Noise Impact Assessment for the Proposed Land Use Reclassification

West Can Seal Coating Gravel Pit
8-35-32-6 W5M

Prepared for:
Matthew Arnill
West Can Seal Coating Inc.

Prepared by:

Michel Freitas, PMP
Sanath Hapuarachchi, Technician
Richard Patching, M.Eng., P.Eng.

Patching Associates Acoustical Engineering Ltd.

Consultants in Acoustics, Noise Control and Vibrations

October 22, 2012
File: 2012-3469

Notice

This report has been prepared by Patching Associates Acoustical Engineering Ltd (PAAE) in response to a specific request for service from, and for the exclusive use of, the Client to whom it is addressed. The findings contained in this report are based, in part, upon information provided by others. The information contained in this study is not intended for the use of, nor is it intended to be relied upon, by any person, firm, or corporation other than the Client to whom it is addressed, with the exception of the applicable regulating authority to whom this document may be submitted.

PAAE accepts no liability or responsibility for any damages that may be suffered or incurred by any third party as a result of the use of, reliance on, or any decision made based on this report.

Executive Summary

Patching Associates Acoustical Engineering Ltd. was retained by West Can Seal Coating Inc. to evaluate and predict the noise level from the proposed Gravel Pit to be located in the west of Sundre on Section 8-35-32-6 W5M.

The study was conducted in order to:

- Assess the sound data of typical equipment and operations that are proposed for the West Can Seal Coating Gravel Pit,
- Predict the noise level from exploration phases, during the Stripping stage, and the Crushing and Transportation operation phase at the potentially most affected receiver locations.

This noise impact assessment was conducted in accordance with requirements of the Energy Resources Conservation Board (ERCB) Noise Control Directive 038, as the project area has no explicit noise regulations limiting the noise levels from this type of industry.

The proposed gravel extraction component of the project will be divided in 4 phases grouped into 2 major operations; stripping and gravel extraction, crushing, washing, asphalt production and transportation.

The sound power levels emitted from the facility were determined through the use of theoretical calculations and field measurements of similar facilities. Sound propagation calculations were then undertaken to determine the sound pressure level that will exist at the most impacted residences around the facility for proposed four (4) exploration phases in 8 scenarios to be located at different depths. The modeling was performed using the CadnaA noise-modeling package.

The following table summarises the predicted noise levels based on the **Stripping Operation** phase and **Crushing, Washing, Asphalt production & Transportation** Operation phase of the project in the pit area.

Summary of Predicted Noise Levels Generated by Stripping and Crushing, Washing, Asphalt production & Transportation Operation Activities from the Proposed Inland Gravel Pit Under downwind conditions

Location	Predict Noise Level Day Time plus Ambient Sound Level (dBA)							
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8
Receiver 1	54	60	52	60	53	59	62	60
Receiver 2	50	49	51	51	61	55	52	50
Receiver 3	50	48	52	50	61	54	53	49
Receiver 4	50	47	60	53	56	49	54	48
Receiver 5	50	46	54	49	51	47	50	47
Receiver 6	50	47	49	46	47	46	48	46
Receiver 7	55	47	52	47	47	46	52	46
Receiver 9	49	57	47	57	47	57	50	57
Receiver 8	47	48	47	48	48	48	48	48

Table of Contents

Introduction and Scope-of-Work

Patching Associates Acoustical Engineering Ltd. was retained by West Can Seal Coating Inc. to evaluate and predict the noise level from the proposed Gravel Pit to be located in the West of Sundre on 8-35-32 W5M.

The study was conducted in order to:

- Assess the sound data of typical equipment and operations that are proposed for the West Can Seal Coating Gravel Pit,
- Predict the noise level from exploration Phases during the Stripping stage, and the Crushing and Transportation operation phase at the potentially most affected receiver locations.

This noise impact assessment was conducted in accordance with requirements of the Energy Resources Conservation Board (ERCB) Noise Control Directive 038.

Noise Criteria

The proposed location for the gravel pit has no stated noise guidelines for the gravel industry. Therefore, this NIA follows the methodology of Directive 038 from the Alberta Energy and Resources Conservation Board (ERCB). The ERCB Directive permits specified sound levels attributable to energy industry facilities at designated receptor points. These allowable limits are dependent on the population density, proximity to heavily traveled transportation routes (motor vehicles, rail and aircraft) and other specified adjustments. Note that the ERCB directive does not strictly apply to gravel operations, but is used to assess reasonable noise limits for this area.

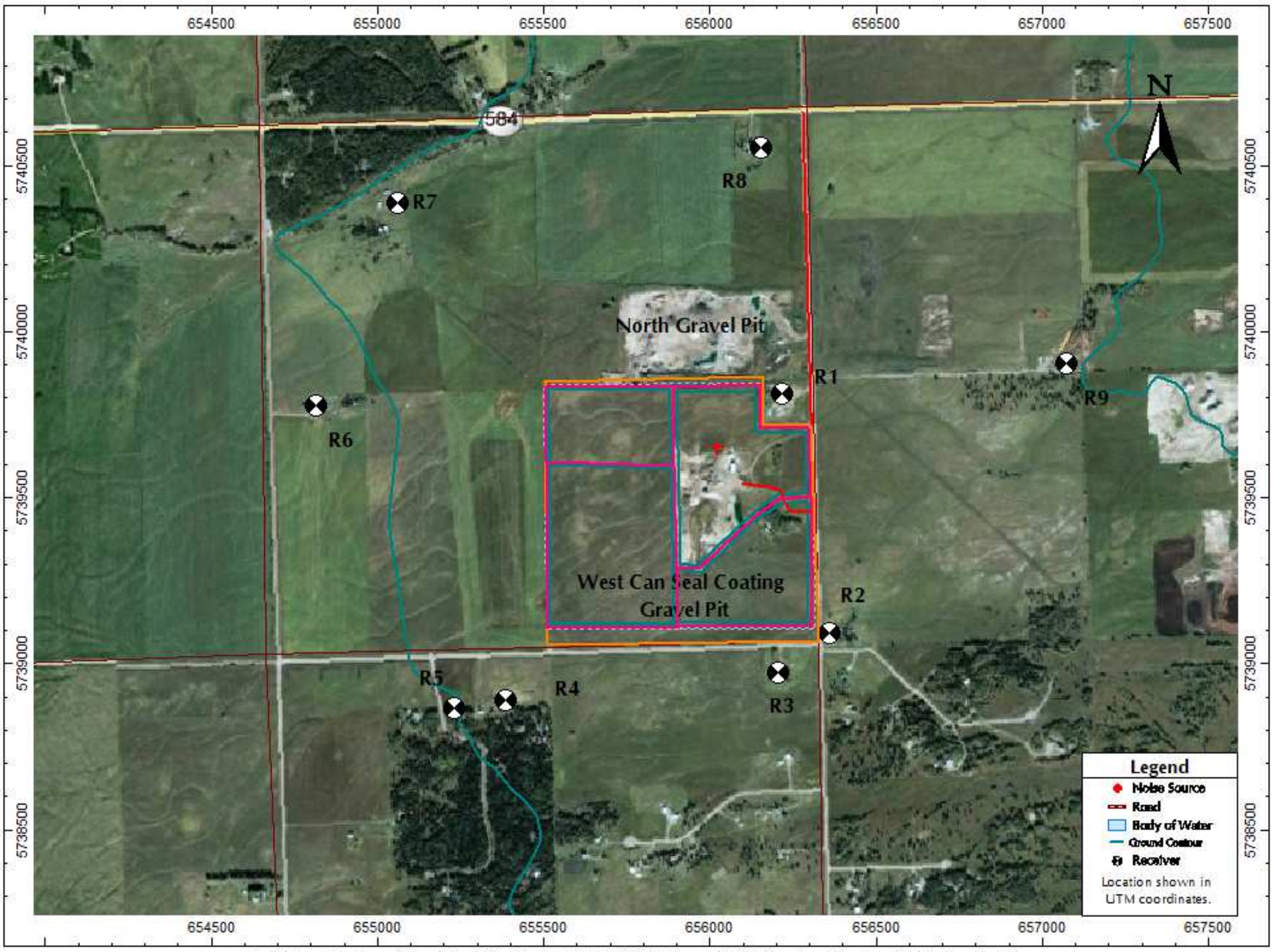
The Permissible Sound Level (PSL) is the limit that the sound emanating from a facility may not exceed over a specified period, as measured in the yard of the nearest, most impacted, or complainant's residence and including the average ambient sound level. The average ambient sound level is assumed to be 5 dBA less than the Basic Sound Level (BSL) for nighttime described by the Directive.

The L_{eq} is the equivalent-continuous sound level. This index is an energy average of the varying sound levels over a specified period. The use of this index permits the description of a varying sound level environment as a single number. As the L_{eq} is an "average" level, the measured sound level may exceed the criterion level for a short period, provided that the duration is limited. The L_{eq} value considers both the sound level and the length of time that the sound level occurs. Appendix A provides a detailed explanation of the L_{eq} index. In this report, for the most part, the L_{eq} levels are A-weighted.

Project Study Area

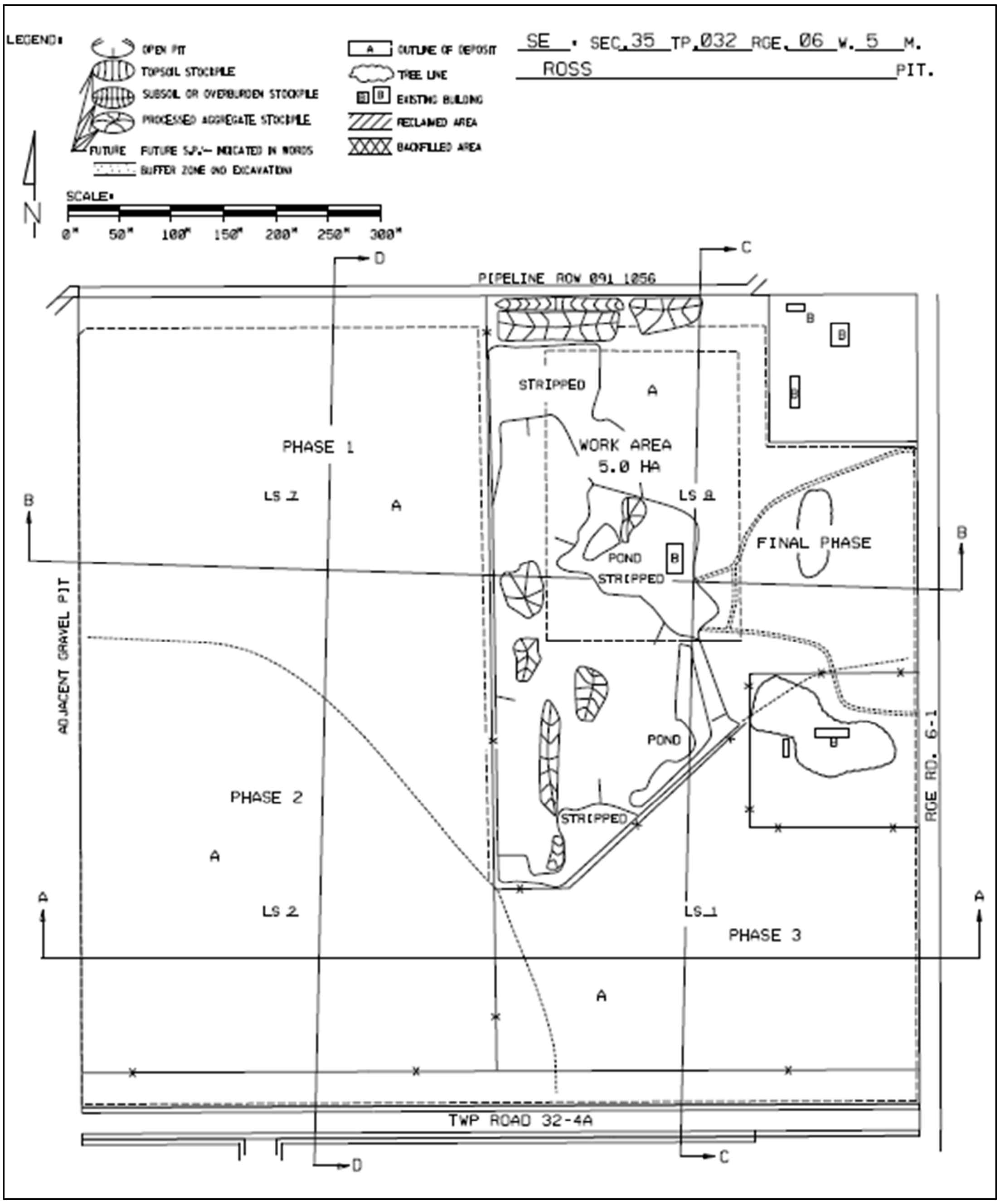
The project study area is located in the west of Sundre. The terrain around the gravel pit is mainly flat and grassed, with the elevation rising to the northwest. There is another gravel pit located along the north boundary of the proposed pit. There are residences located around the proposed project area .Figure 1 & 2 presents an overview of the project study area.

Figure 1: Overview of the project study area.



Aerial Image Courtesy of Google Earth Pro, Version 5.0.11733.9347 Licensed to Patching Associates Acoustical Engineering Ltd.

Figure 2: Overview of the project study area



Proposed Major Operations

The proposed gravel extraction component of the project will be divided in 4 phases grouped into 2 major operations; Stripping and Crushing, Washing, Asphalt production and Transportation. The facility equipment details are shown in Table 1.

Table 1: Major Equipment Details

Equipment Description	Equipment Details
Operation 1 – Stripping	• Two (2) CAT 627 or Terex TS14 Motor Scrapers • Engine Exhausts are assumed to be equipped with Hospital grade Silencers
Operation 2 – Crushing, Washing, Asphalt production & Transportation	• Three (3) CAT 980 Loader • One Feed Hopper and Conveyor • One (1) 22″ X 42″ Jaw Crusher and 6′ X 16′ Double Deck Vibratory Screener • One (1) 54″ Cone Crusher • One 7′ X 20′ Triple Deck Vibratory Screener • Surge Bin and Conveyor • Three (3) CAT 980 Loader (Asphalt Plant) • One (1) CAT 980 Loader (Washing Plant)

Operation Scenarios Studied

The operation scenarios studied are described in Table 2.

Table 2: Operation Scenarios Studied

Scenario	Operation	Section
Scenario-1	• Stripping without Berms on 1 m depth	Phase 1
Scenario-2	• Crushing, Washing, Asphalt Production & Transportation without berms on 3 m depth	Phase 1
Scenario-3	• Stripping without Berms on 1 m depth	Phase 2
Scenario-4	• Crushing, Washing, Asphalt Production & Transportation without berms on 3 m depth	Phase 2
Scenario-5	• Stripping without Berms on 1 m depth	Phase 3
Scenario-6	• Crushing, Washing, Asphalt Production & Transportation without berms on 3 m depth	Phase 3

Scenario-7	• Stripping without Berms on 1 m depth	Phase 4
Scenario-8	• Crushing, Washing, Asphalt Production & Transportation without berms on 3 m depth	Phase 4

Proposed Initial Operations Schedule

For all the scenarios, the plant will operate 11 hours per day (when weather permits), 6 days per week excluding statutory holidays, with an assumed 80% availability. The background noise levels for the area will vary considerably over that period and it is difficult to speculate the day-to-day fluctuations of noise levels over a 12 month period. Project operations will be in addition to the normal fluctuations in background noise levels. Relative humidity, temperature, temperature inversions, the number and varied noise sources are some of the factors that affect sound level and sound propagation.

Method

The distance to the residences and facility physical layout information were obtained from satellite photos and drawings provided by West Can Seal Coating Inc. and the field visit on October 10, 2012 made by the PAAE Staff. Sound power levels were determined for all of the major noise sources at the proposed facility. Sound propagation calculations were then undertaken to determine the sound pressure level that will exist at the most impacted residences around the facility for Stripping phase, and Crushing, washing, Asphalt production & Transportation phase of the proposed four (4) exploration phases in 8 scenarios including different depths. All calculations were undertaken in octave bands.

The octave band sound power level for each source that will exist at the facility was obtained or calculated from manufacturer's data, acoustical reference literature or previous studies. The results of the sound propagation calculations were compared to the permissible sound level to determine if the facility will meet the ERCB guideline.

Sound Power Level Calculations

Octave band sound power levels were calculated for all of the major noise sources that are present at the facility. These octave band sound power levels and the source of the data are presented in Table 3; these assume low-performance engine exhaust silencers.

Table 3 – Source Octave Band Sound Power Levels

Source Description	Data Source	Linear Octave Band Centre Frequency (dB, ref 1 pW)									Total (dBA)
		31.5	63	125	250	500	1k	2k	4k	8k	
Tractor Scraper, Scraper Engine	Theoretical Calculation	98	106	113	113	112	114	113	107	100	**118**
Tractor Scraper, Tractor Engine	Theoretical Calculation	98	106	113	113	112	114	113	107	100	**118**
Truck PWL	Theoretical Calculation	134	130	119	111	110	112	111	106	99	**117**
Jaw Crusher and Double Deck Vibratory Screener	Previous Study	105	111	114	112	110	111	109	105	97	**115**
Triple Deck Vibratory Screener	Previous Study	105	108	109	116	111	110	108	104	96	**115**
Tractor Scraper, Scraper Engine Exhaust Silenced	Theoretical Calculation	140	136	124	107	107	105	107	98	90	**115**
Tractor Scraper, Tractor Engine Exhaust Silenced	Theoretical Calculation	140	136	124	107	107	105	107	98	90	**115**
Cone Crusher	Previous Study	102	108	109	108	107	105	104	101	92	**111**
CAT 980 Loader	Previous Study	102	111	107	101	96	95	95	89	75	**101**
Feed Hoper and Conveyor	Previous Study	98	108	106	101	97	94	92	85	76	**100**
Surge Bin and Conveyor	Previous Study	99	101	101	94	92	96	92	86	75	**99**

Sound Propagation Calculations

The sound propagation calculations were undertaken using the noise modeling software package CadnaA by Datakustik. CadnaA bases its calculation algorithms on ISO 9613 and the ground cover was modeled as mixed ground between the operations and residential areas, with consideration of some deciduous trees in the area. Octave-band sound power level information was used for the major noise sources for the proposed project. The frequency dependency of sound propagation calculations such as ground absorption, air absorption and elevation relative to the sound source, and barrier effects are considered in the model. The temperature modeled was 10° C as an average temperature over the 12-

month period when outdoor activities are expected, and 80% relative humidity; the temperature and humidity values are conditions with a minimum value of air absorption, and so constitute a "worst case" condition. The CadnaA model calculates the contribution level of each noise source at each receiver location in octave bands as well as the overall dBA level.

Modeling Results

The objective of this study was to predict the noise level from the proposed four (4) exploration phases in 8 Scenarios during the Stripping Operation stages, and the Crushing, Washing, Asphalt production & Transportation operation stage including different depths at the potentially most affected receiver locations. The predictions based on the CadnaA model for this facility are summarized in Table 4 along with the PSL.

Table 4(a) Scenario 1 – Summary of Predicted Noise Levels Generated by stripping operation without Berms in phase 1 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time (dBA)	ERCB Ambient Sound Levels for Daytime (dBA)	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels (dBA)
Receiver 1	53	45	54
Receiver 2	48	45	50
Receiver 3	48	45	50
Receiver 4	48	45	50
Receiver 5	49	45	50
Receiver 6	48	45	50
Receiver 7	54	45	55
Receiver 8	47	45	49
Receiver 9	43	45	47

Table 4(b) Scenario 2 – Summary of Predicted Noise Levels Generated by Crushing, washing, Asphalt production & Transportation without Berms in Phase 1under downwind conditions

Residence Location	Predicted Noise Levels Day-Time (dBA)	ERCB Ambient Sound Levels for Daytime (dBA)	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels (dBA)
Receiver 1	60	45	60
Receiver 2	48	45	49
Receiver 3	46	45	48
Receiver 4	43	45	47
Receiver 5	41	45	46
Receiver 6	42	45	47
Receiver 7	41	45	47
Receiver 8	56	45	57
Receiver 9	45	45	48

Table 4(c) Scenario 3 – Summary of Predicted Noise Levels Generated by stripping operation without Berms in phase 2 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time (dBA)	ERCB Ambient Sound Levels for Daytime (dBA)	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels (dBA)
Receiver 1	50	45	52
Receiver 2	50	45	51
Receiver 3	52	45	52
Receiver 4	60	45	60
Receiver 5	53	45	54
Receiver 6	47	45	49
Receiver 7	52	45	52
Receiver 8	44	45	47
Receiver 9	42	45	47

Table 4(d) Scenario 4 – Summary of Predicted Noise Levels Generated by Crushing, washing, Asphalt production & Transportation without Berms in Phase 2under downwind conditions

Residence Location	Predicted Noise Levels Day-Time (dBA)	ERCB Ambient Sound Levels for Daytime (dBA)	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels (dBA)
Receiver 1	60	45	60
Receiver 2	49	45	51
Receiver 3	48	45	50
Receiver 4	52	45	53
Receiver 5	47	45	49
Receiver 6	40	45	46
Receiver 7	42	45	47
Receiver 8	57	45	57
Receiver 9	45	45	48

Table 4(e) Scenario 5 – Summary of Predicted Noise Levels Generated by stripping operation without Berms in phase 3 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time (dBA)	ERCB Ambient Sound Levels for Daytime (dBA)	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels (dBA)
Receiver 1	53	45	53
Receiver 2	61	45	61
Receiver 3	61	45	61
Receiver 4	56	45	56
Receiver 5	50	45	51
Receiver 6	43	45	47
Receiver 7	42	45	47
Receiver 8	44	45	47
Receiver 9	45	45	48

Table 4(f) Scenario 6 – Summary of Predicted Noise Levels Generated by Crushing, washing, Asphalt production & Transportation without Berms in Phase 3 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time (dBA)	ERCB Ambient Sound Levels for Daytime (dBA)	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels (dBA)
Receiver 1	59	45	59
Receiver 2	54	45	55
Receiver 3	53	45	54
Receiver 4	47	45	49
Receiver 5	43	45	47
Receiver 6	40	45	46
Receiver 7	39	45	46
Receiver 8	56	45	57
Receiver 9	45	45	48

Table 4(f) Scenario 7 – Summary of Predicted Noise Levels Generated by stripping operation without Berms in phase 4 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time (dBA)	ERCB Ambient Sound Levels for Daytime (dBA)	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels (dBA)
Receiver 1	62	45	62
Receiver 2	52	45	52
Receiver 3	52	45	53
Receiver 4	54	45	54
Receiver 5	48	45	50
Receiver 6	45	45	48
Receiver 7	52	45	52
Receiver 8	48	45	50
Receiver 9	46	45	48

Table 4(g) Scenario 8 – Summary of Predicted Noise Levels Generated by Crushing, washing, Asphalt production & Transportation without Berms in Phase 4 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time (dBA)	ERCB Ambient Sound Levels for Daytime (dBA)	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels (dBA)
Receiver 1	60	45	60
Receiver 2	48	45	50
Receiver 3	46	45	49
Receiver 4	46	45	48
Receiver 5	42	45	47
Receiver 6	40	45	46
Receiver 7	40	45	46
Receiver 8	56	45	57
Receiver 9	44	45	48

Project operation is currently planned during the day-time periods only. Therefore, the above results are given for day time periods. The background level of the area is assumed to be 45 dBA as per the ERCB Directive 38.

Figures 3 to 11 show the predicted sound levels for the area. The labeled sound levels are the predicted sound levels from only the facility (ambient sound level is not included). The scales on the figures are the Universal Transverse Mercator (UTM) coordinates in zone 11U.

Figure 3 – Scenario 1- Predicted Facility Sound Contours (Not Including Ambient) from Stripping without Berms Phase 1

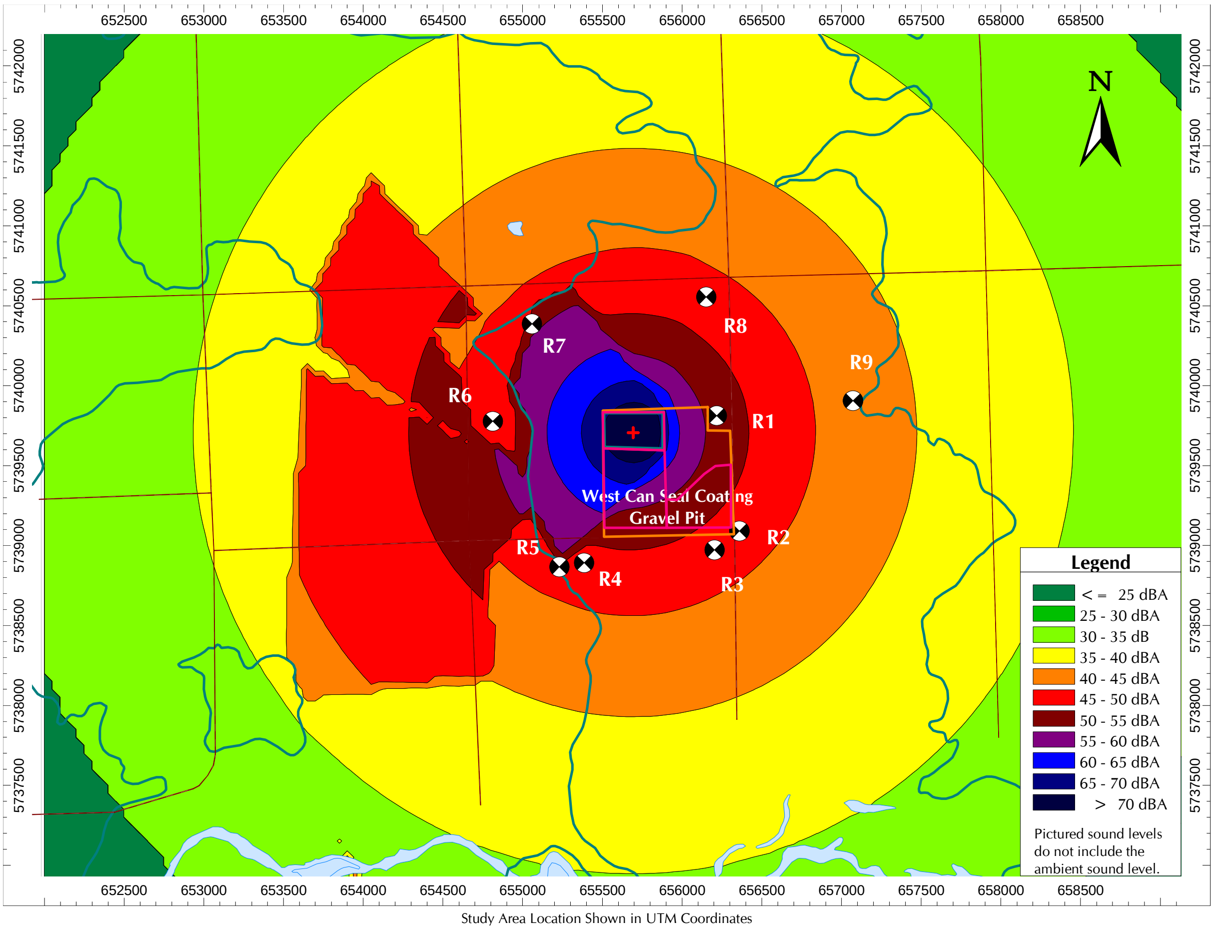


Figure 4 –Scenario 2- Predicted Facility Sound Contours (Not Including Ambient) from Crushing, Washing, Asphalt production & Transportation without Berms in Phase 1

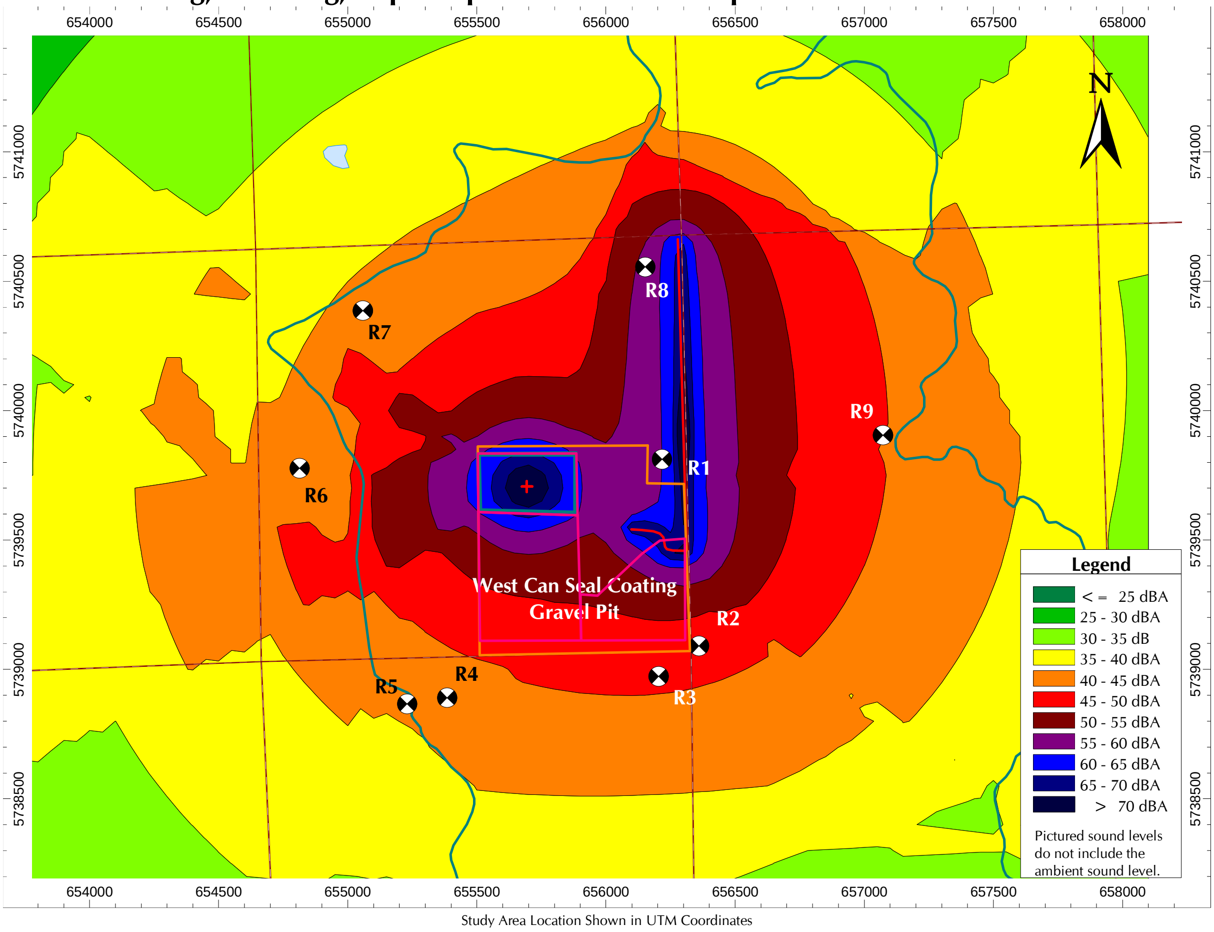


Figure 5 – Scenario 3- Predicted Facility Sound Contours (Not Including Ambient) from Stripping without Berms Phase 2

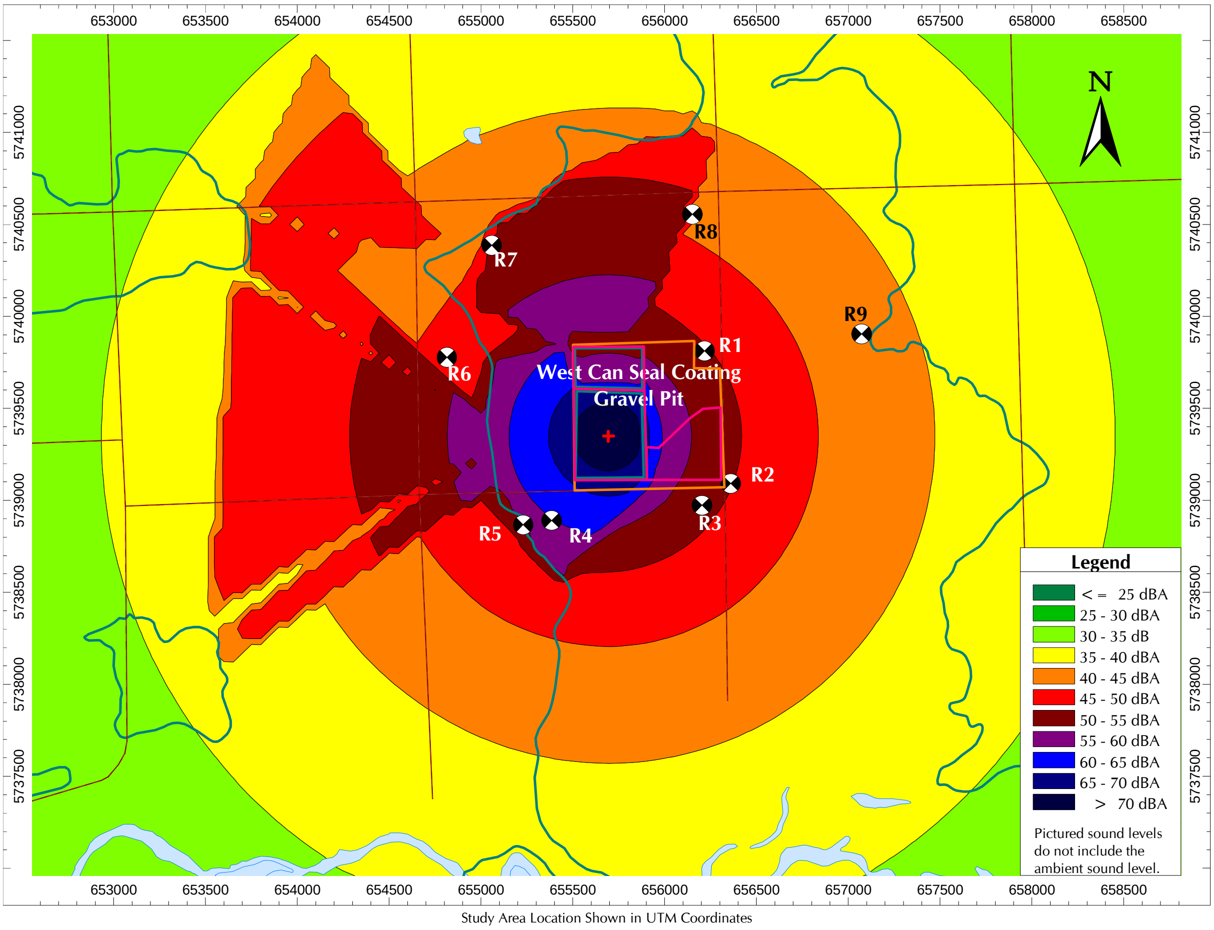


Figure 6 – Scenario 4 - Predicted Facility Sound Contours (Not Including Ambient) from Crushing, Washing, Asphalt production & Transportation without Berms in Phase 2

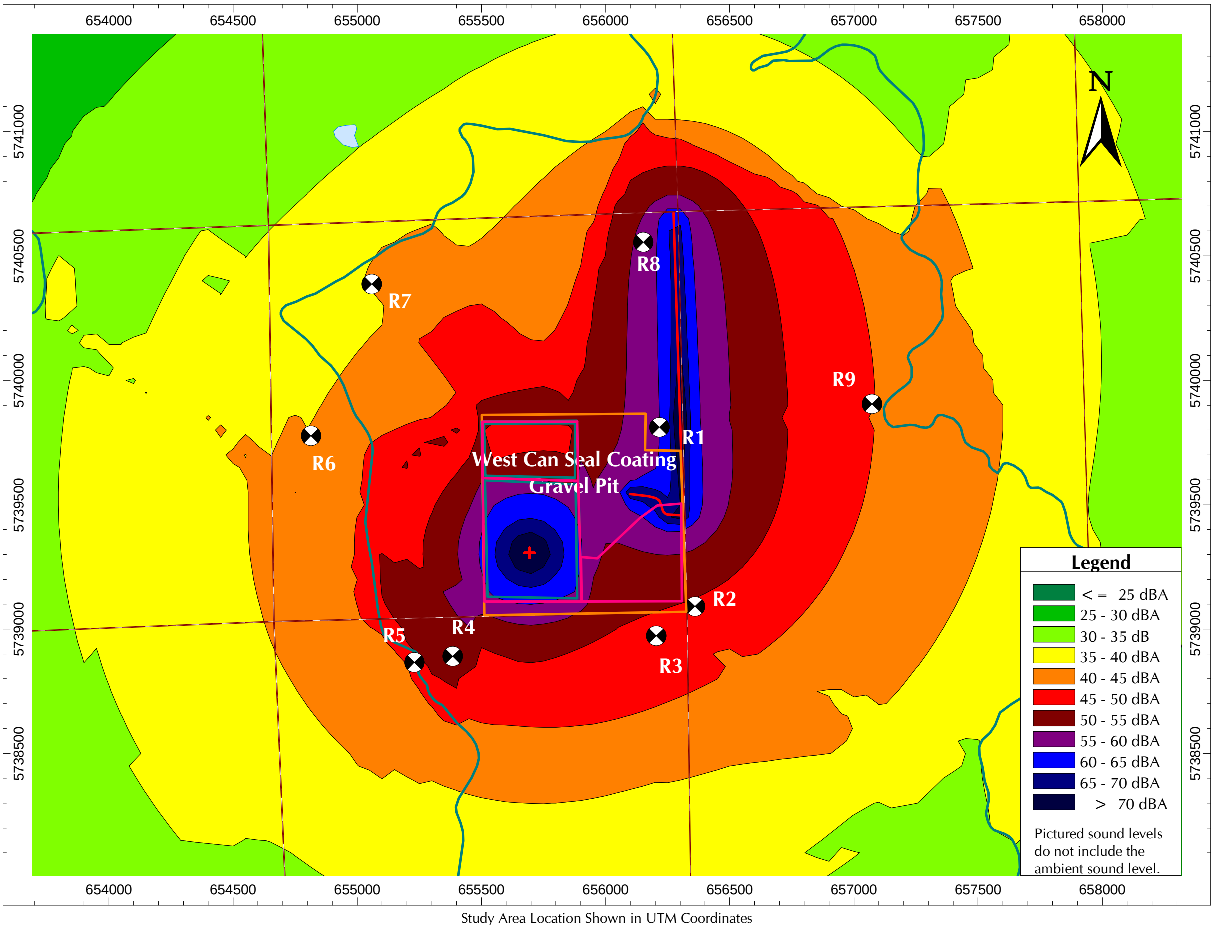


Figure 7 –Scenario 5- Predicted Facility Sound Contours (Not Including Ambient) from Stripping without Berms Phase 3

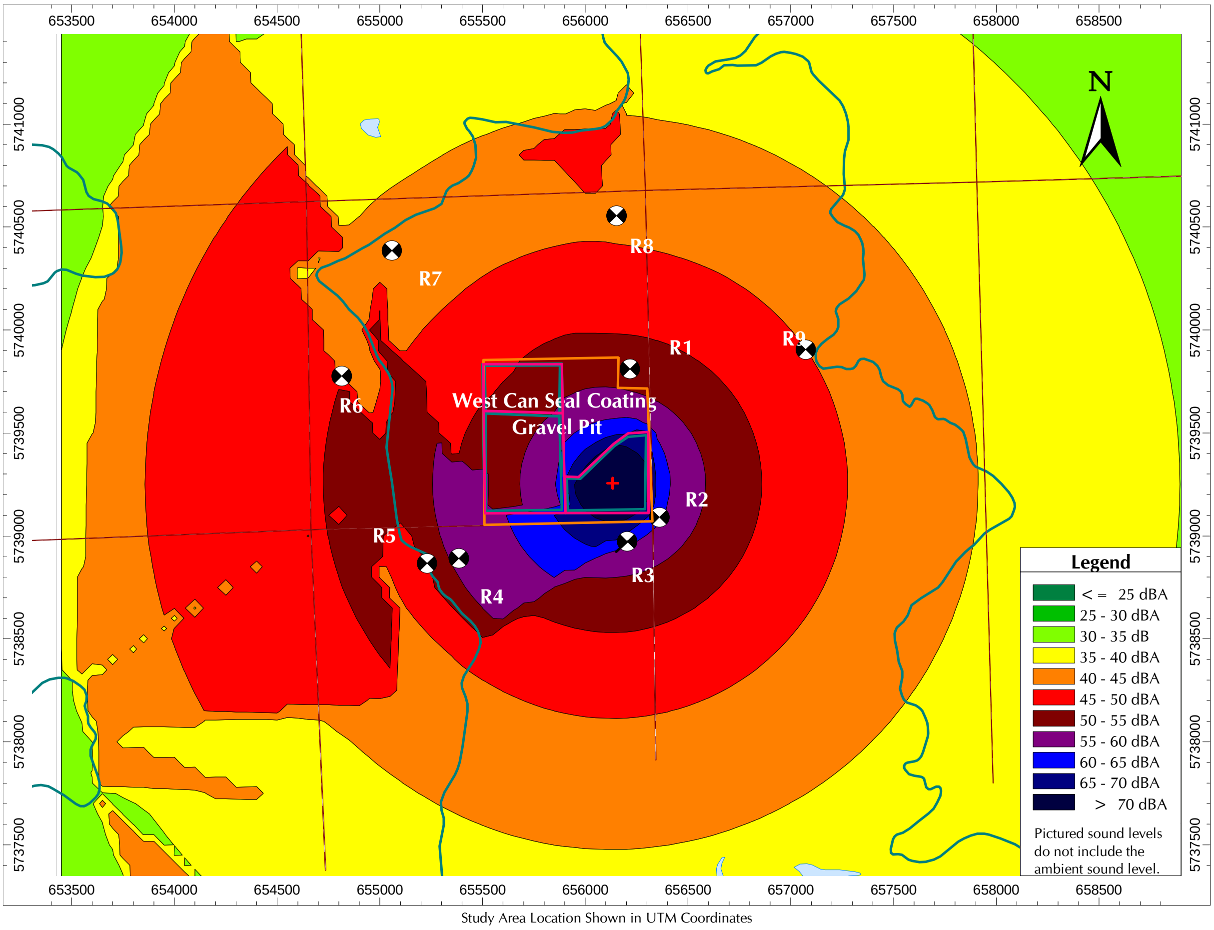
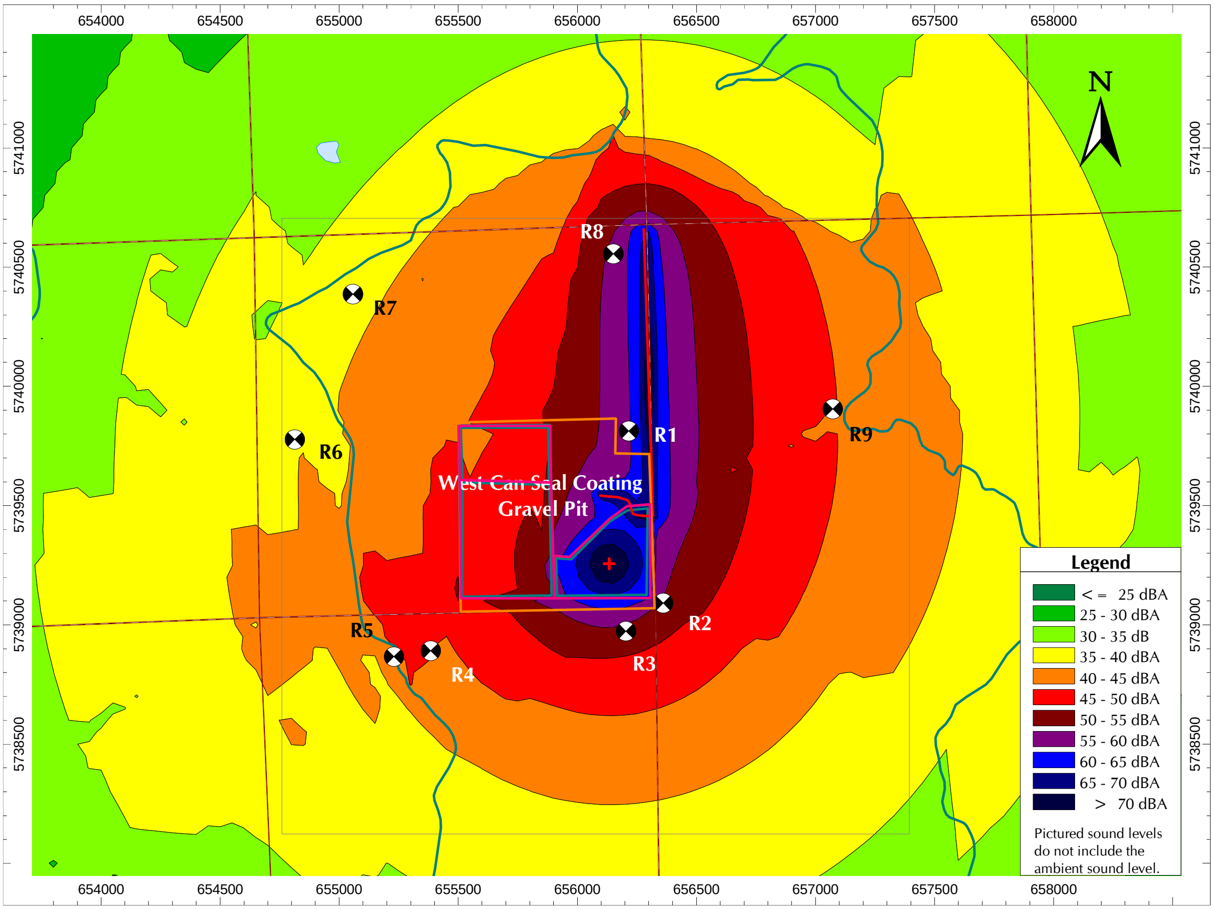
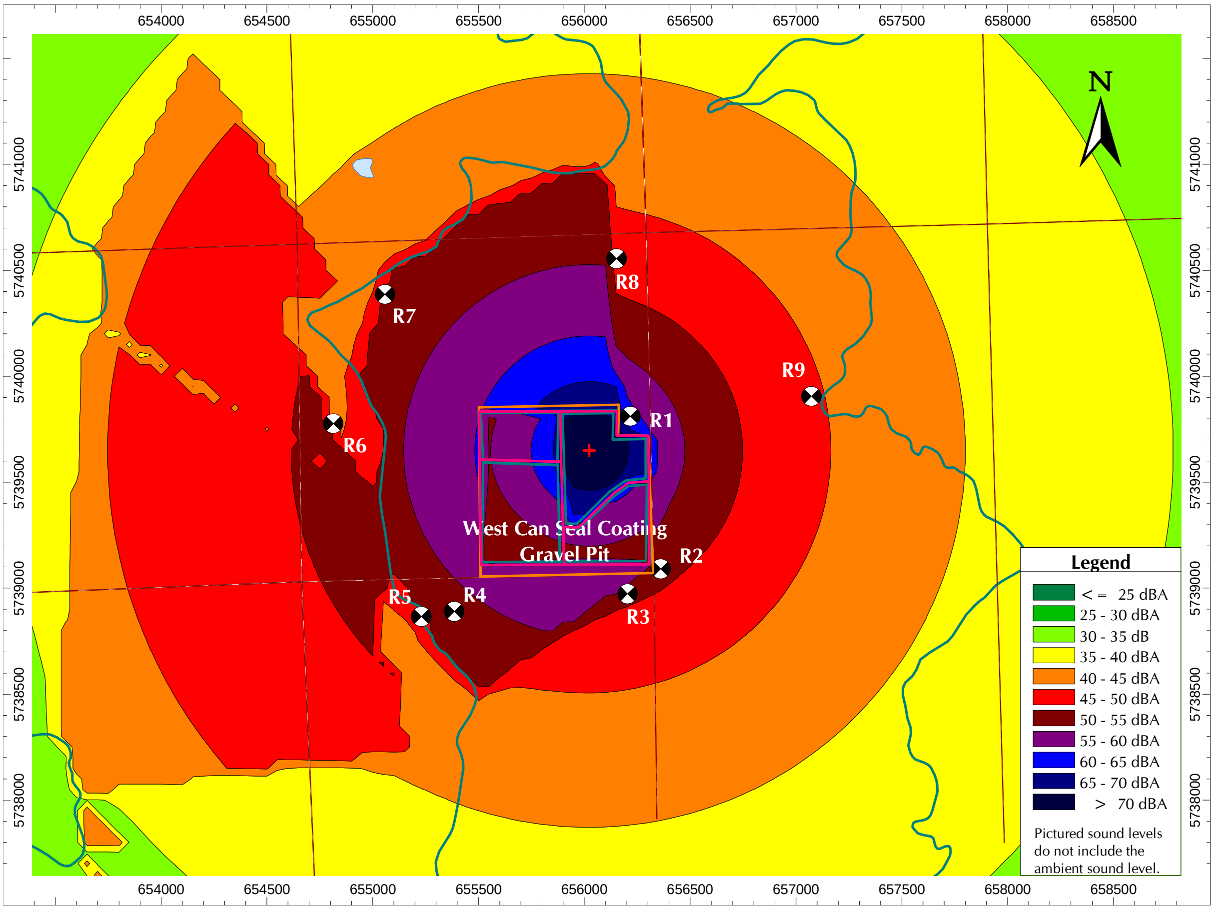


Figure 8 – Scenario 6 - Predicted Facility Sound Contours (Not Including Ambient) from Crushing, Washing, Asphalt production & Transportation without Berms in Phase 3



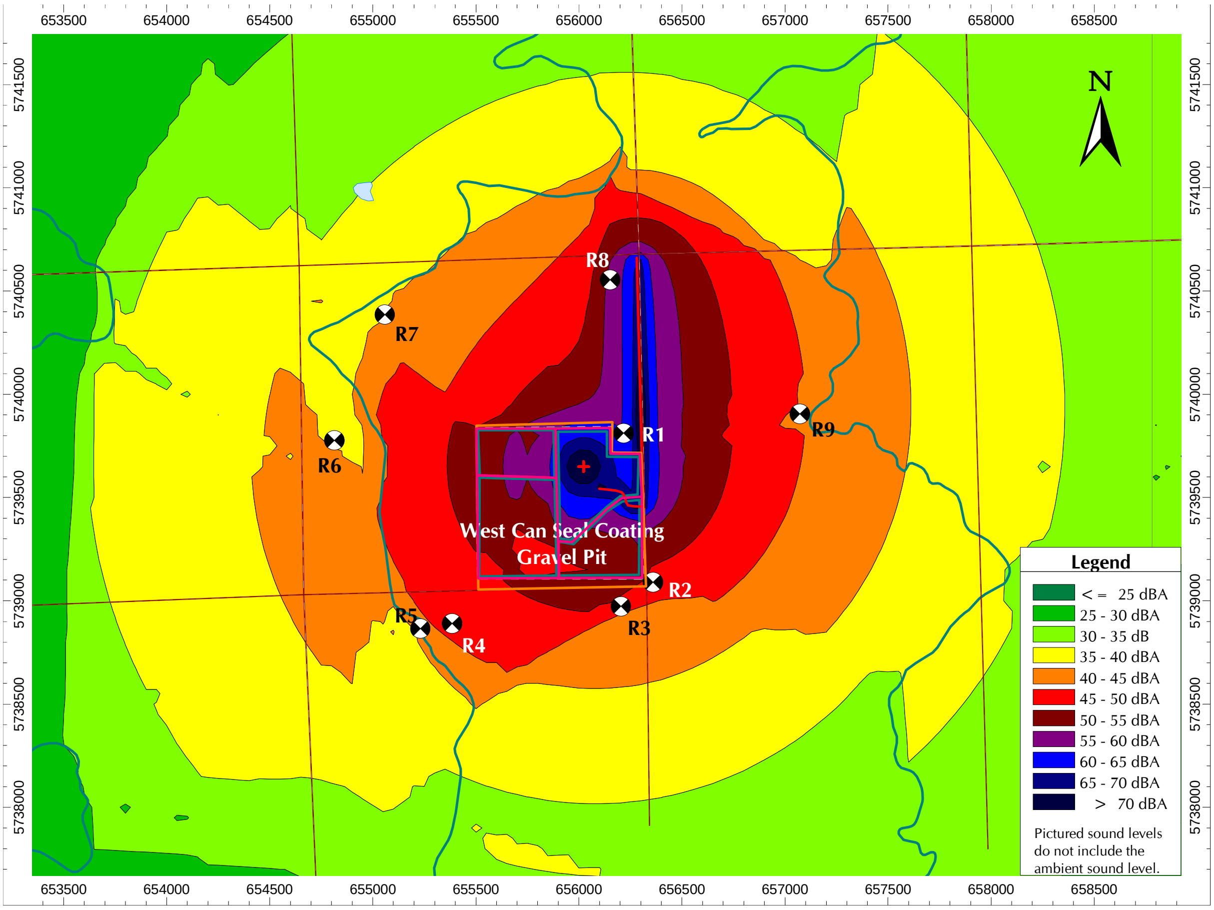
Study Area Location Shown in UTM Coordinates

Figure 9 –Scenario 7 - Predicted Facility Sound Contours (Not Including Ambient) Stripping without Berms Phase 4



Study Area Location Shown in UTM Coordinates

Figure 10 – Scenario 8 - Predicted Facility Sound Contours (Not Including Ambient) from Crushing, Washing, Asphalt production & Transportation without Berms in Phase 4



Study Area Location Shown in UTM Coordinates

Source Order Rankings

Based on the CadnaA model, the sound sources can be ranked by the sound levels at the receivers. The source order ranking for each scenario are shown in Table 5 to 12 for conditions with a wind from the operational areas to the most impacted residences located around the facility.

Table 5 – Source Order Ranking for Receiver-1 NE Scenario 1, Downwind Condition

Source	Levels (dBA)
Tractor Scraper Scraper Engine 1	45
Tractor Scraper Tractor Engine 1	45
Tractor Scraper Scraper Engine 2	45
Tractor Scraper Tractor Engine 2	45
Tractor Scraper Scraper Engine Exhaust 1	43
Tractor Scraper Tractor Engine Exhaust 1	43
Tractor Scraper Scraper Engine Exhaust 2	43
Tractor Scraper Tractor Engine Exhaust 2	43
Total Facility Sound Level	**53**
Average Ambient Level	45
Total Facility Plus Ambient	**54**

Table 6 – Source Order Ranking for Receiver-1 NE Scenario 2- Downwind Condition

Source	Levels (dBA)
Trucking	60
Triple Deck Vibratory Screener	42
Jaw Crusher and Double Deck Vibratory Screener	42
Cone Crusher	38
CAT 980 Crushing Plant Loader 1	29
CAT 980 Crushing Plant Loader 3	29
CAT 980 Washing Plant Loader	29
CAT 980 Asphalt Plant Loader 1	29
CAT 980 Asphalt Plant Loader 2	29
CAT 980 Crushing Plant Loader 2	29
CAT 980 Asphalt Plant Loader 3	29
Surge Bin and Conveyor	26
Total Facility Sound Level	**60**
Average Ambient Level	45
Total Facility Plus Ambient	**60**

Table 7 – Source Order Ranking for Receiver-4 SW Scenario 3- Downwind Condition

Source	Levels (dBA)
Tractor Scraper Scraper Engine Exhaust 1	51
Tractor Scraper Tractor Engine Exhaust 1	51
Tractor Scraper Scraper Engine Exhaust 2	51
Tractor Scraper Tractor Engine Exhaust 2	51
Tractor Scraper Scraper Engine 1	51
Tractor Scraper Tractor Engine 1	51
Tractor Scraper Scraper Engine 2	51
Tractor Scraper Tractor Engine 2	51
Total Facility Sound Level	**60**
Average Ambient Level	45
Total Facility Plus Ambient	**60**

Table 8 – Source Order Ranking for Receiver-1 NE Scenario 4 – Downwind Condition

Source	Levels (dBA)
Trucking	60
Triple Deck Vibratory Screener	39
Jaw Crusher and Double Deck Vibratory Screener	39
Cone Crusher	34
CAT 980 Crushing Plant Loader 1	25
CAT 980 Crushing Plant Loader 3	25
CAT 980 Washing Plant Loader	25
CAT 980 Crushing Plant Loader 2	25
CAT 980 Asphalt Plant Loader 1	25
CAT 980 Asphalt Plant Loader 2	25
CAT 980 Asphalt Plant Loader 3	25
Surge Bin and Conveyor	23
Total Facility Sound Level	**60**
Average Ambient Level	45
Total Facility Plus Ambient	**60**

Table 9 – Source Order Ranking for Receiver-3 S Scenario 5 – Downwind Condition

Source	Levels (dBA)
Tractor Scraper Scraper Engine 1	54
Tractor Scraper Scraper Engine 1	54
Tractor Scraper Scraper Engine 2	54
Tractor Scraper Scraper Engine 2	54
Tractor Scraper Scraper Engine Exhaust 1	50
Tractor Scraper Tractor Engine Exhaust 1	50
Tractor Scraper Scraper Engine Exhaust 2	50
Tractor Scraper Tractor Engine Exhaust 2	50
Total Facility Sound Level	**61**
Average Ambient Level	45
Total Facility Plus Ambient	**61**

Table 10 – Source Order Ranking for Receiver-1 NE, Scenario 6 – Downwind Condition

Source	Levels (dBA)
Trucking	59
Triple Deck Vibratory Screener	42
Jaw Crusher and Double Deck Vibratory Screener	42
Cone Crusher	37
CAT 980 Crushing Plant Loader 1	28
CAT 980 Crushing Plant Loader 3	28
CAT 980 Washing Plant Loader	28
CAT 980 Crushing Plant Loader 2	28
CAT 980 Asphalt Plant Loader 1	28
CAT 980 Asphalt Plant Loader 2	28
CAT 980 Asphalt Plant Loader 3	28
Surge Bin and Conveyor	26
Total Facility Sound Level	**59**
Average Ambient Level	45
Total Facility Plus Ambient	**60**

Table 11 – Source Order Ranking for Receiver-1 NE, Scenario 7 – Downwind Condition

Source	Levels (dBA)
Tractor Scraper Scraper Engine 1	55
Tractor Scraper Scraper Engine 1	55
Tractor Scraper Scraper Engine 2	55
Tractor Scraper Scraper Engine 2	55
Tractor Scraper Scraper Engine Exhaust 1	51
Tractor Scraper Tractor Engine Exhaust 1	51
Tractor Scraper Scraper Engine Exhaust 2	51
Tractor Scraper Tractor Engine Exhaust 2	51
Total Facility Sound Level	**62**
Average Ambient Level	45
Total Facility Plus Ambient	**62**

Table 12 – Source Order Ranking for Receiver-1 NE, Scenario 8 – Downwind Condition

Source	Levels (dBA)
Trucking	59
Jaw Crusher and Double Deck Vibratory Screener	50
Triple Deck Vibratory Screener	50
Cone Crusher	46
CAT 980 Crushing Plant Loader 1	36
CAT 980 Crushing Plant Loader 3	36
CAT 980 Washing Plant Loader	36
CAT 980 Crushing Plant Loader 2	36
CAT 980 Asphalt Plant Loader 1	36
CAT 980 Asphalt Plant Loader 2	36
CAT 980 Asphalt Plant Loader 3	36
Surge Bin and Conveyor	34
Total Facility Sound Level	**60**
Average Ambient Level	45
Total Facility Plus Ambient	**60**

Table 13 and Figure 11 to 26 shows the predicted sound level at the receivers after setting up 3 m and 6 m high berms around the gravel pit as noise control measures.

Table 13(a) Scenario 1 – Summary of Predicted Noise Levels Generated by Stripping Operation with 3m & 5m Berms in phase 1 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels			ERCB Ambient Sound Levels for Daytime (dBA)
	Without Berms	3m High Berm	5m High Berm	
Receiver 1	54	54	54	45
Receiver 2	50	50	49	45
Receiver 3	50	50	50	45
Receiver 4	50	50	50	45
Receiver 5	50	49	49	45
Receiver 6	50	50	50	45
Receiver 7	55	49	49	45
Receiver 8	49	49	49	45
Receiver 9	47	47	47	45

Table 13(b) Scenario 2 – Summary of Predicted Noise Levels Generated by Crushing, Washing, Asphalt production & Transportation with 3m & 5m high Berms in Phase 1 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels			ERCB Ambient Sound Levels for Daytime (dBA)
	Without Berms	3m High Berm	5m High Berm	
Receiver 1	60	59	59	45
Receiver 2	49	49	49	45
Receiver 3	48	47	47	45
Receiver 4	47	47	47	45
Receiver 5	46	46	46	45
Receiver 6	47	47	47	45
Receiver 7	47	46	46	45
Receiver 8	57	57	57	45
Receiver 9	48	48	48	45

Table 13(c) Scenario 3 – Summary of Predicted Noise Levels Generated by Stripping Operation with 3m & 5m Berms in phase 2 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels			ERCB Ambient Sound Levels for Daytime (dBA)
	Without Berms	3m High Berm	5m High Berm	
Receiver 1	52	52	52	45
Receiver 2	51	51	51	45
Receiver 3	52	52	52	45
Receiver 4	60	54	54	45
Receiver 5	54	52	52	45
Receiver 6	49	49	49	45
Receiver 7	52	48	48	45
Receiver 8	47	47	47	45
Receiver 9	47	47	47	45

Table 13(d) Scenario 4 – Summary of Predicted Noise Levels Generated by Crushing, Washing, Asphalt production & Transportation with 3m & 5m high Berms in Phase 2 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels			ERCB Ambient Sound Levels for Daytime (dBA)
	Without Berms	3m High Berm	5m High Berm	
Receiver 1	60	59	59	45
Receiver 2	51	50	50	45
Receiver 3	50	49	49	45
Receiver 4	53	49	49	45
Receiver 5	49	48	48	45
Receiver 6	46	46	46	45
Receiver 7	47	46	46	45
Receiver 8	57	57	57	45
Receiver 9	48	48	48	45

Table 13(e) Scenario 5 – Summary of Predicted Noise Levels Generated by Stripping Operation with 3m & 5m Berms in phase 3 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels			ERCB Ambient Sound Levels for Daytime (dBA)
	Without Berms	3m High Berm	5m High Berm	
Receiver 1	53	53	53	45
Receiver 2	61	60	58	45
Receiver 3	61	60	59	45
Receiver 4	56	50	50	45
Receiver 5	51	49	49	45
Receiver 6	47	47	47	45
Receiver 7	47	47	47	45
Receiver 8	47	47	47	45
Receiver 9	48	48	48	45

Table 13(f) Scenario 6 – Summary of Predicted Noise Levels Generated by Crushing, Washing, Asphalt production & Transportation with 3m & 5m high Berms in Phase 3 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels			ERCB Ambient Sound Levels for Daytime (dBA)
	Without Berms	3m High Berm	5m High Berm	
Receiver 1	59	59	59	45
Receiver 2	55	54	52	45
Receiver 3	54	54	53	45
Receiver 4	49	47	47	45
Receiver 5	47	46	46	45
Receiver 6	46	46	46	45
Receiver 7	46	46	46	45
Receiver 8	57	56	57	45
Receiver 9	48	48	48	45

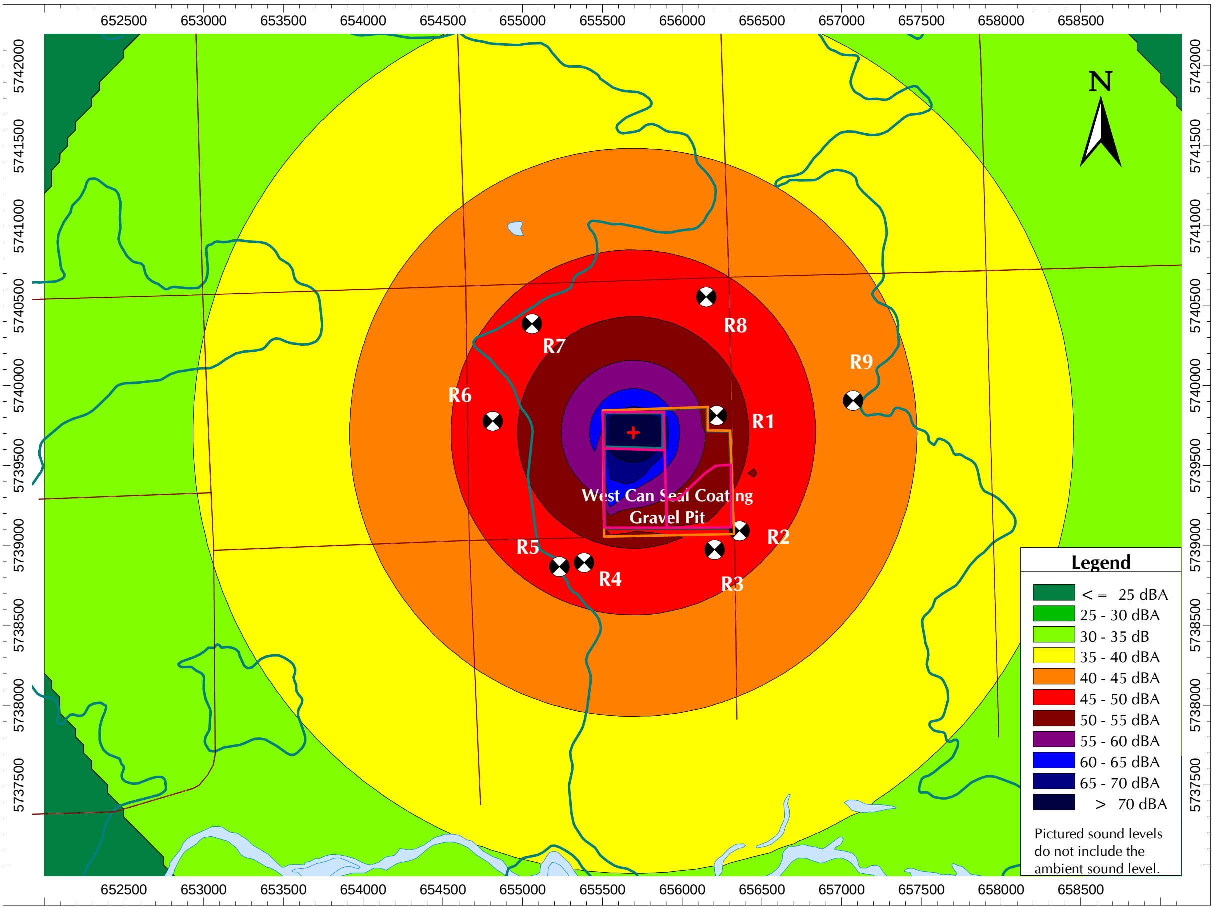
Table 13(g) Scenario 7 – Summary of Predicted Noise Levels Generated by Stripping Operation with 3m & 5m Berms in phase 4 under downwind conditions

Residence Location	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels			ERCB Ambient Sound Levels for Daytime (dBA)
	Without Berms	3m High Berm	5m High Berm	
Receiver 1	62	61	60	45
Receiver 2	52	52	52	45
Receiver 3	53	52	52	45
Receiver 4	54	49	49	45
Receiver 5	50	48	48	45
Receiver 6	48	48	48	45
Receiver 7	52	48	48	45
Receiver 8	50	49	49	45
Receiver 9	48	48	48	45

Table 13(h) Scenario 8 – Summary of Predicted Noise Levels Generated by Crushing, Washing, Asphalt production & Transportation with 3m & 5m high Berms in Phase 4 under downwind conditions

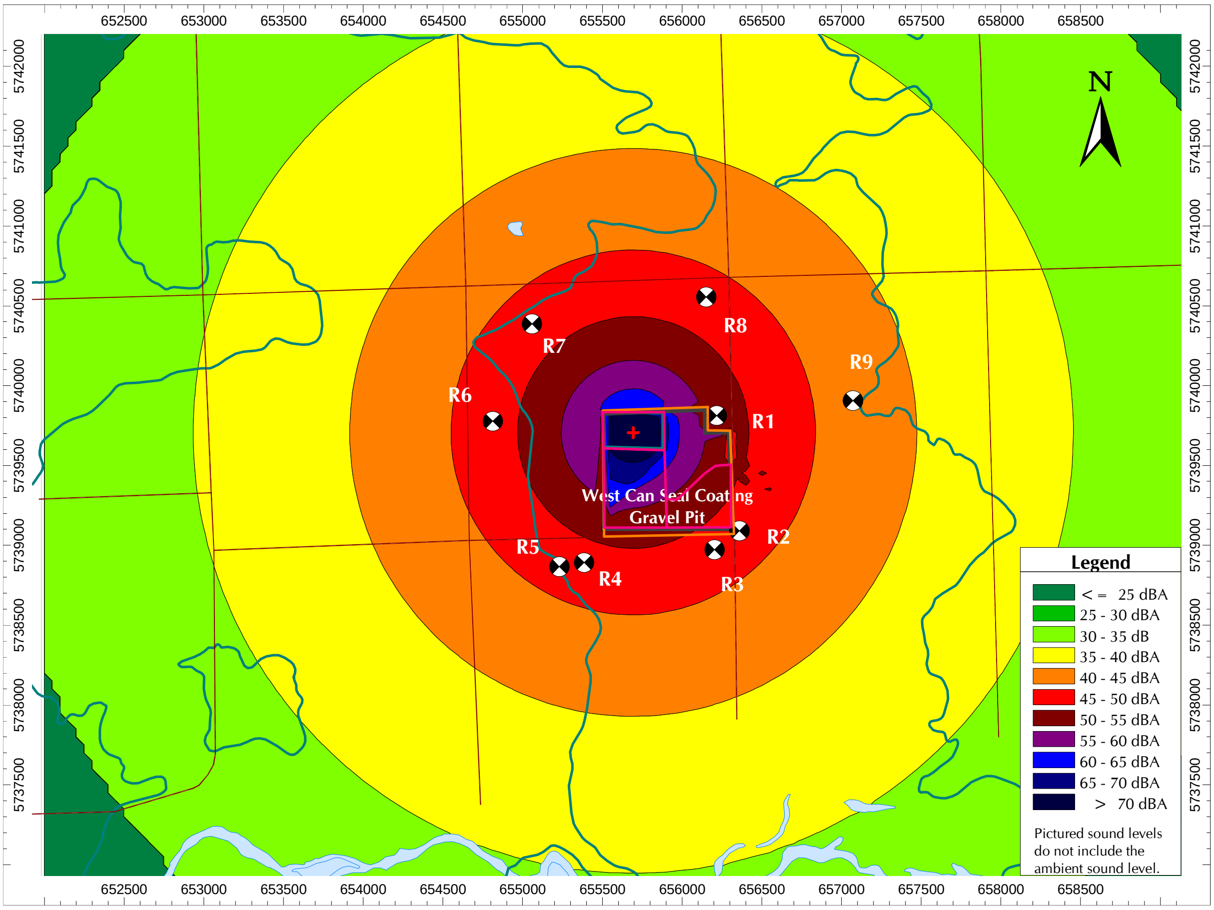
Residence Location	Predicted Noise Levels Day-Time plus ERCB Ambient Sound Levels			ERCB Ambient Sound Levels for Daytime (dBA)
	Without Berms	3m High Berm	5m High Berm	
Receiver 1	60	60	60	45
Receiver 2	50	49	49	45
Receiver 3	49	48	48	45
Receiver 4	48	46	46	45
Receiver 5	47	46	46	45
Receiver 6	46	46	46	45
Receiver 7	46	46	46	45
Receiver 8	57	57	57	45
Receiver 9	48	48	47	45

Figure 11 –Scenario 1 - Predicted Facility Sound Contours (Not Including Ambient) from Stripping with 3m Berms in Phase 1



Study Area Location Shown in UTM Coordinates

Figure 12 –Scenario 1 - Predicted Facility Sound Contours (Not Including Ambient) from Stripping with 5m Berms in Phase 1



Study Area Location Shown in UTM Coordinates

Figure 13 –Scenario 2- Predicted Facility Sound Contours (Not Including Ambient) from Crushing, Washing, Asphalt production & Transportation with 3m Berms in Phase 1

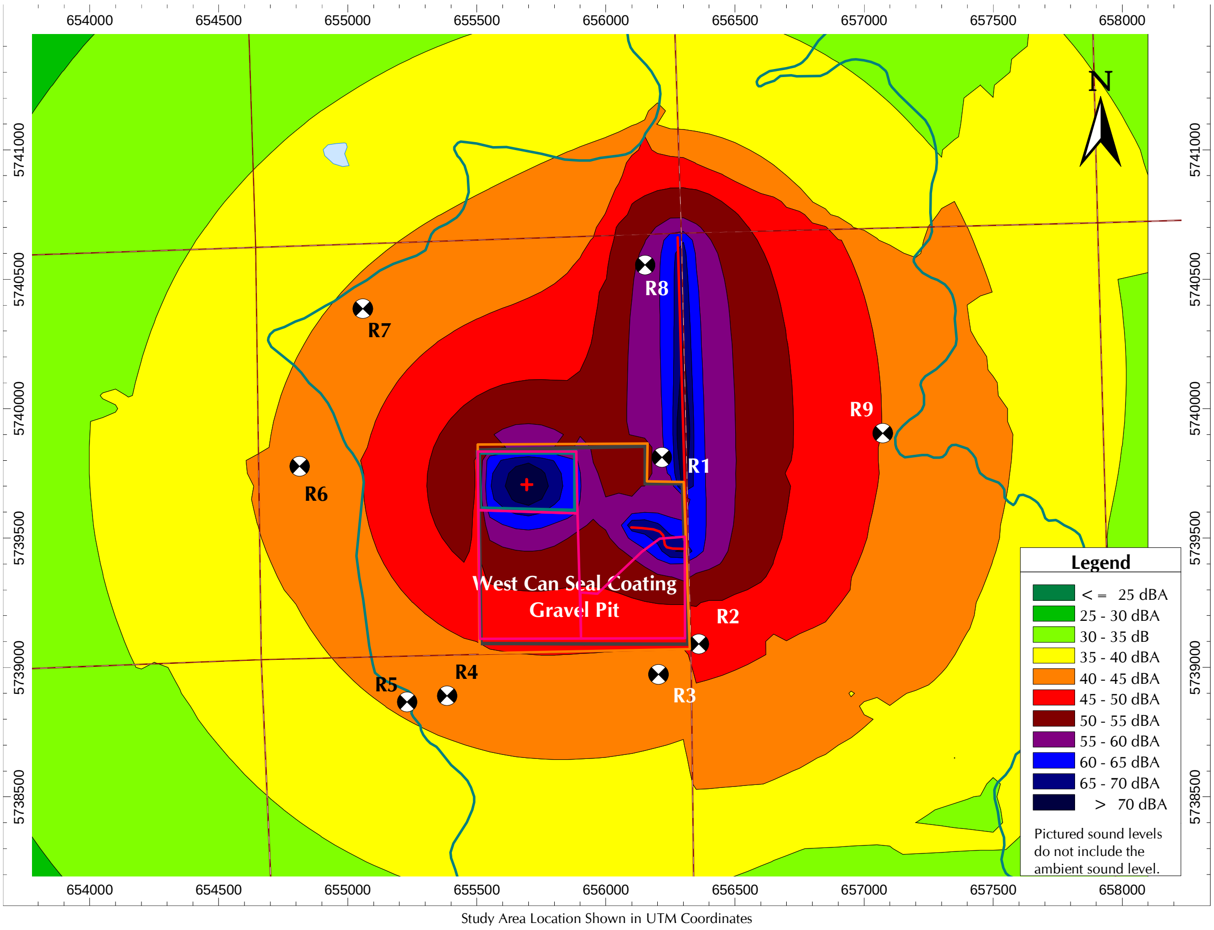


Figure 14 –Scenario 2- Predicted Facility Sound Contours (Not Including Ambient) from Crushing, Washing, Asphalt production & Transportation with 5m Berms in Phase 1

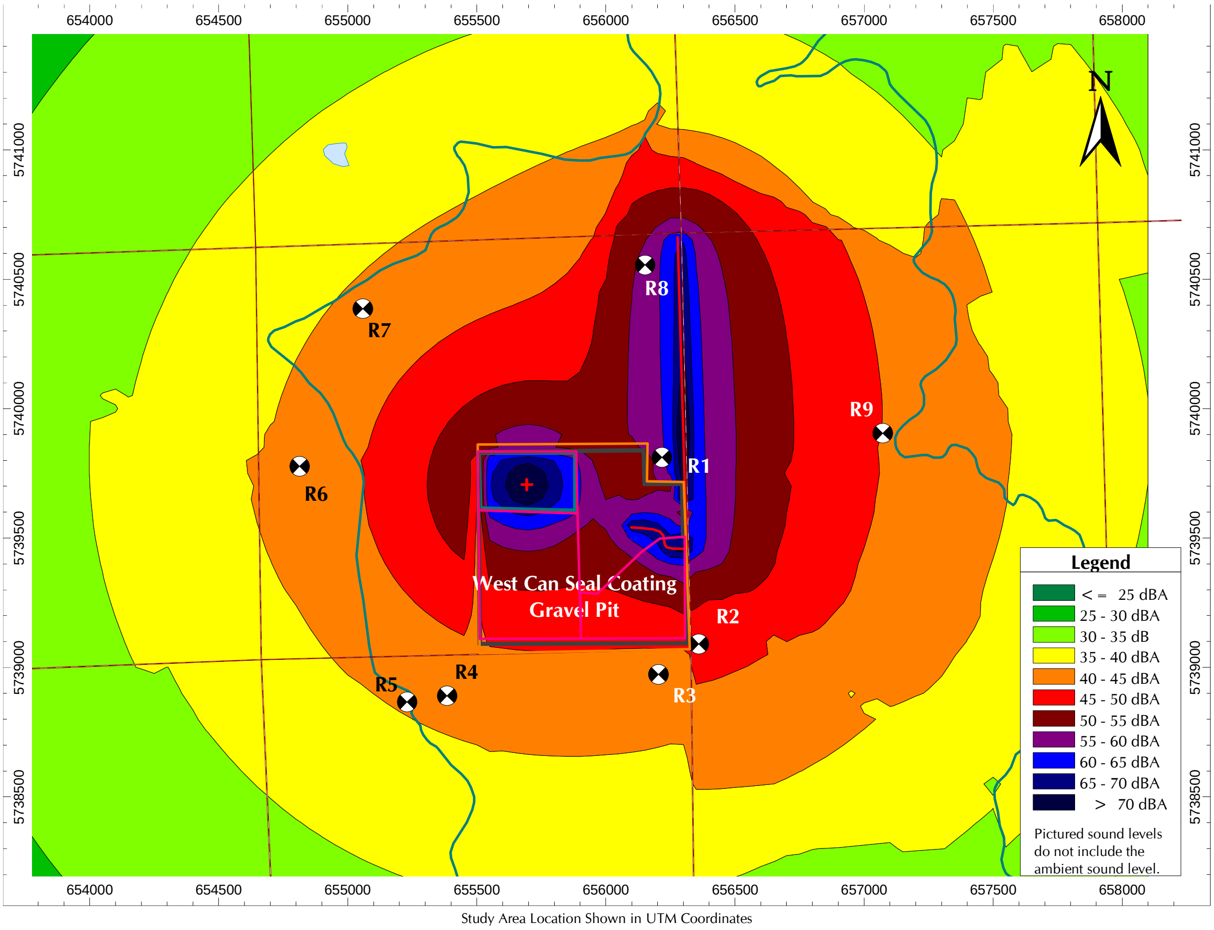
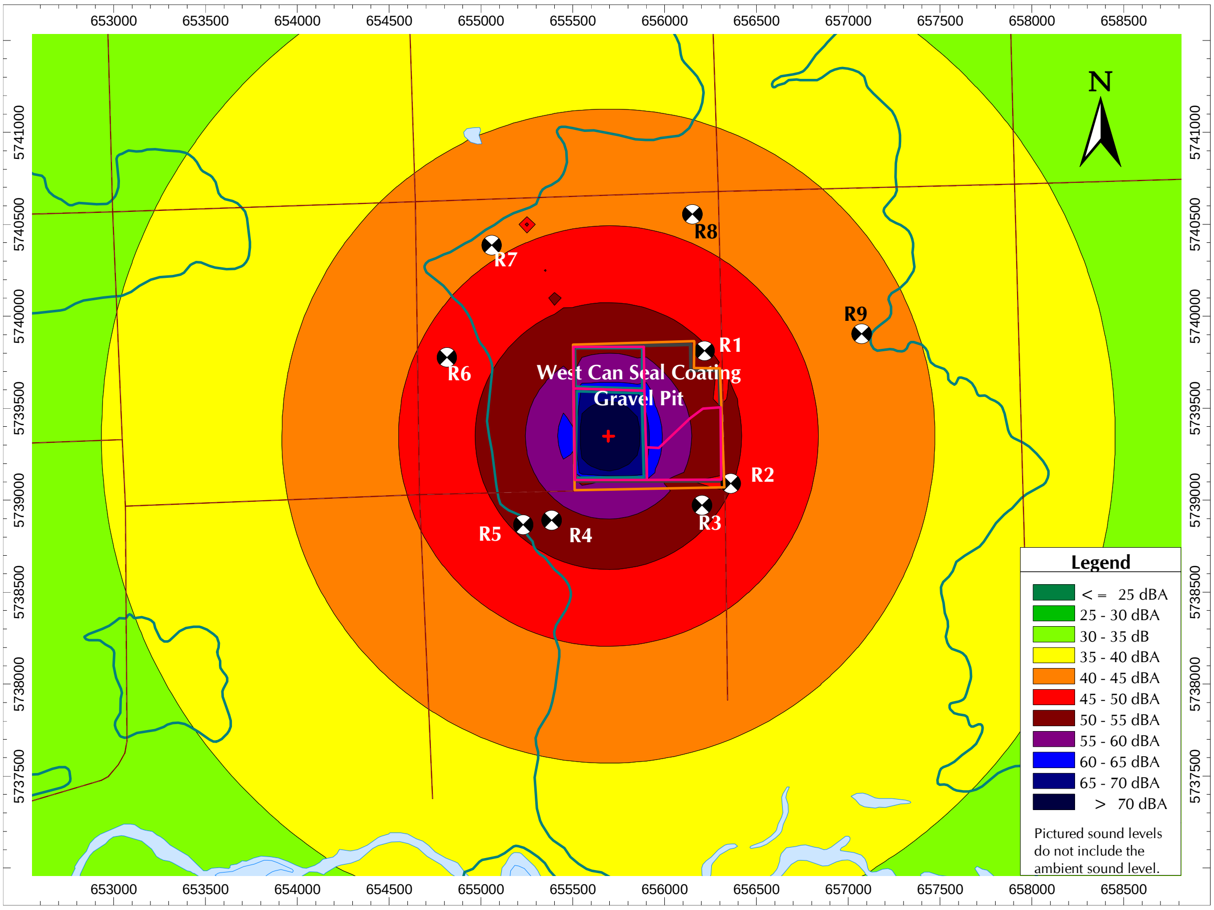


Figure 15 –Scenario 3 - Predicted Facility Sound Contours (Not Including Ambient) from Stripping with 3m Berms in Phase 2



Study Area Location Shown in UTM Coordinates

Figure 16 –Scenario 3 - Predicted Facility Sound Contours (Not Including Ambient) from Stripping with 5m Berms in Phase 2

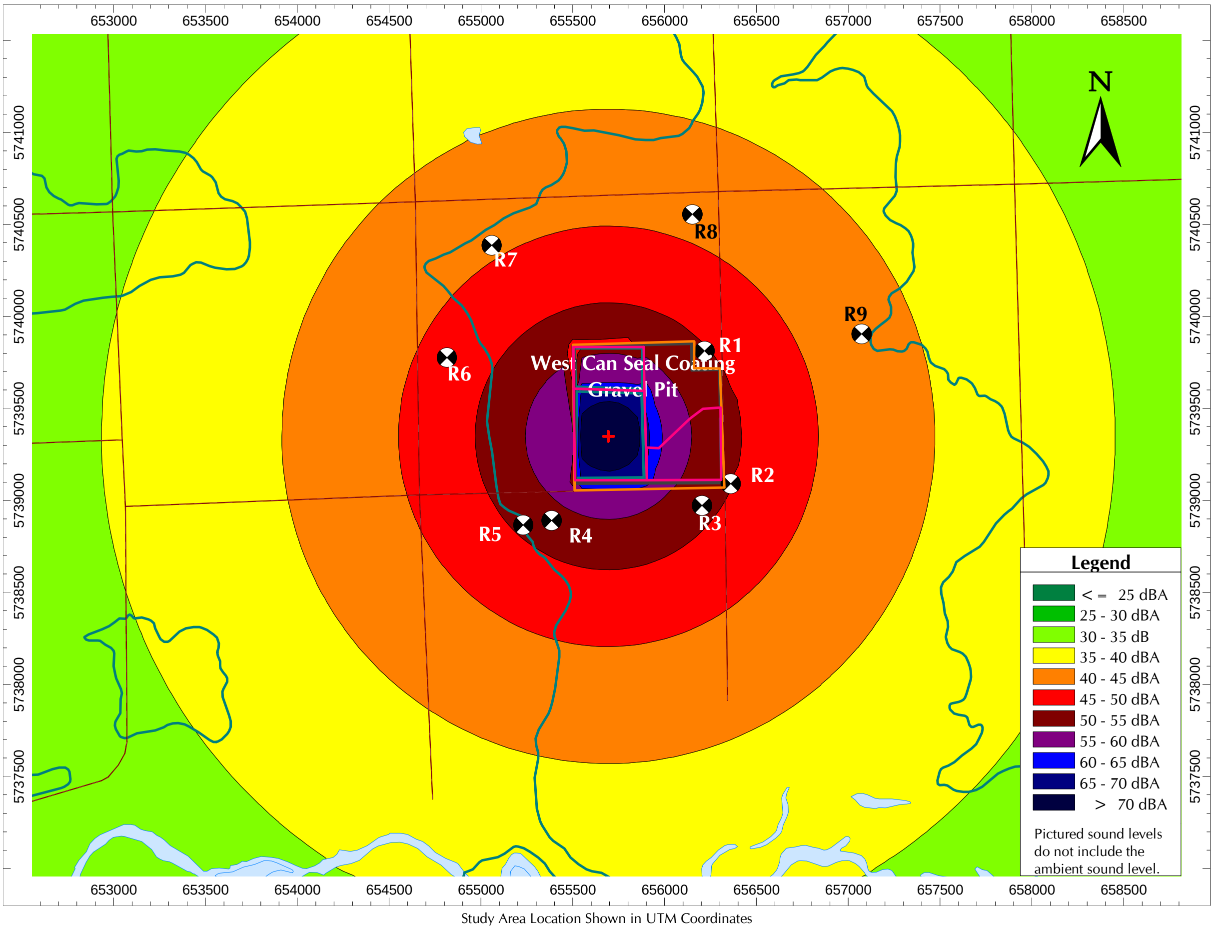
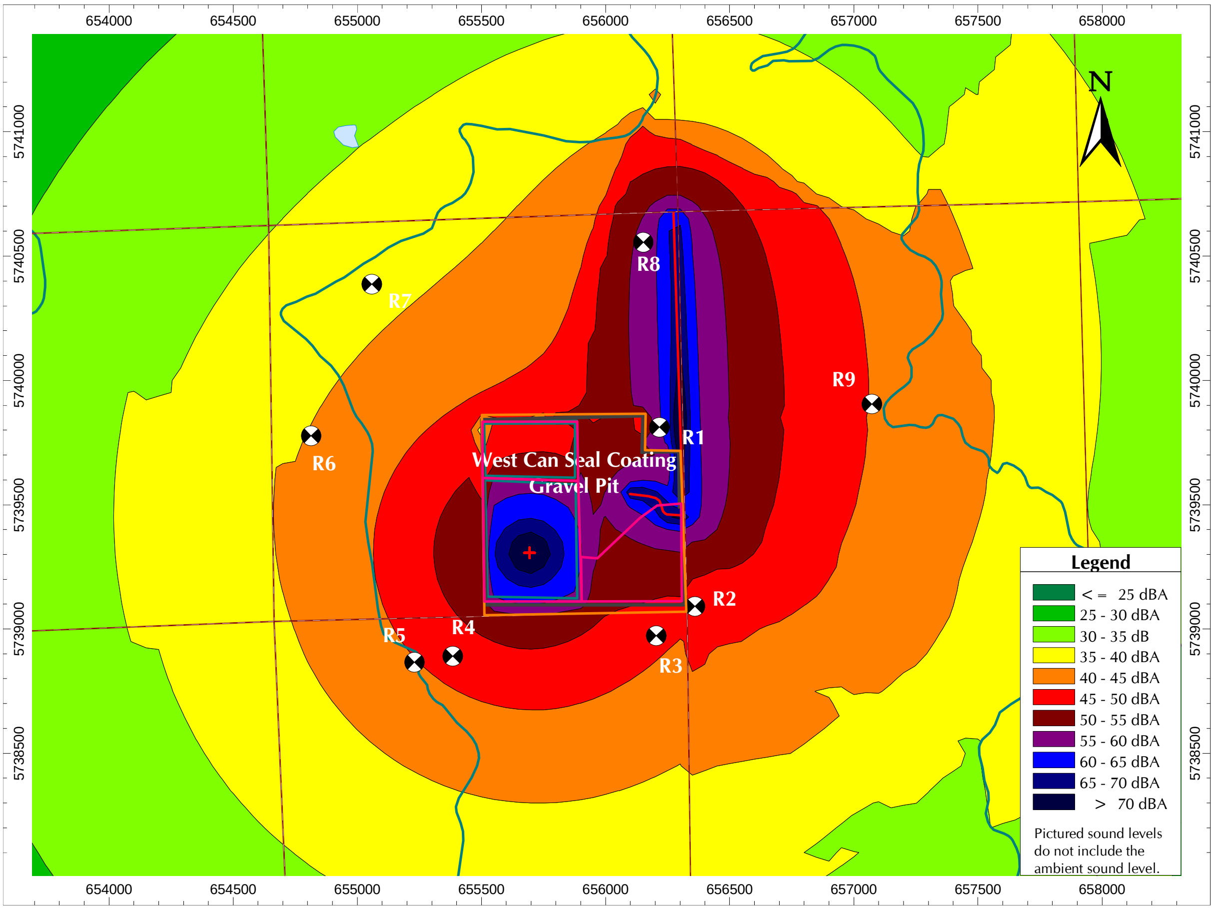


Figure 17 –Scenario 4- Predicted Facility Sound Contours (Not Including Ambient) from Crushing, Washing, Asphalt production & Transportation with 3m Berms in Phase 2



Study Area Location Shown in UTM Coordinates

Figure 18 –Scenario 4- Predicted Facility Sound Contours (Not Including Ambient) from Crushing, Washing, Asphalt production & Transportation with 5m Berms in Phase 2

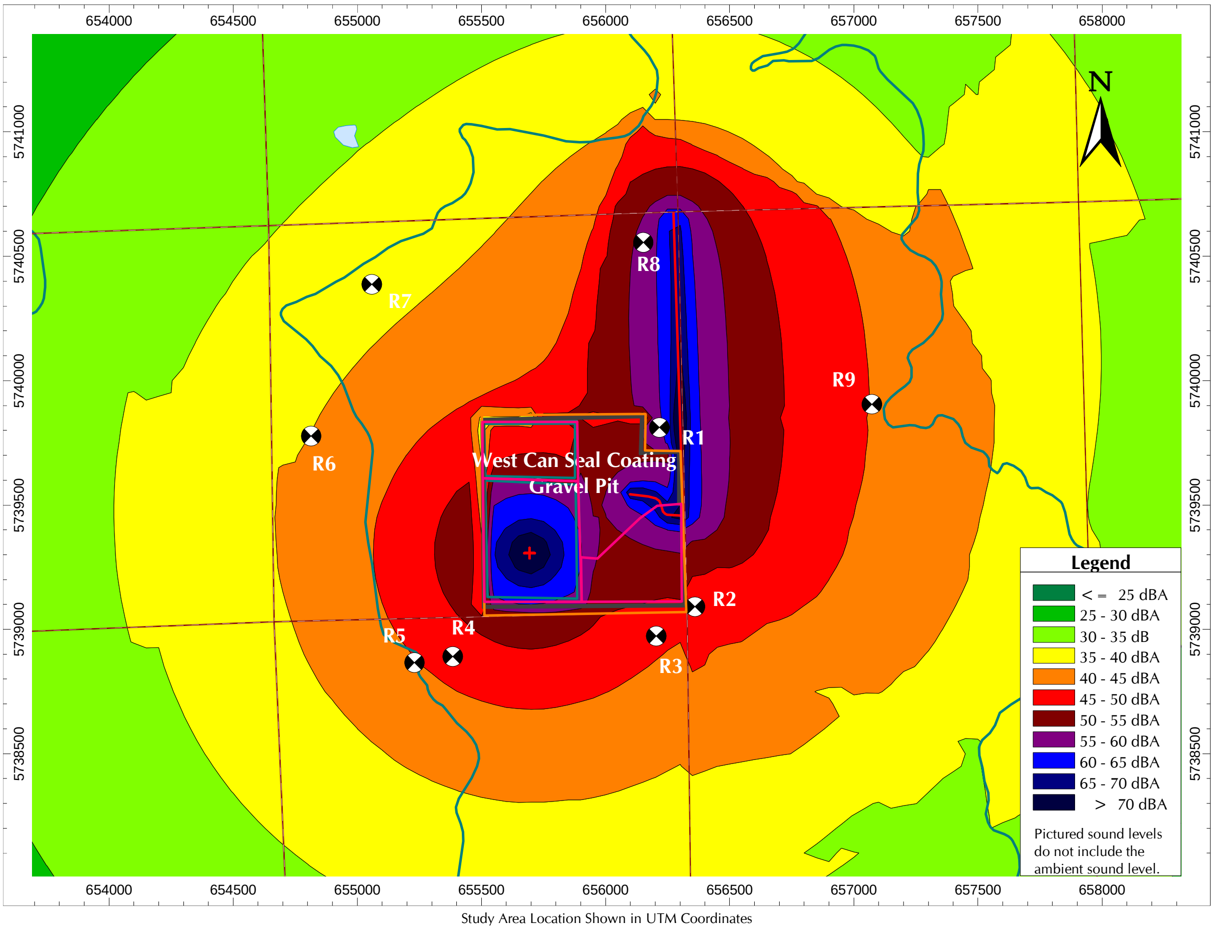


Figure 19 –Scenario 5 - Predicted Facility Sound Contours (Not Including Ambient) from Stripping with 3m Berms in Phase 3

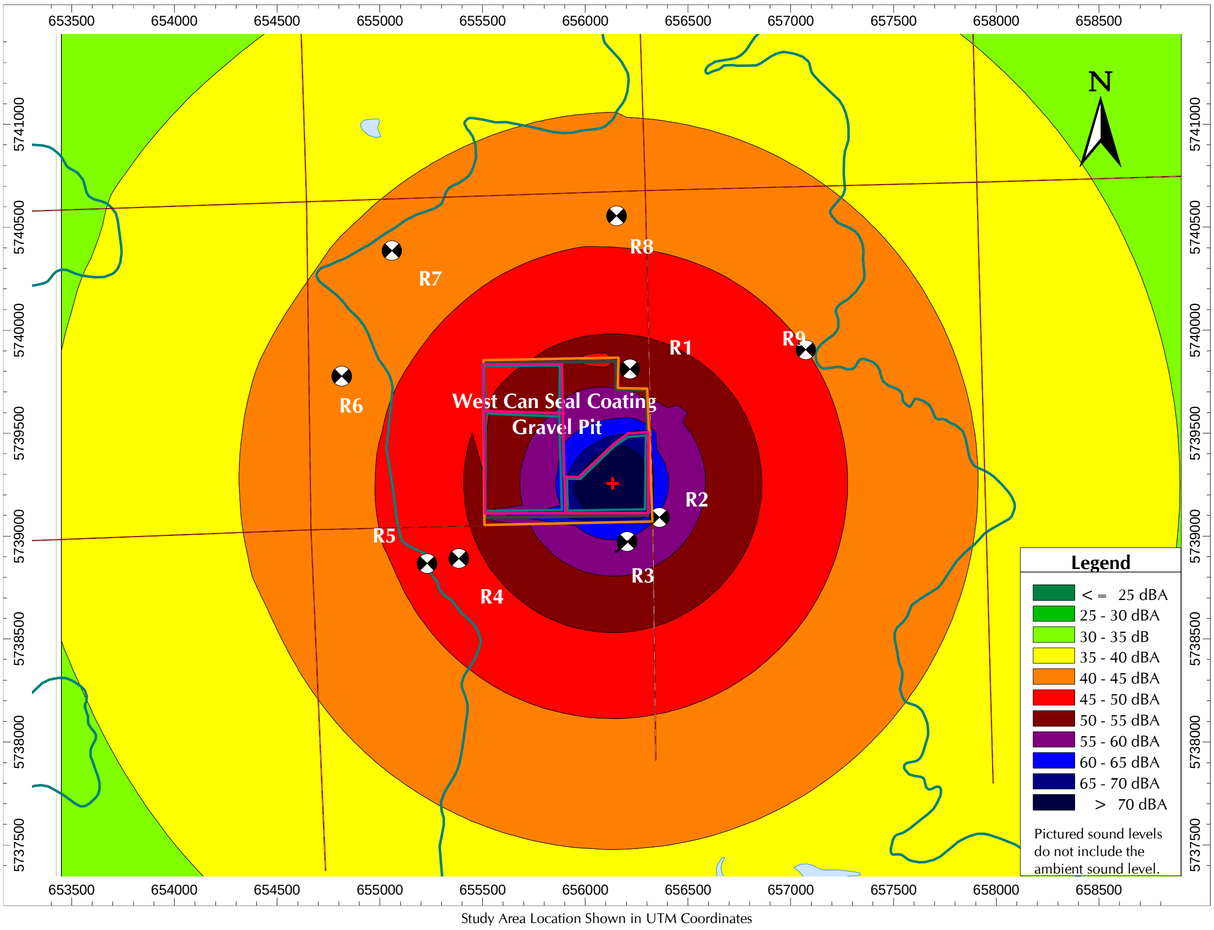
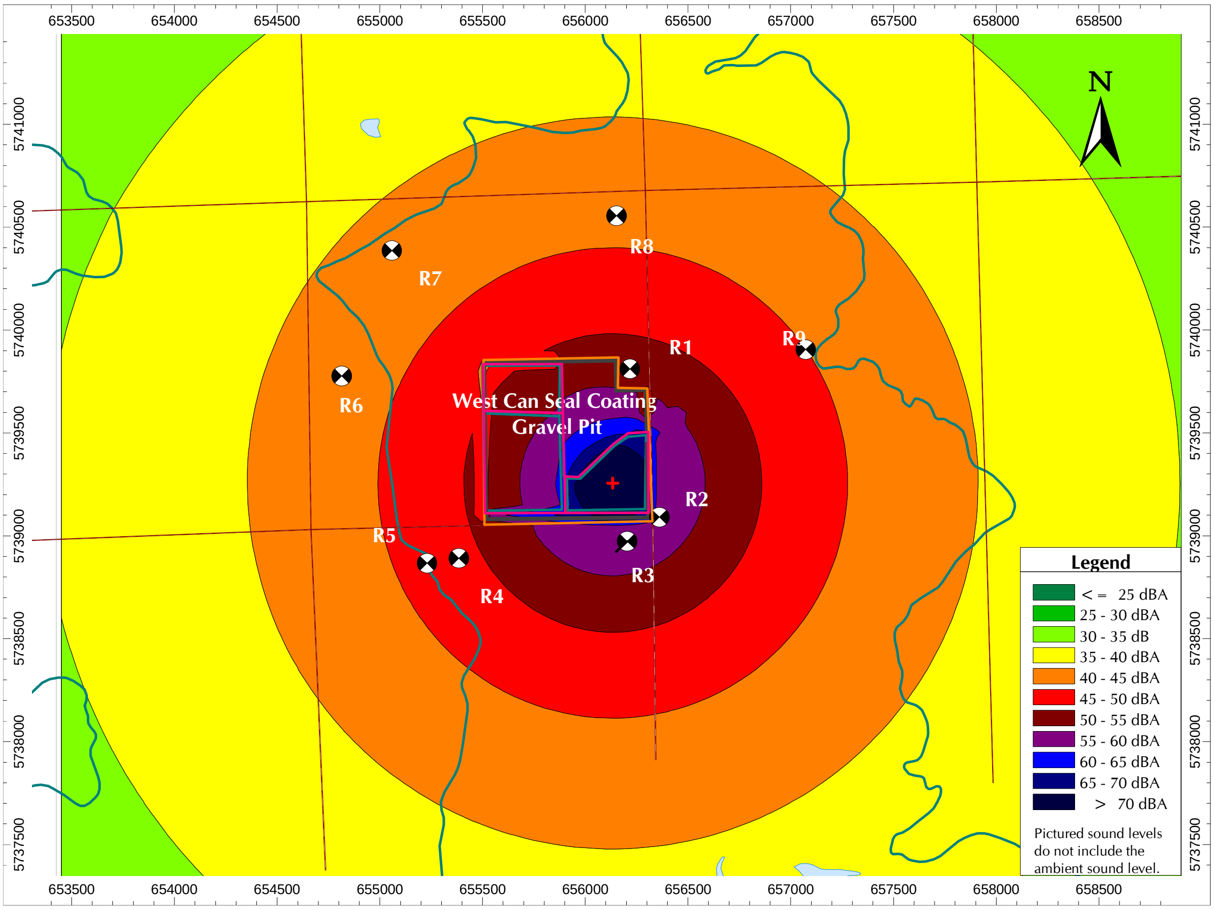


Figure 20 –Scenario 5 - Predicted Facility Sound Contours (Not Including Ambient) from Stripping with 5m Berms in Phase 3



Study Area Location Shown in UTM Coordinates

Figure 21 –Scenario 6- Predicted Facility Sound Contours (Not Including Ambient) from Crushing, Washing, Asphalt production & Transportation with 3m Berms in Phase 3

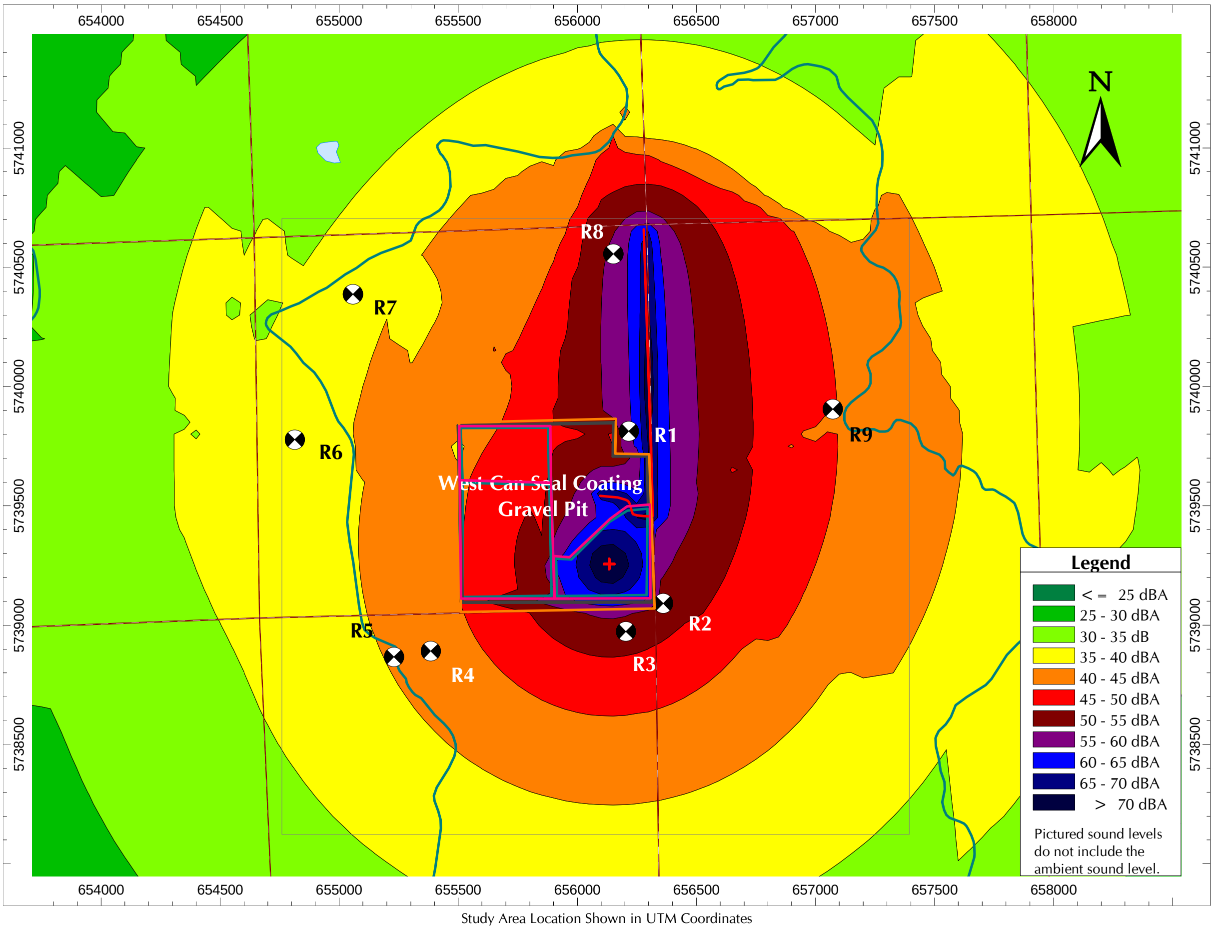


Figure 22 –Scenario 6- Predicted Facility Sound Contours (Not Including Ambient) from Crushing, Washing, Asphalt production & Transportation with 5m Berms in Phase 3

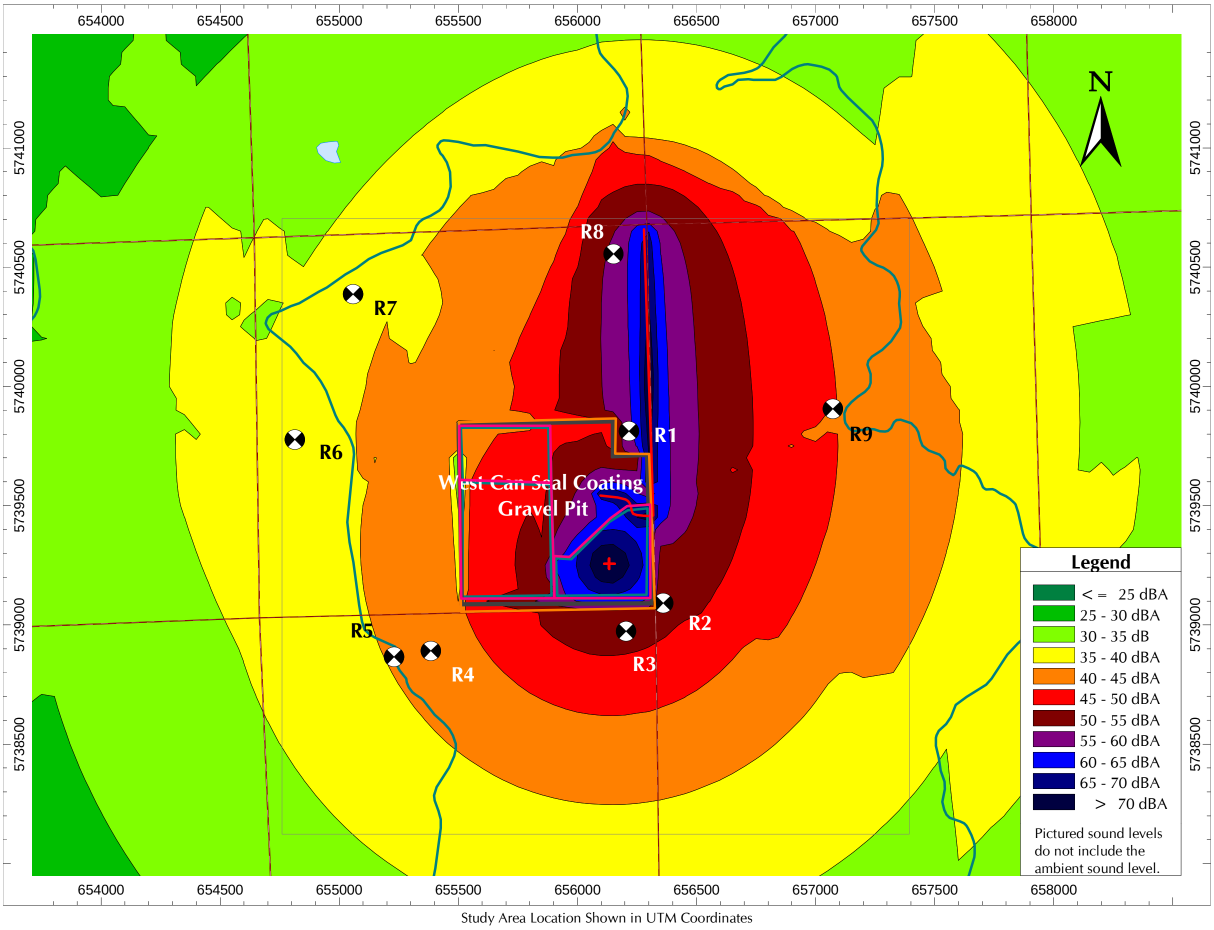
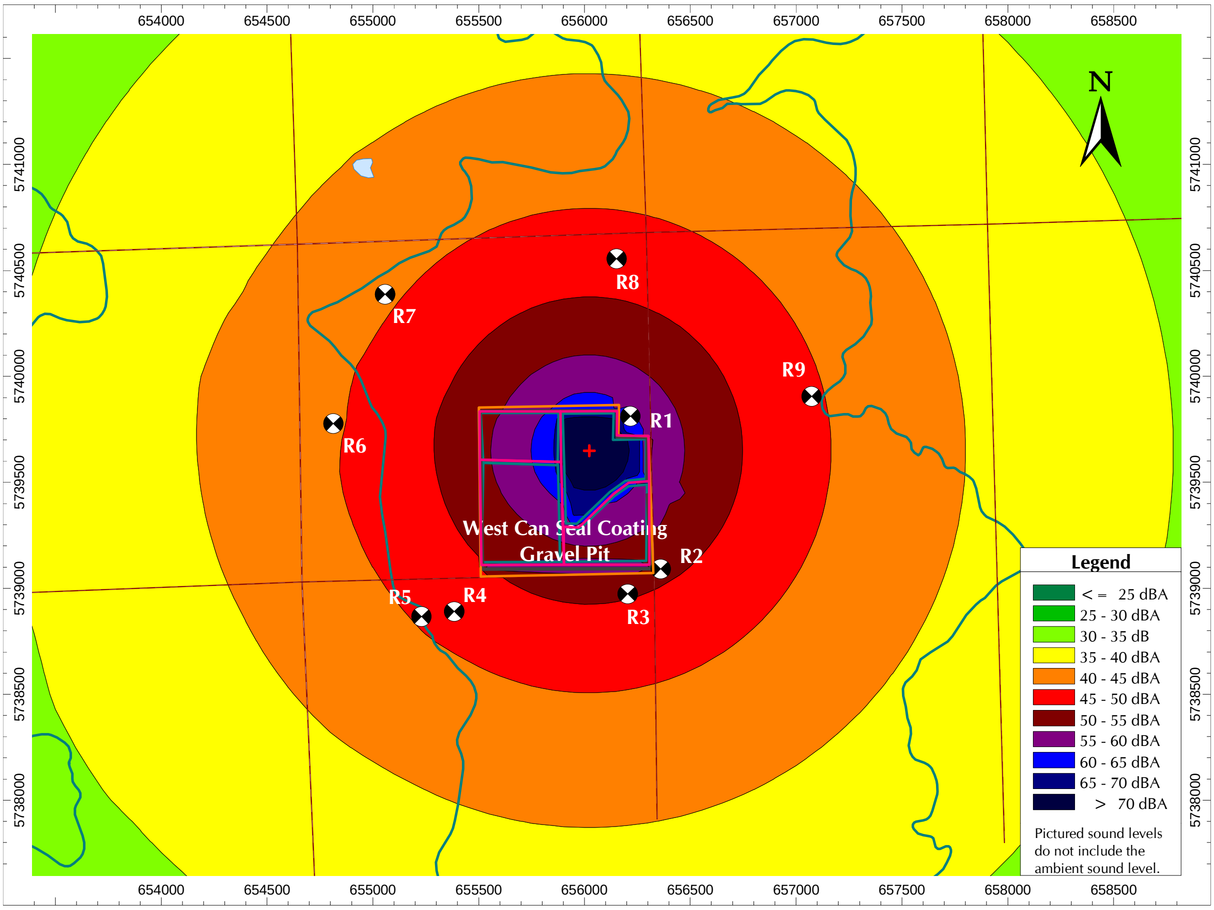


Figure 23 –Scenario 7 - Predicted Facility Sound Contours (Not Including Ambient) from Stripping with 3m Berms in Phase 4



Study Area Location Shown in UTM Coordinates

Figure 24 –Scenario 7 - Predicted Facility Sound Contours (Not Including Ambient) from Stripping with 5m Berms in Phase 4

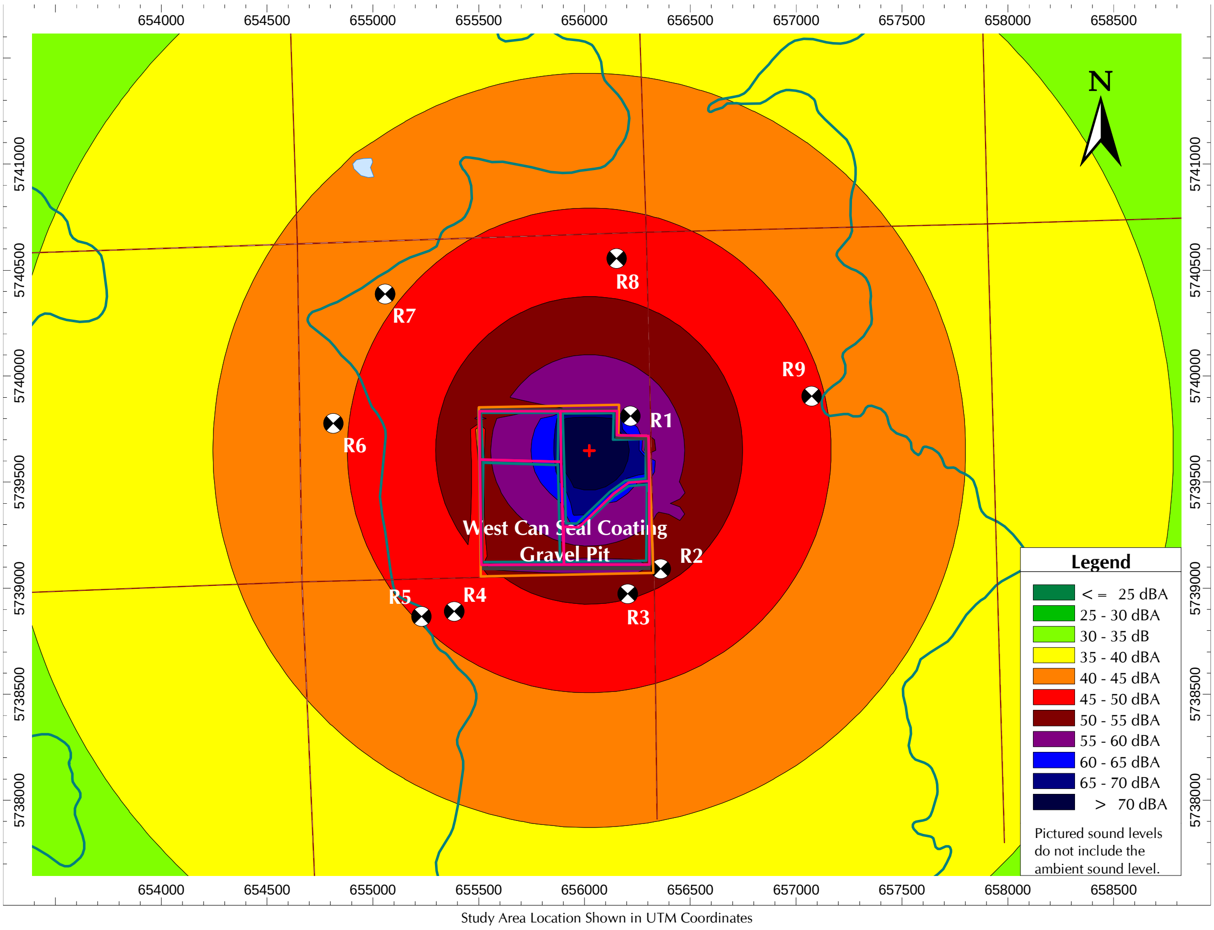


Figure 25 –Scenario 8- Predicted Facility Sound Contours (Not Including Ambient) from Crushing, Washing, Asphalt production & Transportation with 3m Berms in Phase 4

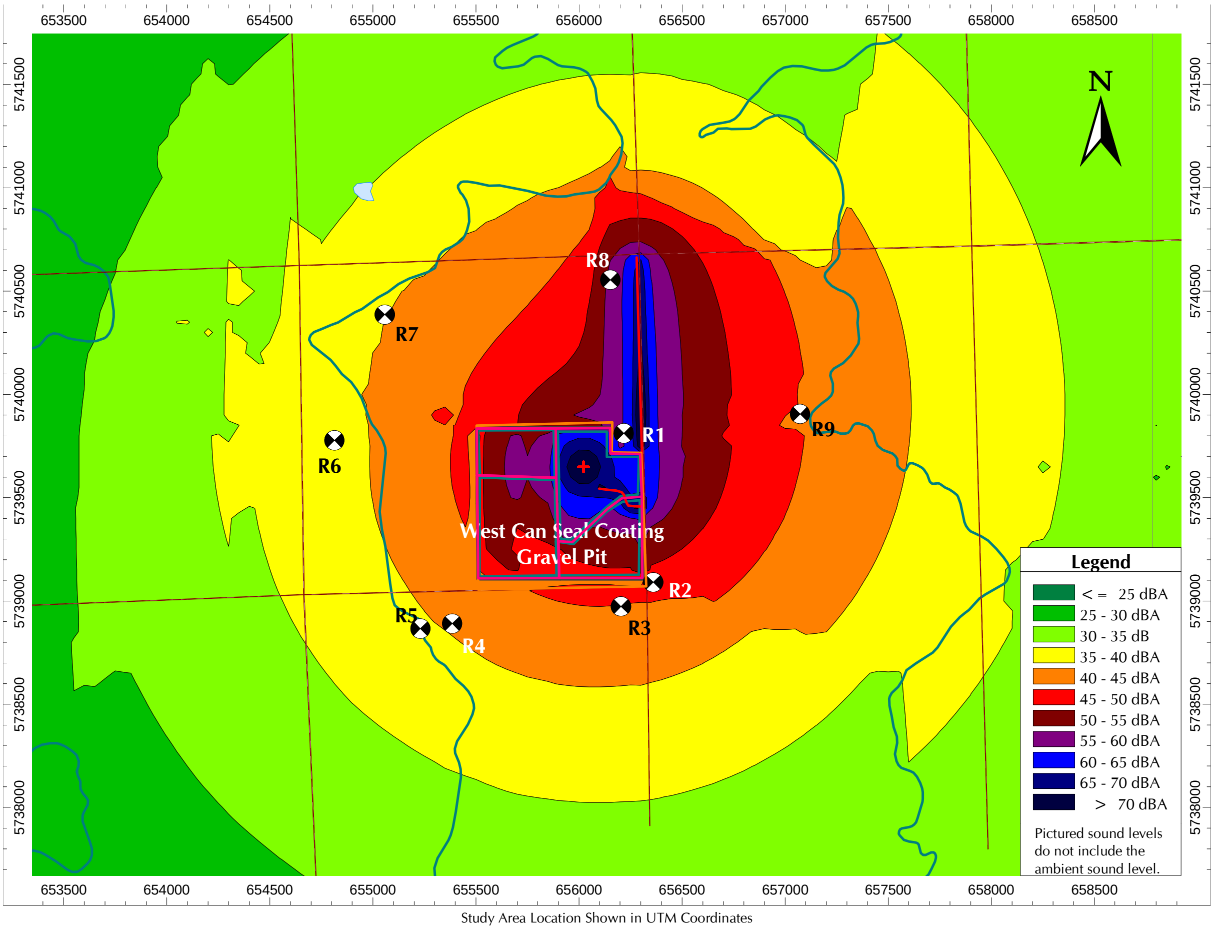
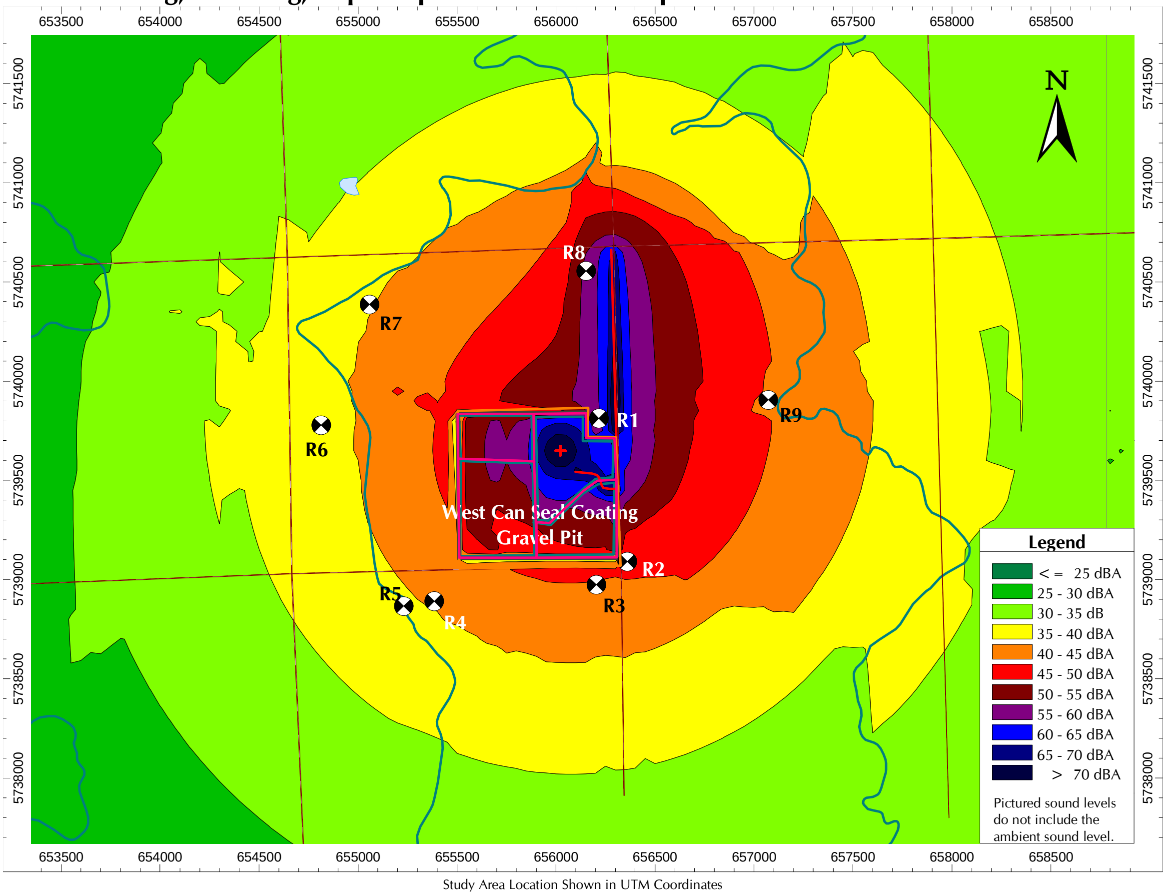


Figure 26 –Scenario 8- Predicted Facility Sound Contours (Not Including Ambient) from Crushing, Washing, Asphalt production & Transportation with 5m Berms in Phase 4



Conclusion

This document reports the expected sound level at the Receivers around the proposed West Can Seal Coating Gravel Pit for the Stripping (Operation 1) and crushing, Washing & Asphalt production (Operation 2), and the 4 proposed exploration areas.

The Predicted Sound Level for stripping phase (without berms) exceeds the Permissible Sound Level (55dBA Daytime) at nearest Receiver to the respective phase of operation.

The Predicted Sound Level for the Crushing, Washing & Asphalt production phase (without berms) are within the Permissible Sound Level (55 dBA Daytime) at all Receivers around proposed gravel pit except Receiver 1 and Residence 7. The predict Sound Level at Receiver 1 & 7 exceed the PSL due primarily to the hauling of product from the site.

The introduction of 3m and 5m high berms brings down the predicted sound level below the PSL during the Striping phase except phase 3 and Phase 4. In the Crushing, Washing & Asphalt Production phase, berms bring down the predicted sound level at all Receivers except Residence 1 and 7.

APPENDIX A

Explanation of Technical Details Regarding Sound Measurement and Analysis

Technical Details

Sound is the phenomena of vibrations transmitted through air, or other medium such as water or a building structure. The range of pressure amplitudes, intensities, and frequencies of the sound energy is very wide, and many specialized fields have developed using different ranges of these variables, such as room acoustics and medical ultrasound.

Due to the wide range of intensities, which are perceived as sound, standard engineering units become inconvenient. Sound levels are commonly measured on a logarithmic scale, with the level (in decibels, or dB) being proportional to ten times the common logarithm of the sound energy or intensity. Normal human hearing covers a range of about twelve to fourteen orders of magnitude in energy, from the threshold of hearing to the threshold of pain. On the decibel scale, the threshold of hearing is set as zero, written as 0 dB, while the threshold of pain varies between 120 to 140 dB. The most usual measure of sound is the sound pressure level (SPL), with 0 dB SPL set at 2.0 X 10^{-5} N/m^2 (also written 20 μPa), which corresponds to a sound intensity of 10^{-12} Watts/m^2 (or 1 picoWatt/m^2, written 1 pW/m^2).

Normal human hearing spans a frequency range from about 20 Hertz (Hz, or cycles per second) to about 20,000 Hz (written 20 KHz). However, the sensitivity of human hearing is not the same at all frequencies. To accommodate the variation in sensitivity, various frequency-weighting scales have been developed. The most common is the A-weighting scale, which is based on the sensitivity of human hearing at moderate levels; this scale reflects the low sensitivity to sounds of very high or very low frequencies. Sound levels measured on the A-weighted scale are written in A-weighted decibels, commonly shown as dBA or dB(A).

When sound is measured using the A-weighting scale, the reading is often called the "Noise level", to confirm that human sensitivity and reactions are being addressed. A table of some common noise sources and their associated noise levels are shown in Table A1.

When the A-weighting scale is not used, the measurement is said to have a "linear" weighting, or to be unweighted, and may be called a "linear" level. As the linear reading is an accurate measurement of the physical (sound) pressure, the term "Sound Pressure Level", or SPL, is usually (but not universally) reserved for unweighted measurements.

Noise is usually defined as "unwanted sound", which indicates that it is not just the physical sound that is important, but also the human reaction to the sound that leads to the perception of sound as noise. It implies a judgment of the quality or quantity of sound experienced. As a human reaction to sound is involved, noise levels are usually given in A-weighted decibels (dBA). An alternate definition of noise is "sound made by somebody else", which emphasizes that the ability to control the level of the sound alters the perception of noise.

Table B1- Noise Levels of Familiar Sources

Source Or Environment	Noise Level (dBA)
High Pressure Steam Venting To Atmosphere (3m)	121
Steam Boiler (2m)	90-95
Drilling Rig (10m)	80-90
Pneumatic Drill (15m)	85
Pump Jack (10m)	68-72
Truck (15m)	65-70
Business Office	65
Conversational Speech (1m)	60
Light Auto Traffic (30m)	50
Living Room	40
Library	35
Soft Whisper (5m)	20-35

The single number A-weighted level is often inadequate for engineering purposes, although it does supply a good estimate of people's reaction to a noise environment. As noise sources, control measures, and materials differ in the frequency dependence of their noise responses or production, sound is measured with a narrower frequency bandwidth; the specific methodology varies with the application. For most work, the acoustic frequency range is divided into frequency bands where the center frequency of each band is twice the frequency of the next lower band; these are called "Octave" bands, as their frequency relation is called an "Octave" in music, where the field of acoustics has its roots. For more detailed work, the octave bands, and certain standard octave and 1/3 octave bands have been specified by international agreements.

Where the noise at the receiver is steady, it is easy to assess the noise level. However, both the production of noise at the source and the transmission of noise can vary with time; most noise levels are not constant, either because of the motion of the noise source (as in traffic noise), because the noise source itself varies, or because the transmission of sound to the receiver location is not steady as over long distances. This is almost always the case for environmental noise studies. Several single number descriptors have been developed and are used to assess noise in these conditions.

The most common is the measurement of the "equivalent continuous" sound level, or L_{eq}, which is the level of a hypothetical source of a constant level which would give the same total sound energy as is measured during the sampling period. This is the "energy" average noise level. Typical sampling periods are one hour, nighttime (9 hours) or one day (24 hours); the sampling period used must be reported when using this unit.

The greatest value of the L_{eq} is that the contributions of different sources to the total noise level can be assessed, or in a case where a new noise source is to be added to a proposed environment, the total noise level from new and old sources can be easily calculated. It is also sensitive to short term high noise levels.

Statistical noise levels are sometimes used to assess an unsteady noise environment. They indicate the levels that are exceeded a fixed percentage of the measurement time period measured. For example, the 10%-ile level, written L_{10}, is the levels exceeded 10% of the time; this level is a good measure of frequent noisy occurrences such as steady road traffic. The 90% level, L_{90}, is the level exceeded 90% of the time, and is the background level, or noise floor. A steady noise source will modify the background level, while an intermittent noise source such as road or rail traffic will affect the short-term levels only.

One disadvantage with the L_{eq} measure, when used alone, is that nearby loud sources (e.g. dogs barking, or birds singing) can confuse the assessment of the situation when it is the noise from a distant plant that is the concern. For this reason, the equivalent level and the statistical levels can be used together to better understand the noise environment. One such indication is the difference between the L_{eq} and the L_{90} levels. A large difference between the L_{eq} and L_{90}, greater than 10 dB, indicates the intrusion of short-term noise events on the general background level. A small difference, less than 5 dB, indicates a very steady noise environment. If the L_{eq} value exceeds the L_{10} value this indicates the presence of significant short-term loud events.

For most noise measurement, instruments are adjusted so that the time response of the instrument is similar to the response of the human ear; this is the "Fast" setting. Measurement with the "Fast" setting therefore assesses the sound environment according to the way humans would hear it and react to it. Where the noise level varies substantially and an average level is wanted without the complexity of and L_{eq} or statistical measurement, the "Slow" setting is used on the sound level meter. The "Slow" setting is also typically used in industrial settings where hearing damage is a concern. Where the noise level changes very rapidly, for example due to impacts or detonations, the "Fast" and "Slow" settings do not respond quickly enough to assess the maximum levels, and the "Impulse" meter setting us used.

The Sound Power Level (abbreviated L_w, SWL or PWL) is the decibel equivalent of the total energy emitted from a source in the form of noise. The reference level for the sound power is 10^{-12} Watts, or 1 picoWatt (abbreviated pW). The sound power level is given by:

$$L_w, \text{SWL}, \text{PWL} = 10 \times \log_{10} (\text{Emitted Power} / 1\ \text{pW})\ \text{dB}$$

Therefore, a source emitting 1 Watt of power in the form of sound would have a sound power level of 120 dB. Sound power levels can be expressed in terms of frequency bands, an overall linear-weighted level or A-weighted, as is the case for sound pressure levels. However, sound power levels are inherent to the source of noise, whereas the sound pressure level is dependent on the source, but also on the distance from the source and other environmental factors.