P14 is established as 1.5 feet (matches P1 through P4). The new VWPs have been added to Table 8 of the redlined APP permit.

ADEQ Comment # 7: *On page 140 and 144 of the Hermosa APP PDF file, for BADCT, undrained stability is required. Please provide the undrained stability analysis including both Peak and Residual factors of safety (FOS).*

South32 Initial Response (April 18, 2024): The BADCT guidance manual states, "The testing program should establish drained shear strength parameters for long-term (static) stability analyses and, ***where appropriate***, undrained shear strength parameters for rapid loading

conditions (e.g., earthquake or rapid drawdown)." *Arizona Mining Guidance Manual BADCT*, Appendix E, p. E-7 (emphasis added). For TSF1 consisting of controlled placement of filtered tailings as detailed in the TSF1 design, undrained shear strength is not an appropriate analysis.

Material properties used in the stability models for the production filtered tailings were based on laboratory test results of the synthetic tailings samples. Laboratory testing included isotropically and anisotropically consolidated undrained triaxial tests showing initially contractive behavior at small strains followed by phase transformation to dilative behavior as they strain to critical state. Brittle tailings behavior was not exhibited. Since dilatant behavior is expected at large strain, undrained shear strengths will generally exceed frictional strengths. Therefore, production filtered tailings were modeled as a purely frictional material using Mohr-Coulomb strength criterion for each loading scenario and it is our opinion that an undrained shear strength model is not appropriate. Results of the strength testing can be referenced in Section 3.4.5 of the TSF1 Design Report (NewFields, 2024a).

Filtered tailings placement will be controlled through a Technical Specification requiring a minimum relative compaction (93%) as well as moisture content range (within 3% of optimum moisture content). The Technical Specification (Appendix E – Specification 0014-SPT-EW) was developed considering the behavior of the compacted filtered tailings in the laboratory testing at the specified minimum relative compaction and moisture content range. As part of operations, material placement in TSF1 will be performed under the oversight of Construction Quality Assurance (CQA). CQA will verify that material placement was in accordance with the Technical Specifications. In addition, cone penetration testing will be performed to systematically confirm that the filtered tailings meet the intent of the design. CQA data can be part of an Annual Report to support verification that the material placed aligns with the initial assumptions used for slope stability modeling.

If cone penetration testing or piezometer monitoring identifies areas where undrained shear strength parameter would be appropriate, undrained stabilities models will be developed to reflect the collected data and presented in the Annual Report (see comment 12).

***South32 Follow-up Response (June 3, 2024)*:** Although South32 Hermosa maintains that the drained model previously developed by NewFields is appropriate for our dry stack Tailings Storage Facility (TSF1), we are providing a new Technical Memorandum, dated May 31, 2024, prepared by NewFields providing a stability analysis of TSF1 based upon an undrained model. The approach taken in this model is highly conservative (in that it assumes that filtered tailings will exhibit an undrained response in the entire TSF) and based upon our conversation with you during our May 7, 2024, conference call. Under undrained conditions, the model shows a calculated minimum static factor of safety (FOS) of 1.4 and a calculated minimum pseudo-static FOS of 1.1, indicating that all portions of TSF1 will remain stable for all loading conditions and achieve prescriptive criteria for TSF design specified in the BADCT manual. The NewFields Technical Memorandum (NewFields, 2024b) is provided in Attachment G to this memorandum.

ADEQ Comment # 8: *On page 144 of the Hermosa APP PDF file, where it is mentioned, 'The estimated settlement is based on elastic theory,' kindly provide the Isopach for the total settlement evaluation. Please include long-term settlement in addition to the calculated elastic settlement.*

South32 Response: Additional information was added to Section 7.2 (Settlement Evaluation) of the TSF1 Design Report (NewFields, 2024a) regarding settlement and the potential impact on maintaining positive grade in the underdrain collection system including the protective layer and piping system. Considering the nature of the foundation materials for TSF1, an isopach (3D settlement model) showing total settlement is not necessary for this site. The design report, including the revisions discussed below, provides our rationale.

See revised pages 77 and 78 of the TSF1 Design Report (NewFields, 2024a) for discussion regarding settlement and maintaining positive drainage (via gravity) in the underdrain collection system including the protective layer and piping system. The last sentence of Section 7.2 stated, "Based on the results, the estimated settlement will not compromise the liner system and/or the ability for the TSF to function as designed."

The following was added to the end of the last sentence in Section 7:

> "(i.e., maintaining positive grade in the underdrain collection system including the protective layer and piping system). The TSF geomembrane lined basin has an average slope of 30% but a minimum of 0.5% (in one isolated area of the TSF basin along the existing TSF Perimeter Road). Considering the minimum 0.5% basin slope, if zero settlement occurred at the toe of the facility and 3 inches occurred under the maximum load of the stack (over a distance of approximately 500 feet), the resulting change in grade would equal 0.05% which is an order of magnitude less than the minimum basin slope. Therefore, the underdrain collection system will maintain positive drainage considering maximum foundation settlement estimates within the basin."

ADEQ Comment # 9: *On page 193 of the Hermosa APP PDF file, on the drawing A262 Note 1 mentioned the GCL may be used in case of low permeability material not available at the site, please consider a CSI that need to be approved by ADEQ before using GCL to replace the low permeability layer.*

South32 Initial Response (April 18, 2024): All instances in the TSF1 Design Report (NewFields, 2024a) (drawings and report text) which allowed South32 to place either low permeability soil layer (LPSL) or geosynthetic clay layer (GCL) were revised to GCL only. The TSF1 basin areas which required LPSL remain unchanged. In the remaining areas, ADEQ

approval will be sought if South32 Hermosa proposes to replace the GCL with an LPSL in the future. A CSI can be added to the permit to implement this approach.

The revised Drawings include:

- Drawings A205, A220, A260, A262, and A264.

The text of the TSF1 Design Report (NewFields, 2024a) is revised as follows with changes in red:

- Section 5.2 (page 48)
  - Composite lining system on upstream embankment slope consisting of 60 mil double sided textured HDPE geomembrane overlying ~~either~~ 12 inches of LPSL or overlying GCL. See Drawing A220 for lining system plan view and specific locations for LPSL and GCL placement.
- Section 5.4 (page 50)
  - The interior face of the perimeter road will utilize a composite liner system consisting of 12 inches of LPSL (or GCL in specified areas) overlain by a 60 mil double sided textured HDPE geomembrane (BADCT 2.5.2.4). The TSF1 lining system plan view can be referenced on Drawing A220 including specific locations for LPSL and GCL. ~~The LPSL portion of the composite liner has a GCL alternative option in areas defined by the engineer (see Drawing A220).~~
- Section 5.5.2 (page 53)
  - ~~A~~ GCL (Cetco Bentomat DN9 or similar) is ~~considered an acceptable alternative to the 12-inch LPSL in~~ designated in specific areas of the TSF basin, see Section 6.11.3 for detailed GCL information, but geotechnical considerations prevent its use throughout the entire facility. LPSL and GCL limits can be referenced on Drawing A220. It should be noted that residual strength values for this interface were selected to model slope stability analysis due to the ~~high probability of~~ potential for movement along this interface during operations. The residual interface strength value~~s~~ defines where GCL can be placed with the TSF footprint.
- Section 6.2 (page 68)
  - GCL is specified in specific areas of the TSF1 basin instead of LPSL ~~an acceptable substitute for LPSL~~ but is limited by geotechnical stability considerations.

South32 Follow-up Response (June 3, 2024): Although South32 responded to this comment in its April 18, 2024 response letter, you subsequently noted that the legend for Drawing A220 still included the LPSL. This was discussed during our conference call on May 7, 2024, and, during our call, you indicated that revising the legend to state "Low Permeability Soil Layer Only" and "Geosynthetic Clay Liner (GCL) Only" would be an appropriate response. NewFields made this change in the revised Drawing A220. The revised drawing and title sheet are submitted as part of this transmittal.

ADEQ Comment # 10: *On Page 211 of the Hermosa APP PDF file, please consider as CSI to provide annual shaft remediation report to ADEQ.*

South32 Response: There is only a single historic shaft located within the expanded TSF1 footprint. The remediation of this shaft will be documented at the completion of construction in the Record of Construction Report for TSF1. A plan view showing the northing and easting of the historic shaft is shown on Drawing A100 and the proposed remediation sections and details are shown on Drawing A500. A borehole (BH22-08) was drilled in the center of the shaft and the borehole log can be referenced in Appendix D.3. A CSI to provide annual shaft remediation reports is not appropriate for the single historic shaft in the TSF1 footprint.

ADEQ Comment # 11: *On page 216 of the Hermosa APP PDF, the contour outside the existing stacking in the initial condition appears confusing. Please clarify or revise it by either replacing it with the current condition or depicting the state before the commencement of material placement.*

***South32 Response*:** See revised Figure 1. The "Initial Conditions" label was changed to "Start of Stacking."

ADEQ Comment # 12: *Please consider as the CSI, the Annual Report for the construction of the filtered tailings placement and waste rock placement, including aerial photos. Additionally, include the Construction Quality Assurance (CQA) report, ensuring that the materials placed align with the initial assumptions used during slope stability analysis.*

South32 Response: South32 Hermosa is willing to submit an annual report regarding filtered tailings and waste rock placement, pursuant to a CSI. The annual report will verify that the material placed aligns with the initial assumptions used for slope stability modeling and will include construction quality assurance (CQA) test results. If the CQA test results for the in-place material does not align with the initial assumptions used for slope stability modeling, additional slope stability modeling will be performed to incorporate the CQA data.

ADEQ Comment # 13: *On page 1329 of the Hermosa APP PDF file, please update Figure No. 1: Slope Stability Evaluation for TSF1 with all available Boreholes (BHs), Test Pits, and Cone Penetration Tests (CPTs).*

South32 Response: Figure 1A provided in Attachment C of this technical memorandum incorporates all the requested information onto a single figure. Figure 1A is provided for ADEQ's purposes but is not intended to be inserted into the TSF1 Design Report (NewFields, 2024a).

ADEQ Comment # 14: *On page 1329 of the Hermosa APP PDF file, please provide two separate figures: one depicting the current condition and another showing the final contour for Figure No. 1, which pertains to the Slope Stability evaluation sections TSF1.*

South32 Response): Figure 1B (start of material placement) and Figure 1C (end of material placement) comprise the requested figures and are provided in Attachment C of this technical memorandum. Figures 1B and 1C are provided for ADEQ's purposes but are not intended to be inserted into the TSF1 Design Report (NewFields, 2024a).

ADEQ Comment # 15: *On pages 1330 to 1344 of the Hermosa APP PDF file, please include the Boreholes (BHs), Test Pits, and Cone Penetration Tests (CPTs) on the four stability cross sections.*

South32 Response: Revised stability cross sections incorporating the requested information are provided in Attachment C of this technical memorandum. Please note, Section C did not intersect any boreholes, test pits, and/or cone penetration tests and therefore Section C is not included. The revised stability cross sections are provided for ADEQ's purposes but are not intended to be inserted into the TSF1 Design Report (NewFields, 2024a). For ease of reference BH-09, BH-11, BH-13, BH22-01, BH22 03, TP-13, TP-32, TP22-08 (which are shown in the cross sections) are included in Attachment C of this technical memorandum. The cone penetration tests are provided in Attachment A of this technical memorandum.

ADEQ Comment # 16: *On pages 1330 to 1344 of the Hermosa APP PDF file, please provide the output of the Stability software, with a specific emphasis on the critical surface and the associated Factor of Safety (FOS). Additionally, include information on the friction along each slice of the critical failure surface, as it pertains to confirming the potential failure passing through HDPE.*

South32 Response: Stability cross sections (with slices) and Slide outputs are provided in Attachment D of this technical memorandum. The stability cross sections and outputs are provided for ADEQ's purposes but are not intended to be inserted into the TSF1 Design Report (NewFields, 2024a).

ADEQ Comment # 17: *Please supply the earthquake deformation analysis for the liquefaction analysis. In the absence of such deformation analysis, consider it a Construction Quality*

Control/Quality Assurance (CSI) requirement to provide earthquake deformation analysis specifically for the filter dry stack.

***South32 Response**:* The following statement was added to Section 3.3.4 (Cyclic Direct Simple Shear) of the TSF1 Design Report (NewFields, 2024a) regarding liquefaction of natural foundation overburden below the TSF:

> "Liquefaction of natural foundation overburden below the TSF was not considered a hazard due to groundwater conditions at significant depth and the thin veneer of overburden overlying near surface rock."

See revised page 30 of the TSF1 Design Report (NewFields, 2024a).

***ADEQ Comment # 18:** Please provide the static liquefaction analysis and include the critical state line for static liquefaction. In the event that there is no existing static liquefaction analysis, consider it a Construction Quality Control/Quality Assurance (CSI) requirement to provide the static liquefaction analysis specifically for the filter dry stack.*

***South32 Response**:* Laboratory testing included isotropically and anisotropically consolidated undrained triaxial tests showing initially contractive behavior at small strains followed by phase transformation to dilative behavior as they strain to critical state. Brittle tailings behavior was not exhibited and therefore static liquefaction cannot be triggered.

South32 Hermosa suggests that the critical state line for future production tailings can be developed and included in the first Annual Report that is submitted after a minimum of eight months of filtered tailings placement.

Climate Memo

***ADEQ Comment # 19:** On page 276 of the Hermosa APP PDF file, in the 'Arizona Mine Site Meteorological Analysis,' ADEQ recommends the installation of a site weather station. This is advised due to the site's high elevation, allowing for the calibration and confirmation of weather data used for the project in comparison to station locations around the area.*

***South32 Response**:* South32 Hermosa uses a weather station located on site to collect site-specific data. The sites-specific data is presented and discussed in the Precipitation and Evaporation Analysis Report (Trinity, 2024). The Trinity report results were used to update Section 2.6.2 and Appendix A (Design Criteria) of the TSF1 Design Report (NewFields, 2024a). All replacement pages associated with this update are provided as part of this transmittal.

***ADEQ Comment # 20:** On page 278 of the Hermosa APP PDF file, please remove the Draft on Table 2 of the Meteorological Analysis March 2017 Technical Memorandum.*

***South32 Response**:* The Precipitation and Evaporation Analysis (Trinity, 2024) report replaces the Arizona Mine Site Meteorological Analysis (ERC, 2017) technical memorandum, so this comment is no longer applicable.

ADEQ Comment # 21: *On page 278 of the Hermosa APP PDF file, the data in Table 2 – Recorded Monthly Site Precipitation (inches) spans from 2007 to 2016. Please update the report using appropriate values with the most recent available data, as per the water balance model, which includes data from 2008 to 2022 (see Table 4.2 on page 1353 of the Hermosa APP PDF file (page 8 of the Water Balance report). NOTE: The values in the "Annual" column on Page 278 for the years 2015 and 2016 are slightly different from that shown in the "Total" column on page 1353.*

***South32 Response**:* The Precipitation and Evaporation Analysis (Trinity, 2024) report includes recorded site precipitation values up to the end of 2022. The Trinity site precipitation values were used to update the TSF Water Balance Assessment (ERC, 2024), which is discussed in Section 8 and Appendix I of the TSF1 Design Report (NewFields, 2024a). All replacement pages associated with this update are provided as part of this transmittal.

The water balance model update resulted in an increased minimum pumping rate from the UDCP to water treatment being required to maintain freeboard during average precipitation conditions plus precipitation from a 100-year, 24-hour storm. This minimum pumping rate increased from 400 gpm to 495 gpm in the updated water balance model. Although the minimum pumping rate is 495 gpm, South32 has conservatively selected 720 gpm, considering the results of the various scenarios presented in the TSF Water Balance Assessment (ERC, 2024).

ADEQ Comment # 22: *On page 283 of the Hermosa APP PDF file, the report titled 'Hansen, et al., Hydrometeorological Report No. 49 (HMR 49), Probable Maximum Precipitation – Colorado River and Great Basin Drainages, National Weather Service, Silver Spring, MD, reprinted 1984.' is approximately 40 years old. Please provide justification for the continued use of this data and explain why it is considered still valid for the project.*

***South32 Response**:* The Precipitation and Evaporation Analysis (Trinity, 2024) report calculates the probable maximum precipitation (PMP) event using HMR 49 as well as an updated methodology developed by Applied Weather Associates, LLC (AWA) for the Arizona Department of Water Resources (ADWR) in July 2013. The PMP values calculated by Trinity using the AWA methodology were used to update Section 2.6.5, Section 9, and Appendix G.5 of the TSF1 Design Report (NewFields, 2024a). The PMP values from HMR 49 and AWA are presented in the table below:

Probable Maximum Precipitation Calculation Methodology	Local Probable Maximum Precipitation (6 hours)	General Probable Maximum Precipitation (72 hours)
HMR 49	14.63 inches	20.81 inches
AWA	16.00 inches	20.46 inches
Difference (total depth)	+1.37 inches	-0.35 inches

The newer AWA values were utilized to update the TSF1 design. Please note, the AWA results not only modify the total precipitation depth for the PMPs but also modify the hydrograph. For example, the PMP hydrograph from HMR 49 contained a maximum rainfall intensity of 7.99 inches over a 15-minute increment (31.96 inches per hour) compared to the PMP hydrograph from AWA which contains a maximum rainfall intensity of 3.34 inches over a 10-minute increment (20.05 inches per hour).

In general, the updated hydrology calculations (using the AWA PMP values) resulted in a decrease in maximum flow rate due to the decrease in maximum storm intensity. As a result, one revision was made to the TSF1 design elements which involved re-sizing of the TSF1 stilling basin (see Drawings A272, A274 and A276). The TSF1 stilling basin has been reduced in size to match the new peak flow rate resulting in the following changes (see Drawing A276 for dimension callouts):

Stilling Basin Dimension		
Dimension	**Previous Value**	**Revised Value**
L_{111}	17 ft	12 ft
W_1	10 in	8 in
S_1	10 in	8 in
H_1	10 in	8 in
D_1	10 in	8 in
H_3	17 in	13 in
W_3	12 in	10 in
S_3	12 in	10 in
H_4	14 in	11 in
D_2	6.75 ft	4.5 ft
D_2 + FB	7.75 ft	5.5

No other design elements required revisions. In addition, Drawing A410 (Pond Filling Curves) was updated to show the revised PMP storage level or Probable Maximum Flood (PMF) water

level on the filling curves. All replacement pages associated with this update are provided as part of this transmittal.

ADEQ Comment # 23: *Please update the data on Table 8 – Pan Evaporation Recorded at the Site (inches) on page 288 of the Hermosa APP PDF file. The current data covers the period from 2007 to 2016. Do the same for the evaporation data in the Water Balance memo (see page 1356).*

South32 Response*:* The Precipitation and Evaporation Analysis (Trinity, 2024) report includes recorded site evaporation values up to the end of 2022. The Trinity evaporation values were used to update the TSF Water Balance Assessment (ERC, 2024) which is discussed and presented in Section 8 and Appendix I of the TSF1 Design Report (NewFields, 2024a). All replacement pages associated with this update are provided as part of this transmittal.

ADEQ Comment # 24: *On page 288 of the Hermosa APP PDF file, the data on Table 9 – Completeness of Pan Evaporation Recorded at the Site spans from 2007 to 2016. Please update the dates with the most recent available data, as indicated in the water balance model, which includes information from 2008 to 2022.*

South32 Response*:* The Precipitation and Evaporation Analysis (Trinity, 2024) report includes recorded site evaporation values up to the end of 2022. The Trinity evaporation values were used to update the TSF Water Balance Assessment (ERC, 2024), which is discussed and presented in Section 8 and Appendix I of the TSF1 Design Report (NewFields, 2024a). All replacement pages associated with this update are provided as part of this transmittal.

Water Balance

ADEQ Comment # 24: *On page 1360 of the Hermosa APP PDF file, "The water balance model was developed using an analytical spreadsheet model developed in Microsoft Excel." ADEQ recommends developing a GoldSim model for the future water balance, allowing for calibration and adjustments based on site-specific data.*

South32 Response*:* Thank you for your recommendation. The method used to develop the current water balance is reliable and accurate. However, South32 and NewFields will evaluate the potential for developing a GoldSim model for use in future water balance updates.

ADEQ Comment # 25: *On Page 1354 of the Hermosa APP PDF file, "Table 4.4 summarizes the precipitation depths with modifications set by the predicted climate change effects on design storm intensity for the year 2030." Please provide the dry and wet conditions for the water balance to support the pumping rate and ensure a satisfactory freeboard. Additionally, include*

the project strategy for managing excess water or addressing water deficits in the overall project plan.

***South32 Response**:* The following information was added to Section 4.2.1 of the TSF Water Balance Assessment (ERC, 2024) regarding dry and wet conditions for the water balance:

- "The data shows, the site has distinct wet and dry seasons including an annual monsoon system that typically occurs in July, August, and September. Given that the data set is generated from the on-site weather station over an extended period of time, it represents the current best estimate of site precipitation and was therefore used as the basis for this analysis."

  Information was added to Section 4.2.3 of the TSF Water Balance Assessment (ERC, 2024) regarding future modification of dry and wet conditions for the water balance based on predicted climate change. Climate change was applied on a quarterly basis (instead of annual) to account for a minor increase in expected precipitation during July, August, and September (third quarter). Precipitation is expected to decrease quarterly in all but the third quarter (monsoon season) where it is expected to increase by approximately 3.9%. Although precipitation is expected to decrease from October through June no adjustments were made to those months. See Section 4.2.3 of the TSF Water Balance Assessment (ERC, 2024) for additional information.

  The following information was added to Section 2.0 of the TSF Water Balance Assessment (ERC, 2024) regarding the project strategy for managing excess water or addressing water deficits in the overall project plan:

- "From a water management standpoint, dry conditions do not negatively impact the water balance because the intent is to maintain as little water as practicable in the UDCP. Given the desire to maintain the UDCP with as little water as practicable, no action will be taken when the pond is empty. For wet conditions, water that accumulates in the UDCP will be directed to water treatment. The minimum required pumping rate for sending water from the UDCP to water treatment considers historic site-specific precipitation data with projected climate change values and theoretical design storm events along with the requirement that freeboard be maintained. The evaluation considers historic site-specific precipitation data including a 7-day interval of 12.37 inches of rainfall and a 30-day interval of 18.38 inches of rainfall. The 7-day (12.37 inches) and 30-day (18.38 inches) periods of rainfall exceed the 7-day and 30-day, 1,000-year storm events as determined by the NOAA Atlas 14 Point Precipitation Frequency Data Server."

ADEQ Comment # 27: *On Page 1348 of the Hermosa APP PDF file, please explain the distinction between active and passive evaporation as depicted in Figure 3.1 of the Water Balance Model Schematic.*

Response*:* The following information was added to Table 3.1 of the TSF Water Balance Assessment (ERC, 2024) regarding the distinction between active and passive evaporation:

- "Active Evaporation" was revised to "Active Evaporation (Evaporative Blowers)" and "Passive Evaporation" was revised to "Passive Evaporation (Evaporation Losses Due to Ambient Conditions)."

ADEQ Comment # 28: *On Page 1353 of the Hermosa APP PDF file, it is noted that as part of the water balance analysis, the system was assessed for a 100-year, 24-hour storm occurring at the end of each day, considering a dataset spanning from 2008 to 2022 (14 years). Please explain the process to obtain 100-year, 24-hour storm.*

South32 Response*:* Please reference Section 4.2.2 (page 9) of the TSF Water Balance Assessment (ERC, 2024), which states, "precipitation depths caused by the 100-year, 24-hour recurrence interval storm at the project site were obtained from NOAA Atlas 14 Point Precipitation Frequency Data Server."

ADEQ Comment # 29: *On Page 1353 of the Hermosa APP PDF file mentioned "precipitation from 2011 was selected to represent average conditions. The total precipitation recorded in 2011 of 23.01 inches was 3% greater than the 15-year average." From the Table 4.2. Monthly Precipitation Totals (2008-2022) in inches, the total precipitation value for 2022 is 25.05 inches. Please justify / clarify the text.*

South32 Response: Table 4.2 was revised to match the data presented in the Precipitation and Evaporation Analysis (Trinity, 2024) report. A row showing average values can be referenced in Table 4.2 of the TSF Water Balance Assessment (ERC, 2024) so that precipitation from 2011 and average values can be easily compared. The rationale regarding the selection of 2011 to represent average values is presented on revised page 8 of the TSF Water Balance Assessment (ERC, 2024):

> "As part of the water balance analysis, the system was evaluated for a 100-year, 24-hour storm occurring at the end of each day over a period of average precipitation. This requires selection of "average" daily site precipitation. It is not appropriate to simply use the average of each day over the 15-year period of available data as this approach mutes the depth of storms that occur. Instead, a single year from the data record was selected to represent annual conditions. After reviewing the available data, 2011 was selected to represent an average year. It was selected because:

- The annual precipitation of 23.01 inches that occurred in 2011 is most similar to the long-term average of 22.23 of any year.
- 2011 included drier than average periods (May and June) and wetter than average periods (July through September) as could occur in a typical year.
- 2011 follows the site's typical pattern of a relatively wet July through September and relatively dry October through June.
- Having both a dry and wet period in the "average" year makes the selection of 2011 a conservative modeling approach.
- Individual days of significant rainfall events in excess of one inch (1.96 inches on March 16th,
- 2.39 inches on September 1st, 1.44 inches on September 9th and 1.13 inches on December 13th) occurred during 2011. Using a year with larger events such as this helps ensure results are conservative."

ADEQ Comment # 30: *Please provide the annual water balance data, differentiating the inflow and outflow for each facility, and provide a revised Figure 3.1 in Appendix I, Water Balance in Attachment A showing volume of inflows and outflows. Additionally, present any deficit or excess water that the project may experience throughout the life of the mine.*

South32 Response: Annual inflows and outflows for each facility are dynamic, given the evolving configuration of TSF1. For this reason, it is not practical to include these results in Figure 3.1 in Appendix I. To present the requested data, Table 5.1 was added on Page 17 of the TSF Water Balance Assessment (ERC, 2024), showing annual inflows to the system, outflows from the system, and changes in UDCP storage. Changes in UDCP storage represent the deficit or excess water at the end of each year. Please note that 2032 was modeled as a partial year (January to September) that ends at the conclusion of the monsoonal season. Therefore, 2032 shows more water stored in the UDCP ("Delta Storage" row) than the other years, which were full year model runs. Presented values are based on 2011 precipitation.

ADEQ Comment # 31: *The Water Balance section of the application indicates there is an "Active Evaporation" system. It does not appear that this system was previously evaluated and included in the permit as an additional feature of the BADCT for the Underdrain Collection Pond. Please clarify and provide information related to the active evaporation system including but not limited to the number of units, steps that are implemented to minimize overspray, steps that will be taken during high wind speeds, manufacturer's specifications, etc.*

South32 Initial Response (May 16, 2024): Water from TSF1 will collect in the UDCP. Although not required to meet the freeboard requirements for the design storm event, four mechanical evaporators will be installed at the UDCP. These evaporators are included in the proposed ADEQ air quality permit, and emission rates for particulate matter, including PM10 and PM2.5,

have been calculated. South32 Hermosa will follow all manufacturer's recommendations and air quality permitting requirements when operating the evaporators.

Under the proposed air quality permit, only three of the four evaporators may be used at any one time. Each evaporator may be operated no more than 876 hours per year based upon a 12-month rolling total and records will be maintained on the operating hours of each evaporator unit. Evaporators may run only during daylight hours, and their use will be discontinued during high-wind events to minimize overspray. The proposed ADEQ air quality permit allows the use of nozzle "type" evaporators with a system flow rate of 66 gpm.

South32 Follow-Up Response (July 2, 2024): Active evaporation is not necessary to comply with prescriptive Best Available Demonstrated Control Technology (BADCT) for the Underdrain Collection Pond (UDCP.) The BADCT Manual states that the appropriate design storm return period is 100 years unless another regulatory program requires a larger design or there is a threat to human life. Neither is the case. The Water Balance Assessment (ERC, 2024) does mention the evaporators but states that they would only be used in the event of a 1 in a 1,000-year storm event. As a result, active evaporation is not necessary to meet prescriptive BADCT.

South32 is, however, providing the material requested on the evaporators for informational purposes. Hermosa currently has four evaporators on-site; none are in use or are even connected at present. The evaporators could, however, be used in an emergency, such as a 1 in 1,000-year storm event. Under the ADEQ air quality permit, only three of the four evaporators may be used at any time. The permit specifies the use of nozzle "type" evaporators with a system flow rate of 66 gallons per minute. Each evaporator may only be operated 876 hours per year based upon a 12-month rolling total, and records will be maintained on the operating hours of each evaporator unit. Evaporators may only be used during daylight hours.

The four evaporators present on-site are SMI Evaporative Solutions "Super Polecat Evaporators." The manufacturer's specifications for the evaporators are included in Attachment H accompanying this submittal.

ADEQ Comment # 32: *Explain why the model does not account for direct precipitation on the expanded TSF1 footprint (see Figure 3.1 in Appendix I, Water Balance in Attachment A).*

South32 Response: The Water Balance does account for direct precipitation on the expanded TSF1 footprint. Please reference Section 4.1 of the TSF Water Balance Assessment (ERC, 2024) stating, "The areas contributing runoff and direct precipitation to the UDCP considering the TSF1 expanded footprint were input into the water balance model. The land types and surface areas used to model runoff characteristics are presented in Appendix A as a function of time."

ADEQ Comment # 33: *Explain why the water balance model is only evaluated for the period between 2024 and 2032.*

South32 Response: The Water Balance evaluates the period between 2024 and 2032 because those years are the anticipated operational timeframe for TSF1.

Seismic Hazard Analysis

ADEQ Comment # 34: *On Page 233 of the Hermosa APP PDF file, it is stated that "Historical seismicity in the region was reviewed to identify earthquake events with a moment magnitude (Mw) of 4.0 or greater." Please provide justification for the rationale behind specifically using earthquake events with a moment magnitude (Mw) greater than 4.0 in the review of historical seismicity in the region.*

South32 Response: Additional information was added to Section 2.4 (Seismic Hazard) of the TSF1 Design Report (NewFields, 2024a) regarding the rationale for using earthquake events with a moment magnitude greater than 4.0 in the review of historical seismicity in the region. The bullet stating:

- "The historic earthquake search indicates few sizeable seismic events have been recorded within the vicinity of the Project since 1850" was revised as follows:
  - "The historic earthquake search was limited to magnitude events greater than 4.0. Commonly it is assumed that events less than magnitude 5.0 do not generate sufficient energy to negatively influence engineered structures, but due to the paucity of historic events greater than this threshold, the threshold was reduced to a magnitude 4.0 to provide a more detailed spatial review of historic events. The search indicates few sizeable seismic events have been recorded within the vicinity of the Project since 1850."

See revised page 10 of the TSF1 Design Report (NewFields, 2024a).

ADEQ Comment # 35: *On Page 235 of the Hermosa APP PDF file, please provide the V_{s30} value from geophysical data from the site as mentioned on page 4 of the report "For seismic hazard evaluations, the averaged shear wave velocity in the upper 100 - feet below the ground surface (V_{s30})".*

South32 Response: Additional information was added to Section 2.4 (Seismic Hazard) regarding the shear wave velocity data. The bullet stating:

- "Foundation conditions below the facility are based on a seismic site class B" was revised as follows:

  - "Foundation conditions below the facility are based on a seismic site class B developed from measured shear wave velocity data (presented in Appendix E of NewFields' Tailings and PAG Material Remediation, Placement and Storage Project (2017b)). A value of 2,800 ft/sec was used with the ground motion prediction equations."

See revised page 10 of the TSF1 Design Report (NewFields, 2024a).

ADEQ Comment # 36: *On Page 240 of the Hermosa APP PDF file, please provide the following references:*

a. *Boore, D.M., Stewart, J.P., Seyhan, E., and Atkinson, G.M. (2014). NGA-West2 Equations for Predicting PGA, PGV, and 5% Damped PSA for Shallow Crustal Earthquakes, Earthquake Spectra, Vol. 30 (3).*
b. *Campbell, K.W., and Bozorgnia, Y. (2014). NGA-West2 Ground Motion Model for the Average Horizontal Components of PGA, PGV, and 5% Damped Linear Acceleration Response Spectra, Earthquake Spectra, Vol. 30 (3).*
c. *Chiou, B.J., Youngs, R. R. (2014). Update of the Chiou and Youngs NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra, Earthquake Spectra, Vol. 30 (3).*

South32 Response: These references were provided to ADEQ via email on February 15, 2024.

ADEQ Comment # 37: *Please provide the natural frequency of the TSF.*

South32 Response: Additional information was added to Section 2.4 (Seismic Hazard) regarding the natural frequency of the TSF. A bullet was added stating the following:

- "The uniform hazard response spectra (UHRS) is included in the existing Seismic Hazard Analysis (SHA) (Appendix B). The natural period of the future TSF, after completion of stacking is estimated to be approximately 1.2 seconds for the maximum section to approximately 0.5 seconds for the average fill heights."

See revised page 11 of the TSF1 Design Report (NewFields, 2024a).

ADEQ Comment # 38: *On Page 237 of the Hermosa APP PDF file, Table 4.1 Probabilistic Design Accelerations presented the PGA for different return period the values is around half of the values for the nearby mining site (Copper World). See "Site-Specific Seismic Hazard Analyses and*

Development of Design Ground Motions for Rosemont Copper World Project, Arizona." Please explain the reason for difference between UHS of the two- close mining site.

South32 Response: The reported peak ground acceleration values for the Hermosa Project are not approximately half of the values reported for the nearby mining site (Copper World). The reported peak ground acceleration values for the two projects are relatively close. In fact, for the three return intervals that were analyzed in both applications, the mean values presented for the Hermosa project are greater than the reported mean values for the Copper World project. The peak ground acceleration for a 475-year return event was reported as 0.03g for the Hermosa project, versus 0.024g for the Copper World project. For the 5,000-year return event, the peak ground acceleration was reported as 0.15g for the Hermosa project, versus 0.115g for the Copper World project. And for the 10,000-year return event, the peak ground acceleration was reported as 0.22g for the Hermosa project, versus 0.173g for the Copper World project.

Other

ADEQ Comment # 39: *The application indicates that the expansion of TSF1 will provide an additional capacity of approximately 5.4 Mcy of total storage capacity. However, the "Material to be stored in the TSF1" is presented 6.9 Mcy. Explain the discrepancy and revise as necessary.*

South32 Response: See page 48 of the TSF1 Design Report (NewFields, 2024a), where the storage capacities are presented in Table 5.1. The TSF is currently permitted to store 2.6 million cubic yards (Mcy) of material. To date, 1.1 Mcy of material has been permanently placed in the TSF (largely as a result of Voluntary Remediation Program work), leaving 1.5 Mcy of storage capacity remaining. TSF1 will create an additional 5.4 Mcy of storage capacity beyond the 2.6 Mcy which is currently permitted, bringing the total storage capacity to approximately 8 Mcy (2.6 Mcy plus 5.4 Mcy). The 1.5 Mcy (which is currently permitted but has not been utilized to date) and the additional 5.4 Mcy of storage capacity created by TSF1 equates to 6.9 Mcy of available storage capacity for future material placement.

ADEQ Comment # 40: *What does TSF-AD in Table 5.2 mean represent?*

South32 Response: TSF-AD stands for the Tailings Storage Facility Amended Design submitted to ADEQ in 2020 as the "Hermosa Project – Trench Camp Property, Aquifer Protection Permit SIGNIFICANT Amendment Application, P-512235, Santa Cruz County, Arizona" dated August 14, 2020. The Tailings Storage Facility Amended Design permitted additional storage capacity through lateral and vertical expansion of the stacking while remaining entirely within the existing constructed geomembrane lined TSF basin. That amendment was approved in August 2021.

"TSF-AD" in Table 5.1 was revised to "Tailings Storage Facility Amended Design (NewFields, 2020b)." Please note Table 5.2 was revised to Table 5.1 (see comment 41).

ADEQ Comment # 41: *Information pertaining to quantities or volumes of filtered tailings, waste rock, construction cut, and miscellaneous materials presented in Appendix A Design Criteria does not seem to match the application of the existing permit. Explain the discrepancy of revise as necessary.*

South32 Response: See revised page 47 of the TSF1 Design Report (NewFields, 2024a). Table 5.1 was removed and a reference to Appendix A was provided instead. The sentence stating:

- "Table 5.1 shows the quantities for the various materials to be placed within TSF1 (estimated by South32)." was revised as follows:
    - "The quantities of the various materials to be placed within TSF1 (estimated by South32) are presented in Appendix A."

The values presented in Appendix A reflect the most up to date estimates where Table 5.1 did not.

ADEQ Comment # 42: *The Contingency Plan (see Section 3 and 4) indicates that in the event of the freeboard is approaching the established limit or there is a potential for overtopping of the Underdrain Collection Pond, the solutions may be recycled back into the TSF. Explain where the solutions will be placed on the TSF and confirm that the Engineer of Record (EOR) has approved this contingency action. Indicate a maximum volume that may be placed on the TSF during such events as discussed above and provide the rationale.*

South32 Response: Solution in the UDCP that is recycled back into the TSF as part of the Contingency Plan, will be discharged into the inlet of the 24 inch diameter CPe Detention Pond Outfall and Underdrain Pipe located at the southeast side of the facility. The water that is recycled back into the TSF will enter the underdrain collection system and report back to the UDCP. Recycling water from the UDCP back to the TSF will provide a temporary reduction in water volume at the UDCP. Recycling of water from the UDCP is not limited to a maximum volume because the water will not be detained in the TSF but rather return to the UDCP through the normal function of the underdrain collection system. The Engineer of Record (Craig Thompson – NewFields) has approved this contingency approach.

ADEQ Comment # 42: *In the application include Operation and Maintenance (O&M) actions that will be taken by field staff when O&M actions are to be implemented during inspections as required by the permit.*

South32 Initial Response (April 18, 2024): Please reference Appendix J of the TSF1 Design Report (NewFields, 2024a) where a summary of the Operations, Maintenance, and Surveillance (OMS) Plan in association with TSF1 is provided. The OMS Plan lists inspection items, areas of

focus, and inspection type and frequency. In addition, in conjunction with the EOR, an OMS Manual (South32 Hermosa Inc, 2024b) was prepared for TSF1 (see Attachment E of this technical memorandum).

South32 Follow-up Response (June 3, 2024): After South32 responded to this comment, you subsequently noted that in Table 6.2 of the OMS Manual, did not provide follow-up actions for certain situations. In response, South32 revised the OMS to ensure that follow-up actions are identified in the OMS for all TSF1 conditions. The revised OMS Manual (South32 Hermosa Inc, 2024b) for TSF1 is provided as Attachment E to this memorandum.

ADEQ Comment # 44: *Please provide the Failure Mode and Effects Analysis (FMEA) for the TSF and monitoring for mitigation of the FMEA for the TSF.*

South32 Response: The results of the Failure Mode and Effects Analysis (FMEA) for TSF1 are presented in the Emergency Preparedness and Response Plan (EPRP) for TSF1 (South32 Hermosa Inc, 2024a). The current version of the EPRP is presented in Attachment F of this technical memorandum. The EPRP will be revised and optimized as needed in the future.

ADEQ Comment # 45: *In the Contingency Plan, include a description of procedures, personnel, and equipment proposed to mitigate unauthorized discharges.*

South32 Response: The following description of procedures, personnel and equipment has been added to the Contingency Plan to mitigate an unauthorized discharge:

- Actions may include but are not necessarily limited to:
    - Control of the source of the unauthorized discharge,
    - Soil cleanup and/or removal,
    - Cleanup of affected surface waters,
    - Cleanup of affected parts of the aquifer, or
    - Mitigation measures to limit the impact of pollutants on existing uses of the aquifer.

- Personnel used to mitigate an unauthorized discharge may include but is not limited to South32 Hermosa onsite personnel such as the Site Services Manager, Health, Safety and Security Manager, Responsible Tailings Facility Engineer as well as offsite personnel such as the Accountable Executive, Vice President Project Delivery, Communities Specialist and Director, Environment and Permitting. Other South32 Hermosa on-site employees also may be called in to assist, depending on the nature of the response action. Non-South32 Hermosa employees will be utilized as needed, such as the Engineer of Record, licensed contractors, water treatment specialists, drillers, and environmental consultants.

- Equipment used to respond to an active unauthorized discharge may include but is not limited to mine radio / telephone system for communication, earth moving equipment to help direct and contain flow or develop emergency access, roadblocks to prevent access to any potentially dangerous areas, and digital cameras or mobile phones to document the event.

- Equipment used after an unauthorized discharge to mitigate impacts may include but is not limited to sampling equipment (i.e., excavator, drill rig, or direct push rigs), vac trucks, pumps, earth moving equipment. If water treatment is necessary, pumps, treatment technology, and tanks may be deployed.

References

Clear Creek Associates, LLC, (2023), Hermosa Project, Aquifer Protection Permit, Significant Amendment Application, P-512235, Santa Cruz County, Arizona, dated December 21, 2023.

Ecological Resource Consultants, Inc., (2017), Arizona Mine Site Meteorological Analysis, dated March 13, 2017.

Ecological Resource Consultants, LLC, (2024), TSF Water Balance Assessment dated May 9, 2024.

NewFields Mining Design & Technical Services, (2024a), Hermosa Project, Tailings Storage Facility 1 (TSF1), Aquifer Protection Permit (APP) Significant Amendment, Best Available Demonstrated Control Technology (BADCT) Design dated December 8, 2023 (Revised May 9, 2024).

NewFields Mining Design & Technical Services, (2024b), Hermosa Project, Tailings Storage Facility 1 (TSF1) Undrained Stability Model Results, dated May 31, 2024.

South32 Hermosa Inc, (2024a), Emergency Preparedness and Response Plan (EPRP) for Tailings Storage Facility 1 (TSF1), dated April 10, 2024.

South32 Hermosa Inc, (2024b), Tailings Storage Facility TSF1 Operations, Maintenance and Surveillance Manual, dated May 2024.

Trinity Consultants, (2024), Precipitation and Evaporation Analysis, dated April 2024.