I MINA'TRENTAI SAIS NA LIHESLATURAN GUÅHAN

Informational Briefing/Hearing/ Oversight Hearing / Roundtable Hearing

STANDING COMMITTEE / SENATOR	HEARING	COMMITTEE REPORT	HEARING DATE	DATE COMMITTEE REPORT FILED	NOTES
Committee on Health, Land, Justice, and Culture	Informational Hearing	Existing Laws and agency regulatory, permitting, and environmental guidelines relative to mineral extraction on Guam	4/6/22 3:00 p.m.	12/29/22 2:49 p.m.	

Office of the Speaker
THERESE M. TERLAJE
I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice, and Culture

December 23, 2022

The Honorable Amanda L. Shelton
Acting Chairperson, Committee on Rules
I Mina'trentai Sais na Liheslaturan Guåhan
163 Chalan Santo Papa Hagåtña Guam, 96910

RE: Committee Report for April 6, 2022 Informational Hearing on Existing Laws and agency regulatory, permitting, and environmental guidelines relative to mineral extraction on Guam.

Håfa Adai Acting Chairperson Shelton:

Transmitted herewith is the *Committee Report for the Informational Hearing on Existing Laws and agency regulatory, permitting, and environmental guidelines relative to mineral extraction on Guam* held on Wednesday, April 6, 2022.

Si Yu'os Ma'åse'
Therese M. Terlaje

COMMITTEE ON RULES
RECEIVED:
December 23, 2022
8:00 A.M.

Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910
Tel: (671) 472-3586 | Fax: (671) 969-3590 | Email: senatorterlajeguam@gmail.com | www.senatorterlaje.com

**For transmittal of official Messages & Communications to the Guam Legislature to be distributed to all Senators, please send to: speaker@guamlegislature.org*

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THERESE M. TERLAJE
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Committee on Health, Land, Justice, and Culture

COMMITTEE REPORT

Informational Hearing on Existing Laws and agency regulatory, permitting, and environmental guidelines relative to mineral extraction on Guam

By. Speaker Therese M. Terlaje

Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910
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Gmail **Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com>**

FIRST NOTICE of Virtual Public Hearing - Wednesday, April 6, 2022, beginning at 9:00 a.m.

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Wed, Mar 30, 2022 at 5:10 PM
To: phnotice@guamlegislature.org
Cc: Audio / Video <av@guamlegislature.org>, Guam MIS <mis@guamlegislature.org>, Ibarra Hernandez <ihernandez@guamlegislature.org>, Tom Unsiog <sgtarms@guamlegislature.org>
Bcc: mindy@postguam.com, The Post Editor in Chief <editor@postguam.com>, Oyaol Ngirairikl <managingeditor@postguam.com>, haidee@postguam.com, John Oconnor <john@postguam.com>, reporters@postguam.com, rlimtiaco@guampdn.com, Rindraty Limtiaco <slimtiaco@guampdn.com>, Guam PDN <news@guampdn.com>, Jerick Sablan <jpsablan@guampdn.com>, life@guampdn.com, dmgeorge@guampdn.com, Mar-Vic Cagurangan <publisher@pacificislandtimes.com>, Pacific Island Times <pacificislandtimes@gmail.com>, Maureen Maratita <publisher@glimpsesofguam.com>, bryan@mvariety.com, emmanuel@mvariety.com, mabuhaynews@yahoo.com, editor@saipantribune.com, Bruce Hill <pacificjournalist@gmail.com>, Jason Salas <jason@kuam.com>, Sabrina Salas Matanane <sabrina@kuam.com>, Chris Malafunkshun Barnett <Chris@kuam.com>, Nestor Licanto <nestor@kuam.com>, reporters@kuam.com, K57 <news@k57.com>, Patti Rodriguez <parroyo@spbguam.com>, pattiontheradio@yahoo.com, Sorensen Pacific Broadcasting <news@spbguam.com>, raygibsonshow@gmail.com, manasilva626[redacted], KISH <kstokish@gmail.com>, Manuel Cruz <[redacted]>, Troy Torres <troy@kanditnews.com>, Maria Louella Losinio <louella.losinio@gmail.com>, "Mayors' Council of Guam - Admin." <mcogadmin@teleguam.net>, "Mayor Paul M. McDonald" <mayor.mcdonald671@gmail.com>, agatmayor@yahoo.com, agatvice.chrisfejeran@yahoo.com, "Mayor Frankie A. Salas" <asanmainamayor@gmail.com>, June Blas <mayorbarrigada@gmail.com>, Jessie Bautista <jessie.bautista007@gmail.com>, Jessy Gogue <ocp.mayor@gmail.com>, MELISSA SAVARES <melissa.savares@gmail.com>, "Vice Mayor Peter John S. Benavente" <onedededo@gmail.com>, hagatnamayor@hotmail.com, Mayor Anthony Chargualaf <inalahanmayor@gmail.com>, Allan Ungacta <mayorallan.ungacta@yahoo.com>, Vice Mayor Kevin AN Delgado <mangilao.vicemayor@gmail.com>, mayorernestc@yahoo.com, mtmmayorpaco17@gmail.com, Jesse Alig <jesse.alig@pitiguam.com>, Dale Alvarez <daleealvarez@gmail.com>, Robert Hofmann <guammayor@gmail.com>, rudy iriarte <rudyiriarte@gmail.com>, Mayor Taitague <talofofomayor@gmail.com>, "Mayor Louise C. Rivera" <Mayorlcrivera.tatuha@gmail.com>, "Vice Mayor Albert M. Toves" <atoves.tatuha@gmail.com>, Umatac Mayor <umatacmo@gmail.com>, "Mayor Anthony P. Sanchez" <ymayortony@gmail.com>, "Vice Mayor Loreto V. Leones" <lloretoleones@gmail.com>, "Mayor Bill A. Quenga" <yonamayor2020@gmail.com>, jolene@postguam.com, Phil Leon Guerrero <phil@postguam.com>, Gerry Partido <gerrypartido@gmail.com>, gerry@spbguam.com, Damen Borja <damen@spbguam.com>, tlamoren[redacted], jsantotoma@guampdn.com, freeguam2021[redacted]

March 30, 2022

MEMORANDUM

To: All Senators, Stakeholders and Media

From: Speaker Therese M. Terlaje, Chairperson
Committee on Health, Land, Justice and Culture

Subject: **FIRST NOTICE of Virtual Public Hearing** - Wednesday, April 6, 2022, beginning at 9:00 a.m.

Buenas yan Håfa Adai,

Please be advised that the Committee on Health, Land, Justice and Culture will convene a virtual public hearing, using the Legislature's virtual Zoom platform on Wednesday, April 6, 2022, beginning at 9:00 a.m., for the following agenda items:

9:00 AM:

- **Bill No. 242-36 (LS) - Mary Camacho Torres / Therese M. Terlaje / Tina Rose Muña Barnes / Amanda L. Shelton / James C. Moylan / Jose "Pedo" Terlaje / V. Anthony Ada / Frank Blas Jr. / Clynton E. Ridgell / Joe S. San Agustin / Christopher M. Dueñas -** AN ACT TO ADD A NEW §40110 TO CHAPTER 40, TITLE 7, GUAM CODE ANNOTATED, AND TO FURTHER ADD A NEW § 30.400 TO CHAPTER 30 OF TITLE 9, GUAM CODE ANNOTATED, RELATIVE TO THE TRANSFER OR RELEASE OF FAMILY VIOLENCE VICTIMS FROM SHARED WIRELESS PLANS.

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2:00 PM

- **APPOINTMENT HEARING:** Appointment of Earl J. Garrido to serve as a Member of the CHamoru Land Trust Commission, for a term of three (3) Years; April 11, 2021, to April 10, 2024, to fill term of Austin Duenas whose term has expired.

3:00 PM

- **INFORMATIONAL HEARING:** on existing laws and agency regulatory, permitting, and environmental guidelines relative to mineral extraction on Guam.

Please contact (671) 472-3586 or senatorterlajeguam@gmail.com by TUESDAY, APRIL 5, 2022, to register to provide virtual testimony. Written testimony may also be submitted via email or to the Office of Speaker Therese Terlaje at the Guam Congress Bldg; 163 Chalan Santo Papa, Hagåtña, Guam.

All hearings will be broadcast on GTA TV Channel 21, Docomo Channel 117/112.4, and Guam Legislature Media on YouTube and will be available on the Guam Legislature Media YouTube Channel after the hearings. In compliance with the Americans with Disabilities Act, Individuals in need of assistance or accommodations should also contact the Office of Speaker Therese M. Terlaje.

We look forward to your participation!

Si Yu'os Ma'åse'!

Office of Speaker Therese M. Terlaje
Committee on Health, Land, Justice and Culture
I Mina'trentai Sais na Liheslaturan Guåhan
36th Guam Legislature
Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910
T: (671) 472-3586 F: (671) 989-3590 Email: senatorterlajeguam@gmail.com
website: www.senatorterlaje.com

FIRST NOTICE OF VIRTUAL PUBLIC HEARING- APRIL 6, 2022_TMT.pdf
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Office of the Speaker
THERESE M. TERLAJE

I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

March 30, 2022

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We look forward to your participation!

Si Yu'os Ma'åse'!

Judge: Trump likely committed crimes in trying to block Biden

WASHINGTON (The Washington Post) – A federal judge said Monday that then-President Donald Trump "more likely than not" committed federal crimes in trying to obstruct the congressional count of electoral college votes on Jan. 6, 2021 – an assertion that is likely to increase public pressure on the Justice Department to investigate the former commander in chief.

The determination from U.S. District Judge David O. Carter came in a ruling addressing scores of sensitive emails that Trump ally and conservative lawyer John Eastman had resisted turning over to the House select committee investigating the Jan. 6 riot and related efforts to overturn the 2020 presidential election result.

Eastman wrote key legal memos aimed at denying Democrat Joe Biden's victory. The judge was assessing whether Eastman's communications were protected by attorney-client privilege and was analyzing in part whether Eastman, Trump and others had consulted about the commission of a crime.

"Based on the evidence, the Court finds it more likely than not that President Trump corruptly attempted to obstruct the Joint Session of Congress on January 6, 2021," wrote Carter, who is based in California and has jurisdiction because that is where Eastman filed the case.

Trump spokesman Taylor Budowich called the ruling "absurd and baseless" and said it was an example of "how the left is weaponizing every branch of government against President Trump."

Donald Trump

Eastman's legal team issued a statement saying that Eastman had a "duty" to raise attorney-client privilege claims to protect communications for those he represented, but that he "intends to comply with the court's order" to turn over documents.

Carter based his assertions on a review of Eastman's email communications – only one of which the judge determined might be evidence of the furthering of a crime – as well as publicly known facts about Trump's actions in the run-up to the Jan. 6 riot.

Jan. 6 committee may seek interview with wife of Justice Thomas

WASHINGTON (Reuters) — The congressional panel investigating the deadly Jan. 6, 2021, attack on the U.S. Capitol may seek to interview Virginia Thomas, a Republican activist and wife of Supreme Court Justice Clarence Thomas, a source familiar with the matter said Monday.

The U.S. House of Representatives' Select Committee has conducted hundreds of interviews in its investigation of the attack on the Capitol last year by supporters of former President Donald Trump as lawmakers were poised to certify the 2020 election.

The January 6 committee met behind closed doors Monday night to discuss whether to invite Thomas to testify. Rep. Bennie Thompson, chairman of the Jan. 6 committee, told reporters after the meeting that the panel had not made a decision on whether to ask her to testify.

Several media outlets, including CNN on Monday, have reported the committee's possible interest in hearing from Virginia Thomas since her texts with Trump's then-chief of staff, Mark Meadows, were made public last week in a Washington Post/CBS report.

Virginia Thomas, who goes by Ginni, is active in conservative circles and earlier this month said in a separate media interview that she had attended Trump's rally hours before the Capitol riot.

In a series of 29 messages to Meadows following Trump's loss, Thomas repeatedly asked Meadows to work to overturn the election results. Meadows was found in contempt of Congress for refusing to cooperate fully with the Jan. 6 probe.

Gmail **Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com>**

SECOND NOTICE of Virtual Public Hearing - Wednesday, April 6, 2022, beginning at 9:00 a.m.

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Mon, Apr 4, 2022 at 7:02 AM
To: phnotice@guamlegislature.org
Cc: Audio / Video <av@guamlegislature.org>, Tom Unsiog <sgtarms@guamlegislature.org>, Guam MIS <mis@guamlegislature.org>
Bcc: mindy@postguam.com, The Post Editor in Chief <editor@postguam.com>, Oyaol Ngirairikl <managingeditor@postguam.com>, haidee@postguam.com, John Oconnor <john@postguam.com>, reporters@postguam.com, rlimtiaco@guampdn.com, Rindraty Limtiaco <slimtiaco@guampdn.com>, Guam PDN <news@guampdn.com>, Jerick Sablan <jpsablan@guampdn.com>, life@guampdn.com, dmgeorge@guampdn.com, Mar-Vic Cagurangan <publisher@pacificislandtimes.com>, Pacific Island Times <pacificislandtimes@gmail.com>, Maureen Maratita <publisher@glimpsesofguam.com>, bryan@mvariety.com, emmanuel@mvariety.com, mabuhaynews@yahoo.com, editor@saipantribune.com, Bruce Hill <pacificjournalist@gmail.com>, Jason Salas <jason@kuam.com>, Sabrina Salas Matanane <sabrina@kuam.com>, Chris Malafunkshun Barnett <Chris@kuam.com>, Nestor Licanto <nestor@kuam.com>, reporters@kuam.com, K57 <news@k57.com>, Patti Rodriguez <parroyo@spbguam.com>, pattiontheradio@yahoo.com, Sorensen Pacific Broadcasting <news@spbguam.com>, raygibsonshow@gmail.com, manasilva626[redacted], KISH <kstokish@gmail.com>, Manuel Cruz <[redacted]>, Troy Torres <troy@kanditnews.com>, Maria Louella Losinio <louella.losinio@gmail.com>, "Mayors' Council of Guam - Admin." <mcogadmin@teleguam.net>, "Mayor Paul M. McDonald" <mayor.mcdonald671@gmail.com>, agatmayor@yahoo.com, agatvice.chrisfejeran@yahoo.com, "Mayor Frankie A. Salas" <asanmainamayor@gmail.com>, June Blas <mayorbarrigada@gmail.com>, Jessie Bautista <jessie.bautista007@gmail.com>, Jessy Gogue <ocp.mayor@gmail.com>, MELISSA SAVARES <melissa.savares@gmail.com>, "Vice Mayor Peter John S. Benavente" <onedededo@gmail.com>, hagatnamayor@hotmail.com, Mayor Anthony Chargualaf <inalahanmayor@gmail.com>, Allan Ungacta <mayorallan.ungacta@yahoo.com>, Vice Mayor Kevin AN Delgado <mangilao.vicemayor@gmail.com>, mayorernestc@yahoo.com, mtmmayorpaco17@gmail.com, Jesse Alig <jesse.alig@pitiguam.com>, Dale Alvarez <daleealvarez@gmail.com>, Robert Hofmann <guammayor@gmail.com>, rudy iriarte <rudyiriarte@gmail.com>, Mayor Taitague <talofofomayor@gmail.com>, "Mayor Louise C. Rivera" <Mayorlcrivera.tatuha@gmail.com>, "Vice Mayor Albert M. Toves" <atoves.tatuha@gmail.com>, Umatac Mayor <umatacmo@gmail.com>, "Mayor Anthony P. Sanchez" <ymayortony@gmail.com>, "Vice Mayor Loreto V. Leones" <lloretoleones@gmail.com>, "Mayor Bill A. Quenga" <yonamayor2020@gmail.com>, jolene@postguam.com, Phil Leon Guerrero <phil@postguam.com>, Gerry Partido <gerrypartido@gmail.com>, gerry@spbguam.com, Damen Borja <damen@spbguam.com>, tlamorena[redacted], jsantotoma@guampdn.com, freeguam2021[redacted]

April 4, 2022

MEMORANDUM

To: All Senators, Stakeholders and Media

From: Speaker Therese M. Terlaje, Chairperson
Committee on Health, Land, Justice and Culture

Subject: **SECOND NOTICE of Virtual Public Hearing** - Wednesday, April 6, 2022, beginning at 9:00 a.m.

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Committee on Health, Land, Justice and Culture
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5 attachments

SECOND NOTICE OF VIRTUAL PUBLIC HEARING- APRIL 6, 2022_TMT.pdf
435K

Bill No. 244-36 (LS)-2.pdf
1632K

Bill No. 242-36 (LS)-2.pdf
982K

Bill No. 243-36 (LS)-4.pdf
1712K

APPOINTMENT PACKET- EARL GARRIDO, CLTC.pdf
1574K

Office of the Speaker
THERESE M. TERLAJE
I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

April 4, 2022

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- **Bill No. 244-36 (LS) - Mary Camacho Torres / Therese M. Terlaje / Tina Rose Muña Barnes / Amanda L. Shelton / James C. Moylan / Jose "Pedo" Terlaje / V. Anthony Ada / Frank Blas Jr. / Clynton E. Ridgell / Joe S. San Agustin / Christopher M. Dueñas / Sabina F. Perez** - AN ACT TO ADD A NEW CHAPTER 163 TO TITLE 8 OF THE GUAM CODE ANNOTATED, RELATIVE TO ESTABLISHING A BILL OF RIGHTS FOR VICTIMS OF SEXUAL ASSAULT, AND TO FURTHER CITING THIS ACT AS THE "SURVIVOR'S BILL OF RIGHTS ACT OF 2022."

2:00 PM

- **APPOINTMENT HEARING:** Appointment of Earl J. Garrido to serve as a Member of the CHamoru Land Trust Commission, for a term of three (3) Years; April 11, 2021, to April 10, 2024, to fill term of Austin Duenas whose term has expired.

3:00 PM

- **INFORMATIONAL HEARING:** on existing laws and agency regulatory, permitting, and environmental guidelines relative to mineral extraction on Guam.

Please contact (671) 472-3586 or senatorterlajeguam@gmail.com by TUESDAY, APRIL 5, 2022, to register to provide virtual testimony. Written testimony may also be submitted via email or to the Office of Speaker Therese Terlaje at the Guam Congress Bldg; 163 Chalan Santo Papa, Hagåtña, Guam.

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We look forward to your participation!

Si Yu'os Ma'åse'!

SPEAKER THERESE M. TERLAJE

Committee on Health, Land, Justice & Culture
I Mina'trentai Sais na Liheslaturan Guåhan

VIRTUAL PUBLIC HEARING NOTICE
WEDNESDAY, APRIL 6, 2022

9:00 AM:

- **Bill No. 242-36 (LS)** - Mary Camacho Torres / Therese M. Terlaje / Tina Rose Muña Barnes / Amanda L. Shelton / James C. Moylan / Jose "Pedo" Terlaje / V. Anthony Ada / Frank Blas Jr. / Clynton E. Ridgell / Joe S. San Agustin / Christopher M. Dueñas- AN ACT TO ADD A NEW §40110 TO CHAPTER 40, TITLE 7, GUAM CODE ANNOTATED, AND TO FURTHER ADD A NEW § 30.400 TO CHAPTER 30 OF TITLE 9, GUAM CODE ANNOTATED, RELATIVE TO THE TRANSFER OR RELEASE OF FAMILY VIOLENCE VICTIMS FROM SHARED WIRELESS PLANS.

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Gmail **Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com>**

AMENDED SECOND NOTICE OF VIRTUAL PUBLIC HEARING: WEDNESDAY, APRIL 6, 2022 AT 9:00 AM

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Mon, Apr 4, 2022 at 1:56 PM
To: phnotice@guamlegislature.org
Cc: Audio / Video <av@guamlegislature.org>, Tom Unsiog <sgtarms@guamlegislature.org>, Guam MIS <mis@guamlegislature.org>
Bcc: mindy@postguam.com, The Post Editor in Chief <editor@postguam.com>, Oyaol Ngirairikl <managingeditor@postguam.com>, haidee@postguam.com, John Oconnor <john@postguam.com>, reporters@postguam.com, rlimtiaco@guampdn.com, Rindraty Limtiaco <slimtiaco@guampdn.com>, Guam PDN <news@guampdn.com>, Jerick Sablan <jpsablan@guampdn.com>, life@guampdn.com, dmgeorge@guampdn.com, Mar-Vic Cagurangan <publisher@pacificislandtimes.com>, Pacific Island Times <pacificislandtimes@gmail.com>, Maureen Maratita <publisher@glimpsesofguam.com>, bryan@mvariety.com, emmanuel@mvariety.com, mabuhaynews@yahoo.com, editor@saipantribune.com, Bruce Hill <pacificjournalist@gmail.com>, Jason Salas <jason@kuam.com>, Sabrina Salas Matanane <sabrina@kuam.com>, Chris Malafunkshun Barnett <Chris@kuam.com>, Nestor Licanto <nestor@kuam.com>, reporters@kuam.com, K57 <news@k57.com>, Patti Rodriguez <parroyo@spbguam.com>, pattiontheradio@yahoo.com, Sorensen Pacific Broadcasting <news@spbguam.com>, raygibsonshow@gmail.com, manasilva626[redacted], KISH <kstokish@gmail.com>, Manuel Cruz <[redacted]>, Troy Torres <troy@kanditnews.com>, Maria Louella Losinio <louella.losinio@gmail.com>, "Mayors' Council of Guam - Admin." <mcogadmin@teleguam.net>, "Mayor Paul M. McDonald" <mayor.mcdonald671@gmail.com>, agatmayor@yahoo.com, agatvice.chrisfejeran@yahoo.com, "Mayor Frankie A. Salas" <asanmainamayor@gmail.com>, June Blas <mayorbarrigada@gmail.com>, Jessie Bautista <jessie.bautista007@gmail.com>, Jessy Gogue <ocp.mayor@gmail.com>, MELISSA SAVARES <melissa.savares@gmail.com>, "Vice Mayor Peter John S. Benavente" <onedededo@gmail.com>, hagatnamayor@hotmail.com, Mayor Anthony Chargualaf <inalahanmayor@gmail.com>, Allan Ungacta <mayorallan.ungacta@yahoo.com>, Vice Mayor Kevin AN Delgado <mangilao.vicemayor@gmail.com>, mayorernestc@yahoo.com, mtmmayorpaco17@gmail.com, Jesse Alig <jesse.alig@pitiguam.com>, Dale Alvarez <daleealvarez@gmail.com>, Robert Hofmann <guammayor@gmail.com>, rudy iriarte <rudyiriarte@gmail.com>, Mayor Taitague <talofofomayor@gmail.com>, "Mayor Louise C. Rivera" <Mayorlcrivera.tatuha@gmail.com>, "Vice Mayor Albert M. Toves" <atoves.tatuha@gmail.com>, Umatac Mayor <umatacmo@gmail.com>, "Mayor Anthony P. Sanchez" <ymayortony@gmail.com>, "Vice Mayor Loreto V. Leones" <lloretoleones@gmail.com>, "Mayor Bill A. Quenga" <yonamayor2020@gmail.com>, jolene@postguam.com, Phil Leon Guerrero <phil@postguam.com>, Gerry Partido <gerrypartido@gmail.com>, gerry@spbguam.com, Damen Borja <damen@spbguam.com>, tlamorena[redacted], jsantotoma@guampdn.com, freeguam2021[redacted]

April 4, 2022

MEMORANDUM

To: All Senators, Stakeholders and Media

From: Speaker Therese M. Terlaje, Chairperson
Committee on Health, Land, Justice and Culture

Subject: **AMENDED SECOND NOTICE of Virtual Public Hearing** - Wednesday, April 6, 2022, beginning at 9:00 a.m.

Buenas yan Håfa Adai,

Please be advised that the Committee on Health, Land, Justice and Culture will convene a virtual public hearing, using the Legislature's virtual Zoom platform on Wednesday, April 6, 2022, beginning at 9:00 a.m., for the following agenda items:

9:00 AM:

- **Bill No. 242-36 (LS) - Mary Camacho Torres / Therese M. Terlaje / Tina Rose Muña Barnes / Amanda L. Shelton / James C. Moylan / Jose "Pedo" Terlaje / V. Anthony Ada / Frank Blas Jr. / Clynton E. Ridgell / Joe S. San Agustin / Christopher M. Dueñas -** AN ACT TO ADD A NEW §40110 TO CHAPTER 40, TITLE 7, GUAM CODE ANNOTATED, AND TO FURTHER ADD A NEW § 30.400 TO CHAPTER 30 OF TITLE 9, GUAM CODE ANNOTATED, RELATIVE TO THE TRANSFER OR RELEASE OF FAMILY VIOLENCE VICTIMS FROM SHARED WIRELESS PLANS.

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2:00 PM POSTPONED UNTIL FURTHER NOTICE

- ~~**APPOINTMENT HEARING:** Appointment of Earl J. Garrido to serve as a Member of the CHamoru Land Trust Commission, for a term of three (3) Years; April 11, 2021, to April 10, 2024, to fill term of Austin Ducnas whose term has expired.~~

3:00 PM

- **INFORMATIONAL HEARING:** on existing laws and agency regulatory, permitting, and environmental guidelines relative to mineral extraction on Guam.

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We look forward to your participation!

Si Yu'os Ma'åse'!

Office of Speaker Therese M. Terlaje
Committee on Health, Land, Justice and Culture
I Mina'trentai Sais na Liheslaturan Guåhan
36th Guam Legislature
Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910
T: (671) 472-3586 F: (671) 989-3590 Email: senatorterlajeguam@gmail.com
website: www.senatorterlaje.com

AMENDED SECOND NOTICE OF VIRTUAL PUBLIC HEARING- APRIL 6, 2022_TMT.pdf
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Office of the Speaker

THERESE M. TERLAJE

I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

April 4, 2022

MEMORANDUM

To: All Senators, Stakeholders and Media

From: Speaker Therese M. Terlaje, Chairperson TMT
Committee on Health, Land, Justice, and Culture

Subject: AMENDED **SECOND NOTICE of Virtual Public Hearing** - Wednesday, April 6, 2022, beginning at 9:00 a.m.

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Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910
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We look forward to your participation!

Si Yu'os Ma'åse'!

Gmail **Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com>**

Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

2 messages

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Thu, Mar 31, 2022 at 5:45 PM
To: Edwin Reyes <edwin.reyes@bsp.guam.gov>, maryrose.wilson@dpw.guam.gov, brian.bearden@epa.guam.gov, noni.amar@epa.guam.gov, "Jeffrey S. Quitugua" <Jeffrey.Quitugua@doag.guam.gov>, Antonio S Gumataotao <agumataotao@gpagwa.com>, bhess@guamwaterworks.org, vlaguana@guamwaterworks.org, jtadeo@guamwaterworks.org, "Jose U. Garrido" <jose.garrido@dpr.guam.gov>, al.masga@dpr.guam.gov, Russell Kanai <russell.kanai@dpr.guam.gov>
Cc: "Joseph M. Borja" <joseph.borja@land.guam.gov>, Darline Enaligo <darline.enaligo@land.guam.gov>

March 31, 2022

Transmitted via Electronic Mail:

Members of the Application Review Committee
Guam Land Use Commission

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Håfa Adai Committee Members,

The 36th Guam Legislative Committee on Health, Land, Justice and Culture will convene a virtual informational briefing on Wednesday, April 6, 2022, beginning at 3:00 p.m., to receive information on existing laws and agency regulatory, permitting, and environment guidelines to mineral extraction on Guam.

The Committee would like for your agency to provide information on the types of permits applicable to mineral extraction, the processing of permits, and the regulatory and enforcement responsibilities for respective agencies under federal and local law, whether through grading, excavating, quarrying or any other means to extract minerals on Guam.

Your participation will assist the Committee in gaining a better understanding of the guidelines currently in place, to discover any possible gaps in law or rule, and if you believe these are adequate to protect Guam's health, welfare, and environment. The goal will eventually be to ensure best practices for private industry and appropriate government processes to mitigate any potential negative impacts from mineral extraction on Guam, especially over Guam's aquifer.

I respectfully request for your RSVP by April 4, 2022. In addition, please forward any guidelines or standards used by your agency to evaluate permit applications related to mineral extractions. We look forward to your presentation, discussion, and insight from your particular field of expertise.

Respectfully,

Therese M. Terlaje

Office of Speaker Therese M. Terlaje
Committee on Health, Land, Justice and Culture
I Mina'trentai Sais na Liheslaturan Guåhan
36th Guam Legislature
Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910
T: (671) 472-3586 F: (671) 989-3590 Email: senatorterlajeguam@gmail.com

website: www.senatorterlaje.com

03.31.22 ARC Invitation to Info Briefing Mineral Extraction.pdf
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Mail Delivery Subsystem <mailer-daemon@googlemail.com> Thu, Mar 31, 2022 at 5:45 PM
To: senatorterlajeguam@gmail.com

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- gsmtp
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Final-Recipient: rfc822; noni.amar@epa.guam.gov
Action: failed
Status: 5.1.1
Diagnostic-Code: smtp; 550-5.1.1 The email account that you tried to reach does not exist. Please try
550-5.1.1 double-checking the recipient's email address for typos or
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Last-Attempt-Date: Thu, 31 Mar 2022 00:45:51 -0700 (PDT)

---------- Forwarded message ----------
From: "Speaker Therese M. Terlaje" <senatorterlajeguam@gmail.com>
To: Edwin Reyes <edwin.reyes@bsp.guam.gov>, maryrose.wilson@dpw.guam.gov, brian.bearden@epa.guam.gov, noni.amar@epa.guam.gov, "Jeffrey S. Quitugua" <Jeffrey.Quitugua@doag.guam.gov>, Antonio S Gumataotao <agumataotao@gpagwa.com>, bhess@guamwaterworks.org, vlaguana@guamwaterworks.org, jtadeo@guamwaterworks.org, "Jose U. Garrido" <jose.garrido@dpr.guam.gov>, al.masga@dpr.guam.gov, Russell Kanai <russell.kanai@dpr.guam.gov>
Cc: "Joseph M. Borja" <joseph.borja@land.guam.gov>, Darline Enaligo <darline.enaligo@land.guam.gov>

Bcc:
Date: Thu, 31 Mar 2022 17:45:13 +1000
Subject: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022
----- Message truncated -----

Office of the Speaker
THERESE M. TERLAJE
I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

March 31, 2022

Transmitted via Electronic Mail:

Members of the Application Review Committee
Guam Land Use Commission

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Therese M. Terlaje

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Gmail **Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com>**

Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

1 message

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Thu, Mar 31, 2022 at 5:47 PM
To: "Joseph M. Borja" <joseph.borja@land.guam.gov>
Cc: Darline Enaligo <darline.enaligo@land.guam.gov>

March 31, 2022

Transmitted via Electronic Mail:

Joseph M. Borja, Director
Department of Land Management
joseph.borja@land.guam.gov

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

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Committee on Health, Land, Justice and Culture
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T: (671) 472-3586 F: (671) 989-3590 Email: senatorterlajeguam@gmail.com
website: www.senatorterlaje.com

03.31.22 DLM Invitation to Info Briefing Mineral Extraction.pdf
410K

Office of the Speaker
THERESE M. TERLAJE
I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

March 31, 2022

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I respectfully request for your RSVP by April 4, 2022. In addition, please forward any guidelines or standards used by your agency to evaluate permit applications related to mineral extractions. We look forward to your presentation, discussion, and insight from your particular field of expertise.

Respectfully,

Therese M. Terlaje

Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910
Tel: (671) 472-3586 | Fax: (671) 969-3590 | Email: senatorterlajeguam@gmail.com | www.senatorterlaje.com
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Gmail **Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com>**

Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

1 message

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Thu, Mar 31, 2022 at 5:49 PM
To: Chelsa Muna-Brecht <Chelsa.MunaBrecht@doag.guam.gov>

March 31, 2022

Transmitted via Electronic Mail:

Chelsa Muña-Brecht, Director
Guam Department of Agriculture
chelsa.munabrecht@agriculture.guam.gov

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Håfa Adai Director Muña-Brecht,

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Therese M. Terlaje

Office of Speaker Therese M. Terlaje
Committee on Health, Land, Justice and Culture
I Mina'trentai Sais na Liheslaturan Guåhan
36th Guam Legislature
Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910
T: (671) 472-3586 F: (671) 989-3590 Email: senatorterlajeguam@gmail.com
website: www.senatorterlaje.com

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Office of the Speaker
THERESE M. TERLAJE
I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

March 31, 2022

Transmitted via Electronic Mail:

Chelsa Muña-Brecht, Director
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chelsa.munabrecht@agriculture.guam.gov

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Gmail **Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com>**

Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

1 message

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Thu, Mar 31, 2022 at 5:50 PM
To: Vince Arriola <vince.arriola@dpw.guam.gov>

March 31, 2022

Transmitted via Electronic Mail:

Vincent Arriola, Director
Department of Public Works
vince.arriola@dpw.guam.gov

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Håfa Adai Director Arriola,

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Committee on Health, Land, Justice and Culture
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36th Guam Legislature
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website: www.senatorterlaje.com

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Office of the Speaker
THERESE M. TERLAJE
I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

March 31, 2022

Transmitted via Electronic Mail:

Vincent Arriola, Director
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Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

1 message

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Thu, Mar 31, 2022 at 5:52 PM
To: Edwin Reyes <edwin.reyes@bsp.guam.gov>

March 31, 2022

Transmitted via Electronic Mail:

Edwin Reyes, Administrator
Guam Coastal Management Program,
Bureau of Statistics and Plans
edwin.reyes@bsp.guam.gov

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Håfa Adai Mr. Reyes,

The 36th Guam Legislative Committee on Health, Land, Justice and Culture will convene a virtual informational briefing on Wednesday, April 6, 2022, beginning at 3:00 p.m., to receive information on existing laws and agency regulatory, permitting, and environment guidelines to mineral extraction on Guam.

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Office of Speaker Therese M. Terlaje
Committee on Health, Land, Justice and Culture
I Mina'trentai Sais na Liheslaturan Guåhan
36th Guam Legislature
Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910
T: (671) 472-3586 F: (671) 989-3590 Email: senatorterlajeguam@gmail.com
website: www.senatorterlaje.com

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Office of the Speaker
THERESE M. TERLAJE
I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

March 31, 2022

Transmitted via Electronic Mail:

Edwin Reyes, Administrator
Guam Coastal Management Program,
Bureau of Statistics and Plans
edwin.reyes@bsp.guam.gov

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Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

1 message

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Thu, Mar 31, 2022 at 5:55 PM
To: Walter Leon Guerrero <walter.leonguerrero@epa.guam.gov>
Cc: Michelle Lastimoza <michelle.lastimoza@epa.guam.gov>

March 31, 2022

Transmitted via Electronic Mail:

Walter Leon Guerrero, Administrator
Guam Environmental Protection Agency
walter.leonguerrero@epa.guam.gov

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Håfa Adai Administrator Leon Guerrero,

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Therese M. Terlaje

Cc: Michelle Lastimoza, Deputy Administrator, Guam EPA

Office of Speaker Therese M. Terlaje
Committee on Health, Land, Justice and Culture
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36th Guam Legislature
Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910
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website: www.senatorterlaje.com

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Office of the Speaker
THERESE M. TERLAJE
I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

March 31, 2022

Transmitted via Electronic Mail:

Walter Leon Guerrero, Administrator
Guam Environmental Protection Agency
walter.leonguerrero@epa.guam.gov

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Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

1 message

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Thu, Mar 31, 2022 at 5:58 PM
To: "Dr. Anita Enriquez" <abe@triton.uog.edu>, "Leilani R. Flores (flores.lani@gmail.com)" <flores.lani@gmail.com>, Brian Artero <brian[redacted]>, Nicolas Toft <Nicolas.Toft@land.guam.gov>, Art Chan <achanjr58[redacted]>
Cc: "Joseph M. Borja" <joseph.borja@land.guam.gov>, Cristina Gutierrez <Cristina.Gutierrez@land.guam.gov>

March 31, 2022

Transmitted via Electronic Mail:

Dr. Anita Enriquez, Chairperson
Guam Land Use Commission
abe@triton.uog.edu

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Håfa Adai Chairperson Enriquez,

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Therese M. Terlaje

Cc: Members, Guam Land Use Commission

Office of Speaker Therese M. Terlaje
Committee on Health, Land, Justice and Culture
I Mina'trentai Sais na Liheslaturan Guåhan
36th Guam Legislature
Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910

T: (671) 472-3586 F: (671) 989-3590 Email: senatorterlajeguam@gmail.com
website: www.senatorterlaje.com

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Office of the Speaker
THERESE M. TERLAJE
I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

March 31, 2022

Transmitted via Electronic Mail:

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abe@triton.uog.edu

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Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

1 message

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Thu, Mar 31, 2022 at 5:59 PM
To: John M Benavente <jbenavente@gpagwa.com>
Cc: Tricee Limtiaco <triceelimtiaco@gmail.com>

March 31, 2022

Transmitted via Electronic Mail:

John Benavente, General Manager
Guam Power Authority
jbenavente@gpagwa.com

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Håfa Adai General Manager Benavente,

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Therese M. Terlaje

Cc: Tricee Limtiaco, Deputy General Manager, GPA

Office of Speaker Therese M. Terlaje
Committee on Health, Land, Justice and Culture
I Mina'trentai Sais na Liheslaturan Guåhan
36th Guam Legislature
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Office of the Speaker
THERESE M. TERLAJE
I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

March 31, 2022

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Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

1 message

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Thu, Mar 31, 2022 at 6:02 PM
To: Miguel Bordallo <mcbordallo@guamwaterworks.org>
Cc: "Ann D. Borja-Gallardes" <aborjagallardes@guamwaterworks.org>

March 31, 2022

Transmitted via Electronic Mail:

Miguel C. Bordallo, General Manager
Guam Waterworks Authority
mcbordallo@guamwaterworks.org

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Håfa Adai General Manager Bordallo,

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Committee on Health, Land, Justice and Culture
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36th Guam Legislature
Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910
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Office of the Speaker
THERESE M. TERLAJE
I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

March 31, 2022

Transmitted via Electronic Mail:

Miguel C. Bordallo, General Manager
Guam Waterworks Authority
mcbordallo@guamwaterworks.org

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Håfa Adai General Manager Bordallo,

The 36th Guam Legislative Committee on Health, Land, Justice and Culture will convene a virtual informational briefing on Wednesday, April 6, 2022, beginning at 3:00 p.m., to receive information on existing laws and agency regulatory, permitting, and environment guidelines to mineral extraction on Guam.

The Committee would like for your agency to provide information on the types of permits applicable to mineral extraction, the processing of permits, and the regulatory and enforcement responsibilities for respective agencies under federal and local law, whether through grading, excavating, quarrying or any other means to extract minerals on Guam.

Your participation will assist the Committee in gaining a better understanding of the guidelines currently in place, to discover any possible gaps in law or rule, and if you believe these are adequate to protect Guam's health, welfare, and environment. The goal will eventually be to ensure best practices for private industry and appropriate government processes to mitigate any potential negative impacts from mineral extraction on Guam, especially over Guam's aquifer.

I respectfully request for your RSVP by April 4, 2022. In addition, please forward any guidelines or standards used by your agency to evaluate permit applications related to mineral extractions. We look forward to your presentation, discussion, and insight from your particular field of expertise.

Respectfully,

Therese M. Terlaje

Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910
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Gmail **Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com>**

Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

1 message

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Thu, Mar 31, 2022 at 6:04 PM
To: Patrick Lujan <patrick.lujan@dpr.guam.gov>
Cc: "Carlotta A. Leon-Guerrero" <carlotta.leonguerrero@guam.gov>

March 31, 2022

Transmitted via Electronic Mail:

Patrick Lujan, SHPO
State Historic Preservation Office
Department of Parks & Recreation
patrick.lujan@dpr.guam.gov

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Håfa Adai SHPO Lujan,

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Therese M. Terlaje

Cc: Carlotta Leon Guerrero, Acting SHPO, DPR

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Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

1 message

Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com> Thu, Mar 31, 2022 at 6:05 PM
To: "Dr. John Jenson" <jjenson@triton.uog.edu>

March 31, 2022

Transmitted via Electronic Mail:

John W. Jenson, Ph.D., Director
Water & Environmental Research Institute of the Western Pacific
Chief Hydrogeologist & Professor of Environmental Geology
University of Guam
jjenson@triton.uog.edu

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Håfa Adai Dr. Jenson,

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March 31, 2022

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John W. Jenson, Ph.D., Director
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Committee on Health, Land, Justice and Culture

VIRTUAL PUBLIC HEARING

Wednesday, April 6, 2022, beginning at 9:00 a.m

AGENDA

9:00 AM:

- Bill No. 242-36 (LS) - **Mary Camacho Torres / Therese M. Terlaje / Tina Rose Muña Barnes / Amanda L. Shelton / James C. Moylan / Jose "Pedo" Terlaje / V. Anthony Ada / Frank Blas Jr. / Clynton E. Ridgell / Joe S. San Agustin / Christopher M. Dueñas** - AN ACT TO ADD A NEW §40110 TO CHAPTER 40, TITLE 7, GUAM CODE ANNOTATED, AND TO FURTHER ADD A NEW § 30.400 TO CHAPTER 30 OF TITLE 9, GUAM CODE ANNOTATED, RELATIVE TO THE TRANSFER OR RELEASE OF FAMILY VIOLENCE VICTIMS FROM SHARED WIRELESS PLANS.

10:00 AM:

- Bill No. 243-36 (LS) - **Mary Camacho Torres / Therese M. Terlaje / Tina Rose Muña Barnes / Amanda L. Shelton / James C. Moylan / Jose "Pedo" Terlaje / V. Anthony Ada / Frank Blas Jr. / Clynton E. Ridgell / Joe S. San Agustin / Christopher M. Dueñas / Sabina F. Perez** - AN ACT TO AMEND §25.10(a), §25.15(a)(4)-(7), §25.20(a)(4)-(7), §25.25(a)(3), AND §25.30(a)(2), ALL OF CHAPTER 25, TITLE 9, GUAM CODE ANNOTATED, RELATIVE TO DEFINING "CONSENT," REVISING THE LANGUAGE OF "MENTALLY DEFECTIVE" TO "MENTALLY IMPAIRED," AND EXPANDING THE DEFINITION OF "MENTAL INCAPACITATION" AND "PHYSICALLY HELPESS."

- Bill No. 244-36 (LS) - **Mary Camacho Torres / Therese M. Terlaje / Tina Rose Muña Barnes / Amanda L. Shelton / James C. Moylan / Jose "Pedo" Terlaje / V. Anthony Ada / Frank Blas Jr. / Clynton E. Ridgell / Joe S. San Agustin / Christopher M. Dueñas / Sabina F. Perez** - AN ACT TO ADD A NEW CHAPTER 163 TO TITLE 8 OF THE GUAM CODE ANNOTATED, RELATIVE TO ESTABLISHING A BILL OF RIGHTS FOR VICTIMS OF SEXUAL ASSAULT, AND TO FURTHER CITING THIS ACT AS THE "SURVIVOR'S BILL OF RIGHTS ACT OF 2022."

3:00 PM

- **INFORMATIONAL HEARING:** on existing laws and agency regulatory, permitting, and environmental guidelines relative to mineral extraction on Guam.

All hearings will be broadcast on GTA TV Channel 21, Docomo Channel 117/112.4, and Guam Legislature Media on YouTube and will be available on the Guam Legislature Media YouTube Channel after the hearings. In compliance with the Americans with Disabilities Act, Individuals in need of assistance or accommodations should also contact the Office of Speaker Therese M. Terlaje.

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Office of Speaker Therese M. Terlaje

Committee on Health, Land, Justice and Culture

Date:	**Wednesday, April 06, 2022**	**Time:**	**3:00 PM**		

INFORMATIONAL HEARING: on existing laws and agency regulatory, permitting, and environmental guidelines relative to mineral extraction on Guam.

	NAME	ADDRESS	CONTACT NO.	E-MAIL	Type of Testimony		Support	
					WRITTEN	ORAL	Yes	No
1	Chrisian Benitez, Bureau of Statistics and Plans, ARC member					x		
2	Edwin Reyes, Administrator, Guam Coastal Management Program					x		
3	Patrick Lujan, SHPO					x		
4	Nonito Blas, GLUC Member					x		
5	Celine Cruz, Chief Planner, DLM					x		
6	Joe Borja, Director, DLM					x		
7	Dr. John Jenson, Director, WERI					x		
8	Randy Romero, DPW Building Inspections & Permits					x		
9	Mauryn McDonald, GWA Chief Engineer					x		
10	Director Chelsa Muna-Brecht, Department of Agriculture		671-300-7965	Chelsa.MunaBrecht@doag.guam.gov		x		

I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature

Office of Speaker Therese M. Terlaje

Committee on Health, Land, Justice and Culture

Date:	**Wednesday, April 06, 2022**	**Time:**	**3:00 PM**		

INFORMATIONAL HEARING: on existing laws and agency regulatory, permitting, and environmental guidelines relative to mineral extraction on Guam.

	NAME	ADDRESS	CONTACT NO.	E-MAIL	Type of Testimony		Support	
					WRITTEN	ORAL	Yes	No
1	Art Chan, GLUC Member					x		
2	Vince Arriola, Director, DPW					x		
3	Christine Fejeran, Forestry Division Chief, DOAg					x		
4	CAPT Brian G. Bearden, US Public Health Service/Chief Engineer / Water Division Director, Guam EPA					x		
5	Jeffrey S. Quitugua,Technical Guidance Section, DOAg					x		
6	Roland Gutierrez,Acting Air and Land Division Administrator, Guam EPA					x		
7								
8								
9								

Aggregate Resource Extraction: Examining Environmental Impacts on Optimal Extraction and Reclamation Strategies

by

Brett Afton Campbell

A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science

in

Agricultural and Resource Economics

Department of Resource Economics and Environmental Sociology

University of Alberta

Abstract

Aggregate resources are naturally occurring deposits of sand, gravel and crushed stone that are integral components to the construction of everything from roads and sidewalks, to hospitals and schools. Mining these resources can release deleterious sediments, salt and chemicals into watercourses, soil and the air and can affect scenery. The structure of these environmental externalities raises questions about the optimal extraction of aggregate resources, the timing of reclamation activities, and the appropriate distance gravel mines should be from their market. A social planner optimizing aggregate extraction and incorporation of the effects of the externality may choose a different extraction path and reclamation strategy than a private operator. Hedonic price analysis and difference-in-difference modelling are used in this research to measure the effect of the negative externalities from an aggregate mine in Calgary, Alberta on nearby property values, and to examine how reclamation can address those effects. The empirical hedonic price model findings are used to develop a simulation of gravel mining operations with the incorporation of private and social costs to examine the benefits of locating mines in remote locations versus in close proximity to their intended market, and strategies for reclamation timing.

Acknowledgements

First and foremost, I'd like to extend a huge thank-you to my supervisor Vic Adamowicz. I'd still be a lost graduate-student-soul, wandering hopelessly in the world of research without his patience and dedicated guidance. Another big thank-you to all of the other professors I had the pleasure of interacting with during this process. It was a privilege to be on a first name basis with so many of you.

I also feel grateful for the role of all of the support staff in the Department of REES and across the Faculty of ALES, there were always an abundance of friendly faces around. An especially big thank-you to Robin McClelland who helped us sort out not only administrative problems, but was more importantly a shoulder to lean on if any of us were ever in need. She is truly an angel on earth!

Third, I was privileged to have been surrounded by a diverse cohort of supportive and intelligent individuals. I do not know where I would be today without those late night study sessions in the lunchroom and some fresh Domino's pizza, particularly when we were trying to figure out the lemmas in the early days. How lucky for all of us that we spent these years learning and getting to know each other in the relaxed and supportive environment that is the Department of REES.

Most fortunate of all was my ability to spend so much time with my family and close friends during this process. The nights in the garden, tennis lessons, camping, take-home leftovers and long chats gave me the motivation to keep working hard. I am especially grateful for Darren who played a huge role in helping me to maintain my sanity and happiness.

Last but not least, I would like to acknowledge the NSERC-CREATE Program and The Land Reclamation International Graduate School for both funding this research and giving me the opportunity to expand my academic horizons.

The examining committee for this thesis defense consisted of Vic Adamowicz, Sandeep Mohapatra, Jürgen Meyerhoff and Scott Jeffrey.

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1. Introduction

1.1 An Overview

Aggregate resources are naturally occurring deposits of sand, gravel and crushed stone often referred to simply as "gravel". These deposits are the result of the erosion of bedrock whose particles were then transported most commonly by water or glacial ice, making them most abundant in areas near historical or present rivers (Langer et al 2004). Gravel is a non-renewable resource that is a component of everything from roads, sidewalks, homes, hospitals and schools to numerous manufactured goods including glass and pharmaceuticals. Almost all structures and roads are constructed using aggregate in some form, making it impossible to construct or expand cities without it.

Gravel has a low unit value and is expensive to transport because of its weight. As a result, it is generally extracted in closed proximity to its intended market or end-use. Transporting these materials long distances can result in costs higher than the value of the resource itself, and thus operations are commonly located near developing urban centres (Richards and Peel 2003). Furthermore, gravel operators argue that being closer to their intended market decreases their environmental footprint by decreasing the distance large trucks need to travel with the resource (B&A Planning Group 2012). Although there are numerous issues associated with gravel mining such as impacts on the landscape, water quality and quantity and loss of agricultural land, trucking of aggregate resources is often the most visible and is responsible for generating several environmental externalities which most concern the public such as dust, noise, traffic and degrading road conditions. Believing it will reduce the impact of trucking, the Ontario Government and the Calgary Aggregate Producers have adopted a "close-to-market" strategy. This strategy prioritizes gravel operations that are closer to their market versus those that are further.

A challenge for policy makers and operators is accessing the necessary aggregate resource for construction, while maintaining environmental integrity and minimizing the disturbance to nearby residences. Often as community development expands closer to the source of aggregate, the negative externalities of the mine become increasingly apparent as they negatively impact property values. The first set of analysis in this research has the intent of

identifying the magnitude of the impact of these externalities from a specific gravel mine on property values in nearby neighbourhoods. This will be done using hedonic price analysis accompanied by difference-in-difference (DD) modelling during the life cycle of the gravel mine.

In the second section of the analysis, the empirical hedonic price model findings are used in conjunction with various costs associated with gravel transportation to create a simulation model for a hypothetical mine. The simulation model is intended to evaluate the externality effects of the gravel mine and compare these with transportation costs to identify whether it remains efficient to mine in close proximity to the market when social costs are considered.

Without taking into account the social costs of extraction, the high cost associated with freight transport of gravel appears too high to locate mines too far from their market. Furthermore, industry considers the environmental footprint generated by gravel extraction significantly reduced if the distance gravel must be transported is shortened by extracting near the resources' intended end use or market. The simulation model will estimate the magnitude of social costs associated with extraction and compare this additional value with freight transport costs. When considering both direct and social costs of extraction against the transportation cost, the common perception that shortening the distance the resource must travel to reach its intended market reduces the operation's environmental footprint and costs may be challenged.

The simulation model is also an attempt to create a dialogue on optimal reclamation timing. If the negative externality of a mine extends through time until a reclamation certificate is issued, then reclaiming sooner would reduce the duration of the negative externality on the value of surrounding households. Currently Alberta is regulated by guidelines that do not provide strict reclamation timing schedules to mine operators. By demonstrating the elimination of the social costs associated with aggregate extraction once reclamation has been completed, this research hopes to provide evidence of the economic benefits of timely reclamation.

1.2 Aggregate resource mining in Alberta

Alberta has four sources of aggregate: preglacial deposits of sand and gravel, bedrock, glaciofluvial deposits and recent alluvial deposits (Peel 2004). Approximately 90% of aggregate

resources in Alberta are a result of the last glaciers in the province, with the remainder from recent alluvial deposition (RAMP). These are predominately Early Tertiary to Recent sedimentary deposits (Richards and Peel 2003). These aggregate resources have been used in Alberta since the turn of the twentieth century when there was an enormous influx of European settlers, causing the need for the construction of a railway and road networks (Peel 2004). As the population grew so did our needs for aggregate resources. Edwards (1998) estimated that use jumped to approximately 2.2 billion tonnes from 1950-2000, and will continue to grow to about 5.0 billion tonnes between 2000-2050. There are approximately 5962 aggregate pits in Alberta of varying sizes (Walls 2001), a majority of which are owned privately (Alberta Environment and Sustainable Resource Development). B&A Planning Group (2012) estimated that in Calgary alone annual consumption per capita of aggregate is approximately 10 tonnes and annual demand overall is estimated to be 11.3 million tonnes per year. There is an estimated stock of 200 million tonnes of aggregate available within both approved private and municipal aggregate operations (B&A Planning Group 2012). This will satisfy short term needs for the next approximately 20 years.

In Alberta, the sand and gravel resources are most commonly used for road and building construction, cement making, applying sand to roadways in the winter, for filtration in septic tanks, and as protection against erosion for shorelines (Government of Alberta 2009). Approximately 64% of all aggregate resources in the province are used for construction, and 19% for concrete production. Alberta also produces bricks and other ceramic products from clay and shale, as well as "Alberta rainbow rocks" which are used in landscaping (Government of Alberta 2009). Approximately 99% of demand for aggregate in Alberta is met by sand and gravel deposits mined almost always within a 42 km radius of urban centers (Richards and Peel 2003).

In Alberta, as a result of the *Sand and Gravel Act* (1951), surface materials are most commonly the property of the landowner. Furthermore, the *Law of Property Act* (1980) assigns the rights to gravel deposits to the titled land-owner. This results in equal competition between government, commercial operators and municipalities interested in receiving rights to extract gravel on private land (CharettePellPoscente Environmental Corp. 2013). Only when gravel

deposits are on public land do Alberta Environment and Sustainable Resource Development (ESRD) have the jurisdiction to allocate licenses and enforce environmental standards. The federal government also requires approvals under the *Fisheries Act* as administered by the Department of Fisheries and Oceans (DFO) for any development which may cause alteration, disruption or destruction of fish habitat. As a result, only environmental and safety issues pose constraints on development on private lands, with operations smaller than five hectares (Class II Pits) not requiring environmental approval to begin production. Furthermore, private ownership has resulted in Alberta's lack of adequate information on the production rates and reserve estimates for private operations, as well as incomplete records of public land operations as they are not required to report production and reserve estimates (Richards and Peel 2003).

1.3 Environmental Impacts of Aggregate Resource Mining

Aggregate resource extraction is known to potentially release deleterious sediments, salt and chemicals into watercourses, groundwater sources, soil and air often from erosion. Of particular concern are the noise, dust, water contamination, soil contamination, traffic, negative impacts on road conditions, and negative visual aesthetics associated with their development.

There are approximately 5960 pits in Alberta, resulting in 260 km^2 of surface disturbance (Peels 2004). According to R.D. Peel (2004), if the estimation is correct of 5.0 billion tonnes of gravel consumed from 2000-2050, this will result in approximately 940 km^2 of surface disturbance. This disturbed landscape may result in the introduction of invasive plant species and noxious weeds, which have negative consequences for nearby vegetated areas including riparian areas.

Air pollution as a result of aggregate resource mining is composed of two main types. The silica-rich dust generated during extraction, otherwise known as Total Suspended Particles (TSPs), is the result of crushing, driving on haul roads, stockpiling and screening (B&A Planning Group 2012). The heavy machinery used to mine and freight-transport the resource generally burn diesel fuel which generates Particulate Matter (PM). Aggregate operations in Alberta are required to meet certain strict air-quality standards for PM developed by Alberta Environment because it has been linked to health issues associated with lungs and the cardiovascular system.

Gravel operations typically generate varying levels of noise posing concern to nearby residents (B&A Planning Group 2012). Extraction, crushing and screening and trucking are the most noticeable sources of noise pollution. Because gravel mines are typically situated so proximally to their market, it is a challenge for operators to attempt to mitigate this noise.

In terms of water pollution, it is the long term effects of contamination of aquifers and poisoning of surface water bodies that present the largest issues (Richards and Peel 2003). 20% of drinking water used by North Americans is taken from aquifers (Pielou 1998), while Albertans relied on groundwater for 27% of their freshwater needs (Environment Canada 1999). In Alberta most of the sand and gravel deposits are sealed from surface contamination by a layer of impermeable clay-rich glacial tills (Richards and Peel 2003), which once removed for mining allows the permeable materials below to easily conduct contaminants such as fuel oil spills, runoff containing fertilizers, pesticides, herbicides and sewage directly into an aquifer below (Richards and Peel 2003).

The objective of this research is to evaluate the impacts of the negative externalities generated from a gravel mine on nearby property values. Assessing the impact of these issues is challenging as a result of there being no explicit market value assigned to externalities such as air and water pollution. To carry out the analyses, a hedonic property value analysis, difference-in-difference (DD) analyses and a simulation model were used to attempt to quantify this impact. The site chosen to carry out these analyses is Carburn Park in Calgary, Alberta. Carburn Park was originally an operating gravel mine from 1982-1985, and was announced as a park in 1986. The park features walking trails, picnic areas, and ponds stocked with fish for anglers. It officially received a reclamation certificate about 20 years later in 2005. This is an excellent place to carry out such an analysis because gravel is a required resource for developing municipalities, and Calgary has been rapidly expanding for many years. Furthermore, data were available covering time periods before extraction took place until after reclamation occurred. It should be noted however, that the number of available operations prior to extraction are significantly fewer than those available after.

1.4 Overview of Results

The results from this analysis provide evidence of a significant negative impact on property values as a result of the environmental externalities generated by the gravel mine. During mine operation there is a downward pressure on property values in the surrounding neighbourhoods. After reclamation occurs however, this impact is reversed and property values increase as their proximity to what became Carburn Park increases. The difference-in-difference DD model further supports this finding, with results that also show the positive impact of reclamation. The inclusion of the social costs into the simulation model suggest that in the case of this mine, it may have been more cost effective to move the mine anywhere from 40 to 60 km away from its market if such resources exist at this distance. This finding counters the common perception that transporting gravel large distances is both more expensive and generates a smaller environmental impact.

1.5 Contribution to the Literature

There is limited work published in the literature that directly measures the economic impacts of environmental externalities from gravel mining. Although there are numerous papers which perform hedonic price analyses of housing impacted by various other industrial activities, there are few published papers relating to gravel mines. Of these examples, I could not find an analysis from Canada. This research will contribute to the literature relating to gravel mining in Canada by including hedonic property value and DD estimates of the impacts on property values generated by gravel mining. The research also examines the changes to social costs associated with the location of gravel mines in areas relatively closer to and further from development. Finally, the simulation helps to inform our understanding of the value of more rapid reclamation when sites are located in developing areas.

2.0 Hedonic Property Value Analysis

2.1 Literature Review

Hedonic property value models are indirect valuation methods using observable data for obtaining and understanding values of varying attributes of products which are heterogeneous in nature (Boxall et al 2005). This definition suggests that housing markets are excellent subjects to use for hedonic price analyses. To evaluate the impacts of the gravel pit on nearby neighborhood prices, it is important to examine the literature on property value analysis in general as well as studies of the impact of mine sites on property values.

Rosen (1974) outlined basic hedonic price functions in his seminal paper which has since been used in many analyses, beginning with his initial analysis using housing markets which he expressed in the following way:

(1) $P_i = \beta(X_{i1}, \dots, X_{iJ}; \varepsilon_i)$

Where

P_i = the observed price of commodity *i*;

X_{i1} = amount of some "characteristic" *j* per unit of commodity

ε_i = a disturbance term.

Each household is a heterogeneous product, composed of a series of attributes that differentiate it from the other households in the market. In response to this supply of heterogeneous products, the market in turn provides the equilibrium prices for those products as they correspond to quality. The hedonic price function characterizes this equilibrium price, connecting the amount offered by buyers to the amount accepted by sellers. In other words, the hedonic price function can be considered an envelope of bid functions for all participants in the housing market (Muehlenbachs et al 2013). Considering this point, the obvious correlation of the bid function and the indifference curve becomes apparent.

In his paper, Rosen (1974) described the potential role of environmental attributes alongside a bundle of housing characteristics in determining housing values. As a result of the observable nature of locational choices and neighbourhood amenities, it is possible to tease out

preferences for environmental attributes alongside those of the household itself. Put another way, this means we can estimate an individual's willingness-to-pay for an attribute (for example distance from a gravel mine) by examining the change in price of the household as a result of variations in that attribute (Muehlenbachs et al 2013). In the case of environmental disamenities, such as air pollution generated at a gravel mine, what is often being estimated are individuals' willingness-to-pay to avoid that attribute.

There are numerous examples of studies examining the property value impacts of such environmental disamenities. The locally undesirable attribute ranges in these studies from sour gas wells in Canada (Boxall et al 2005), shale gas development in the United States (Muehlenbachs et al 2013, Gopalakrishnan and Klaiber 2013), the Sydney Tar Ponds on the East coast of Canada (Neupane and Gustavson 2008), to hazardous waste sites in the United States (Ihlanfeldt and Taylor 2004, Messer et al 2006). Each of these studies finds noticeable effects substantial enough to support the notion that these wide array of environmental hazards each produce negative downward pressure on nearby household values.

Boxall et al's (2005) paper is developed around a spatial lag model to capture the spatial dependence between neighboring properties and estimate the impact of oil and gas wells on nearby property values. The analysis was executed using data composed of housing sale prices from 1994 to 2001 which included more than six townships. The most appropriate functional form, where hedonic price analyses often differ, was determined using Box-Cox regression procedures to be a log-log formulation. The results indicate a negative impact on property values as a result of nearby sour gas wells.

Muehlenbachs et al (2013) use a triple difference estimate to assess the impact of shale gas development and resulting perceived groundwater risk to property values in Pennsylvania. They find that there are economic gains to be had as a result of development which result in higher property values with increase proximity to shale gas wells. However, this positive impact is entirely reversed when households attain their water through groundwater sources rather than being piped in from a municipal source indicating individuals' aversion to groundwater risk.

In their analysis of shale gas exploration in Pennsylvania, Gopalakrishnan and Klaiber (2013) found similar results. One of the first empirical analyses of the impact of exploration activities, they found heterogeneous impacts on households depending on their location relative

to major roadways, water sources, proximity to agricultural land and the intensity of activity. The impacts in their study were found to be inconsistent over time.

The Sydney Tar Ponds have a reputation as once being one of the most contaminated sites in Canada. The result of a one hundred year major steel industry on the East Coast of Canada, the tar ponds posed served as a lingering reminder of the significant soil and water contamination dividing the various communities of the town of Sydney, Nova Scotia. Though the negative impacts of the contamination were often downplayed by the government, numerous studies implied significant health impacts associated with the contaminants floating in the tar ponds. Neupane and Gustavson (2008) performed an analysis of the impact of these perceived health risks and concerns over public image of the community as these contaminants became well known on a national scale, and how these impacted property values within Sydney. Their results indicate a loss in property value as a result of these contaminated to sites to amount to approximately $36 million. Their analysis also examined the value of site remediation relative to the welfare gains it can provide to society, indicating they believe it should be carried out if the costs of cleanup do not too heavily outweigh social benefits.

Ihlanfeldt and Taylor (2004) performed hedonic price analyses on regions surrounding the United States Hazardous Waste Sites (HWS). Separate price gradients for before and after HWS announcements by the government and a geographical area covering most of the City of Atlanta were used. Housing sale prices from between 1981 and 1998 were included and combined with three environmental databases which indicated the HWS within the region. A model specification which described the price-distance relationship with a reciprocal transformation was chosen. They believed it to be the best as it "implies that price will increase with distance from the HWS at a decreasing rate until at some point, price will not be increase with distance" (pp. 7). To determine model specification, property prices were regressed against property and also industry factors and some variables were excluded because of multicollinearity, another common issue with hedonic price analyses. Finally, the issue of treatment of spatial dependencies was addressed by their incorporation into a spatial lag model. A significant decrease in housing values post-announcement was found in areas where previously there had been little to no negative effects.

Directly related to gravel mining, the work published by Hite (2006) examining the property value impacts of gravel mining concluded that because property value losses increase for households located closer to a mine, new mines should be developed at greater distances to minimize these losses to individuals. Within a 0.5 mile radius from a mine, she estimated a 36% decrease in property values and a 25% decrease for those within 1.5 miles. Her study from Delaware has been cited by numerous consulting companies when preparing reports for other counties in the United States for proposed gravel mines. One such report was prepared by George E. Erickcek (2009) which stated that "a residential property located a half mile from the gravel mine would experience an estimated 20 percent reduction in value; one mile from the mine, a 14.5 percent reduction; 2 miles from the mine, an 8.9 percent reduction; and 3 miles from the mine, a 4.9 percent reduction" (pp. 5). A report done which estimated the impacts of the Rockfort Quarry (W.E. Upjohn Institute 2009) found these impacts to be permanent, not reversing once mining ceased. This relates to the study of stigmatization effects done by Messer et al in 2006 who found that property values can remain significantly depressed even at remediation occurs in significantly contaminated sites.

In some situations "residents or potential buyers are fearful of a site [and] they may respond by shunning neighboring communities…" (Messer et al 2006, pp. 305). In Messer et al's study, they investigate this phenomenon in three communities with nearby Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites; also known as Superfund sites. Of particular interest to the authors is how prevalent this stigma effect becomes as site cleanup is delayed increasing amounts of time, up to twenty years. To perform their study, Messer et al. use sale prices for a thirty year period (34 000 sales), across three superfund sites. Their results show that an increase in the number of events, whether positive or negative, have a positive effect on the number of homeowners and potential buyers who stigmatize the communities near superfund sites.

Although using a hedonic price analysis can be a powerful tool for determining the effects of environmental externalities on property values, they are not without their limitations. These problems include but are not limited to; the arbitrary nature of functional form selection, endogeneity due to omitted variable bias, and the treatment of spatial considerations in the error

structure of the model (Palmquist and Israngkura 1999, Bockstael and McConnell 2007, Muehlenbachs et al 2013, Boxall et al 2005).

All hedonic analyses are faced with the challenge of functional form and model specification selection, and are considered one of the most arbitrary components to hedonic price analyses (Boxall et al 2005 and Palmquist and Israngkura 1999). Omitted variable bias was the next area of major concern for this research. One source of omitted variable bias occurs when pollution sources are correlated with environmental disamenities, such as gravel mines in neighbourhoods. This unobserved negative external effect, correlated with the observed effect, can generate an upward bias in the coefficient on the observed effect. (Bockstael and McConnell 2007). Furthermore, although data sets on housing value sales are readily available because of the frequency of real estate sales, the socioeconomic data generally required to recover preferences are not. Without this information researchers can only estimate one point of a given household's bid function but not the shape, which because of its direct relation to the indifference curve is what captures information about household preferences. As a result first stage hedonic analyses are usually the extent of analysis that can be performed, as with Boxall et al (2005), which are limited to estimation of marginal willingness-to-pay.

Fixed effects are a method suggested in the literature to attempt to overcome the shortfalls associated with hedonic price analyses such as omitted variable bias. For example, there may be systematic differences in houses closer to a gravel mine than those further away, thus property fixed effects can be employed to difference away these effects (Muehlenbachs et al 2013). These types of spatial fixed effects are recommended by Kuminoff et al (2010) as a means to achieve large gains in accuracy in the evaluation of environmental externalities using hedonic analyses, and to avoid omitted variable bias. Property fixed effects were originally considered as well to account for any systematic differences between those properties in closer proximity to the gravel mine than those further away. If those properties located near to the gravel mine are associated with less desirable effects, then not including property fixed effects would lower the baseline that those households further away are compared to (Muehlenbachs et al 2013). However, because distances to the gravel mine are constant over time, the property fixed effects would be collinear in the model. Thus they are not used in this analysis.

Also suggested in this work is the use of time fixed effects to gain more accuracy of results. Often the impact being examined can vary within time for reasons that are not captured in the explanatory variables in the model, another example of omitted variable bias. By using time dummies for all of the years included in the analysis temporal, effects not accounted for by the explanatory variables can be controlled for.

Difference-in-difference (DD) modelling is suggested by the literature as another method to overcome some of the shortfalls of hedonic price analyses, including sources of unobservable heterogeneity which vary with time (Muehlenbachs et al 2013). The work of Ashenfelter and Card (1985) laid the ground work for what is now a widespread method. In basic DD models, the observed results revolve around two groups and two periods of time. The first group (treatment group) is exposed to a treatment in the second time period only, and the other group (control group) is not exposed in either period. To remove biases in the second time period between the two groups, the average gains from the control group is subtracted by those of the treatment group. In other words, DD models take into account different subpopulations, some of whom are affected by the policy or treatment while others are not, and measure the outcomes from both before and after the policy intervention (Athey and Imbens 2006). This basic model can be specified as follows (Imbens and Wooldridge 2007):

$$(2)\ y = \beta_0 + \beta_1 dB + \gamma_0 d2 + \gamma_1 d2 * dB + \epsilon$$

Where

$y =$ outcome being analyzed

$d2 =$ dummy variable for the second time period

$dB =$ difference between treatment and control groups before policy change

$\gamma_0 =$ coefficient for second time period

$\gamma_1 =$ difference-in-difference coefficient of interest representing the interaction term

These models have become particularly popular for the estimation of the effects of various implemented policy changes, and are effective as they address omitted variable bias as well. One

of the main assumptions in DD analysis is that without treatment, both the treatment and control groups would be subject to the same average change. As a result, time trends which are unrelated to the policy change can be removed by subtracting the outcome experienced by the control group from the outcome of the treatment group. Therefore, DD removes biases from comparisons of both groups in the latter period that could arise as a result of time-varying unobservable heterogeneity between the two groups. Bertrand et al (2003) argue however, that as a result of serial correlation which has been largely ignored by researchers using this method to this point, DD estimations suffer from severely understated standard errors and over-estimation of significance levels. To identify the treatment and control groups to be used in the DD analysis, Linden and Rockoff (2008) utilize a simple regression to compare property values with distance from sex offender's homes residence for two years before and after to find the distance from which this property decline becomes negligible. At this distance is where the boundary between their treatment and control groups is identified. This method is also employed by Muehlenbachs et al. (2013) in their analysis of the impact of shale gas development on property values.

In addition to these considerations, hedonic property value models lack the ability to include the role of people's preferences in their decision-making process. For example, an individual's preferences may affect what areas they choose to live in. Equilibrium sorting models can be used to understand how consumers will "sort" across neighbourhoods based on factors such as their education, income, and availability of public transportation (Kuminoff et al 2010). As these heterogeneous individuals make decisions about where to live, they effectively alter the demographics in a neighbourhood and the supply of amenities such as pollution and road conditions as a result. For example, individuals may influence policy change that requires more diligence on the part of a gravel operator in terms of road maintenance, thus determining the supply of this amenity endogenously. More intuitively, "the sorting literature seeks to understand 'general equilibrium' feedback effects between economic agents and their environments. For example, a shock to the housing market that induces a change in residential location patterns may lead to a redistribution of local amenities that induces more migration and housing development which continues until prices adjust and markets clear" (Kuminoff et al 2010, pp. 2-3).In the case of this research, certain households may sort themselves based on a non-market feedback effect

such as pollution generated by extraction at a gravel mine. This may cause households with certain characteristics and preferences to choose to live closer to or further away from the mine site despite what stage of operation it is in, thus affecting the hedonic price locus. Being privy to this information could provide useful insights and dramatically affect the results of this study. Due to data limitations and the complexity of the method however, it was not employed in this research.

Another important issue for consideration is whether to incorporate spatial error and dependencies within the model. Previous research, such as work by Bell and Bockstael (2000), has demonstrated the importance of incorporating these effects. Spatial autocorrelation can be represented as follows:

$$y = X\beta + \varepsilon \tag{3}$$

where

$$\varepsilon = \rho W\varepsilon + u \tag{4}$$

In this scenario, y is a vector of observations on the dependent variable, X is a matrix of explanatory variables, β is a vector of corresponding and unknown parameters, W is a spatial weight matrix defining the spatial relationships between y, ρ is a scalar parameter to be estimated, ε is a vector of random errors with mean zero and nonspherical variance-covariance matrix, and $\varepsilon \sim N(0,\Omega)$ (Bell and Bockstael 2000 and Boxall et al 2005). If the coefficient ρ has a non-zero value, this indicates the presence of spatial errors. As a result Ordinary Least Squares (OLS) estimates will not be biased but inefficient, and standard error estimates will be biased. Of particular concern is the accuracy of selection of the spatial weighting matrix, which requires choosing the associated properties within a certain distance of the property under consideration, and determining their relative weight against that same property.

These papers provide important insights with regard to how to begin creating an assessment of the impact of gravel pits in Calgary on nearby property values. The most relevant

methods employed in these studies are used in this research to conduct the analysis of property values surrounding what was once an operating gravel mine and has since been transformed into Carburn Park. The methods are summarized in the following section.

2.2 Data and Methods

The data used in this study were obtained from The Calgary Real-Estate Board consisting of 6941 home sale prices from 1981-2010. All housing sale prices were converted using the housing price index for Calgary, Alberta from Statistics Canada to allow for equal weighting of the impacts over time. This analysis includes a combination of structural characteristics considered standard in a hedonic price analysis of housing markets, such as the number of bedrooms, number of bathrooms and the age of the house. This data set is not without its limitations, however. According to the Calgary Real-Estate board, there is no way to conclude that all characteristics of households sold were accurately recorded, thus limiting the accuracy of the hedonic analysis. Furthermore, socioeconomic data were not available to perform a second stage hedonic analysis. Table 1 provides a list and description of all included variables.

Table 1 Property Attributes

Variable	Description	Mean	St. Dev.
Log of Deflated Price	Ln of actual sales price of house deflated by the Housing Price Index	12.6244	0.28281
Presence of Air Conditioning	Dummy for presence of air conditioning in house	0.02982	0.17011
Waterfront	Dummy if house is considered waterfront	0.00144	0.03793
Presence of Garage	Dummy if house has a garage	0.526	0.49936
Size of Garage	Area in square Metres	0.90333	0.92157
Lot Size	Area in square Metres	441.137	6132.28
SFhouse	Dummy for whether house is single family house	0.91644	0.27675
Deck or Balcony	Dummy if house has a deck/balcony	0.48149	0.49969
Area of Home	Size of lot in square meters	109.831	32.6728
No. Bedrooms	Total number of bedrooms	0.00929	0.77539
No. Bathrooms	Total number of bathrooms	0.06573	0.6394
Fire Place	Number of finished fireplaces	0.43812	0.56687
Age of House	Age of house	20.84	16.1709
Reciprocal Distance	Inverse distance of house to point in Carburn Park	0.81672	0.70843

As aforementioned, distance from each property in the data set to a center point in Carburn Park was calculated. The area that these sales were selected from can be viewed in Figure 1, where the locations of sales are represented by the circular points. Carburn Park is located immediately west of the Bow River and is indicated in light green. The inverse of this

distance was then interacted with dummy variables for property sales before 1985, and after 1985. For this research a first stage hedonic analysis was used in Model 1. The sale price was regressed against all of the structural characteristics listed in Table 1, as well as the two inverse distance dummy variables for the periods before and after mine closure (IDA and IDB).

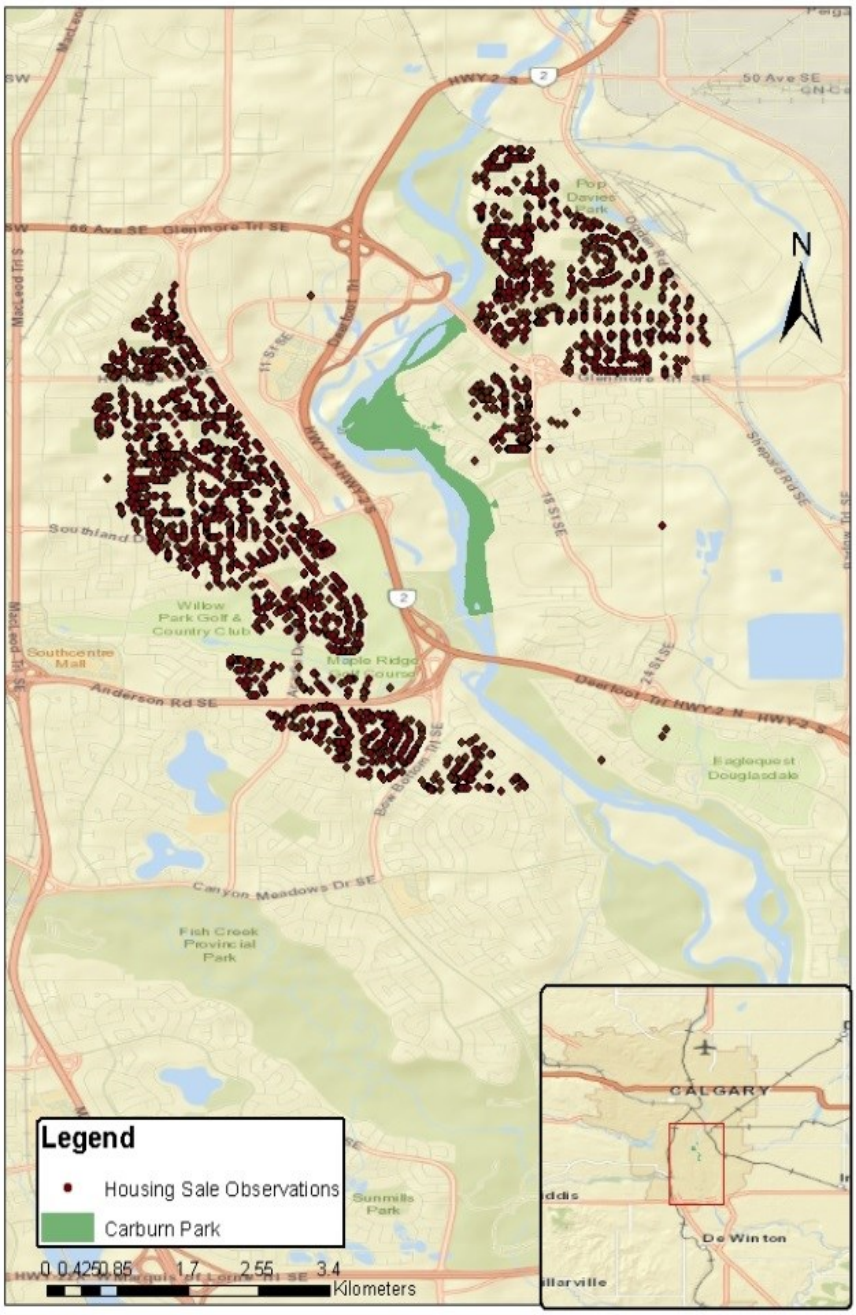

Figure 1 Map of Carburn Park and existing houses in 1985

2.21 Hedonic Price Analysis

The model in this analysis is based upon Ihlanfeldt and Taylor (2004) and their efforts to quantify the effects of property value before and after an increase in public awareness about a contaminated site using a combination of housing characteristics as well as two variables that interact inverse distance with a time dummy indicating the time period before or after mine closure. It is modified to investigate the effects of decommissioning a gravel mine and converting it into Carburn Park in Calgary, Alberta. This gravel mine, which began operations in 1982, finished operation in 1985 and was announced as a park open to the public in 1986 by then Mayor Ralph Klein. A semi-log functional form was decided upon based on the higher goodness of fit when compared to linear or double log functional forms as used in other analyses (Messer et al 2006, Boxall et al 2005). Multicollinearity did not appear to be a problem when choosing model specification as there were only the aforementioned two variables dealing with distance to site. The intent at this stage of research is to investigate whether mine operation had a negative impact on property values, and whether mine closure and reclamation had a positive effect.

The basic hedonic price model to investigate these effects can be expressed in the following way:

$$P_{it} = \alpha + \sum_{j=1}^{J} b_j \, X_{jit} + c_1 ID_i^B + c_2 ID_i^A + \varepsilon_{it} \quad (5)$$

where

P_{it}= log of transaction price of property *i* at time *t, t*=1981-2010,

X_{jit}= *j* property characteristics of property *i* in time *t,* including location-oriented variables,

ID_i^B = inverse distance from property to the park, if sale occurred before the mine closure,

ID_i^A= inverse distance from property to the park, if sale occurred after the mine closure,

ε_{it} = random error.

Eq. (5) assumes that the price-distance relationship is explained by a reciprocal transformation. With this in mind, if the estimated coefficient for distance variable is negative, it

indicates that price will increase with distance at a rate that is decreasing until it approaches an asymptotically constant level (Ihlanfeldt et al. 2004). Likewise, if the same coefficient is positive, it implies increasingly positive effects with closer proximity to the park. By separating the sale categories into before and after the announcement the gravel mines closure, it allows the price-distance relationship to vary accordingly. This model will be hereafter referred to simply as Model 1.

2.22 Difference-in-Difference

DD models have commonly been used to identify the effect of various treatments or events. Furthermore, DD modelling is widely considered an excellent method to avoid common econometric problems such as omitted variable bias (Parmeter and Pope 2009). In the context of this research, the DD model can be used to isolate the effect of a nearby gravel pit on property values and, for example, whether or not the mine is continuing to operate. Basic DD models will examine two groups; a control group which is not exposed to a treatment in either period, and the treatment group which is exposed in the second period but not the first. This relationship can be expressed as follows in the context of evaluating gravel mine impacts on housing prices. Two time periods are examined, where the first time period is prior to closure in 1985 and the second period is after. The analysis also consists of two groups, one of which is the treatment group affected by the gravel mine and within a specific distance of the site. The control group is not affected by the gravel mine and is located further away than the houses within the treatment group. The time period for the analysis was selected based upon the time period during which the gravel mine ceased operations, before and after 1985. After a basic examination of the data, there is evidence of a decrease in property values during mine operation that is reversed in 1985 once the mine closes which supports this decision (see Figure 2. The DD analysis will be referred to as Model 2 hereafter[1].

[1] A third model, Model 3, refers to another DD model which interacts the previous DD parameter with the inverse distance to the site. Essentially this model combines the methods of the previous two models to demonstrate how the variation in price as a result of the environmental externalities changes with distance from the site. The results of this analysis are quantitatively similar to the results of Model 1 and Model 2, and are presented in the appendix.

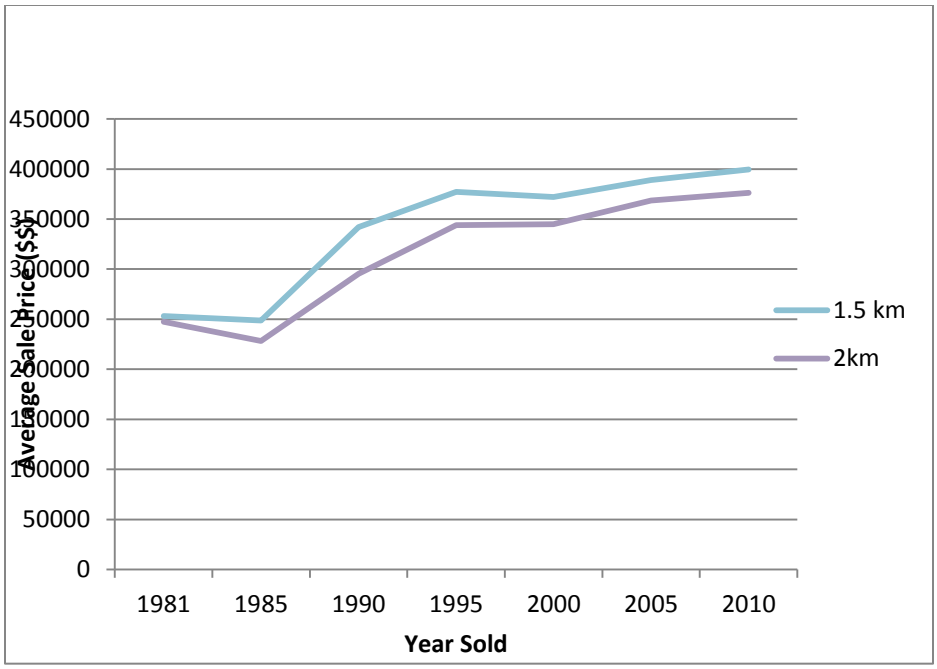

Figure 2 Average sale price from 1981-2010 within 2km treatment zone from Carburn Park

Choosing the correct distance from the site to serve as control and treatment groups was done by comparing the various distances employed in the literature with the size of the area being examined around Carburn Park. The data were analyzed to see how close to the site housing sales were occurring, and until what point there appeared to be a negative impact. A 2 km treatment area was selected as it appeared most appropriate for this site, and also matched well with the treatment areas used in similar research by other contributions in the literature (Linden and Rockoff 2008, Muehlenbachs et al 2013, Boxall et al 2005).

The econometric model for the DD estimation is expressed as follows:

$$(6)\ P_{it} = \alpha + \beta_t X_{it}^T + \beta_R X_{it}^R + \beta_{DD} X_{it}^T * X_{it}^R + \sum_{j=1}^{J} b_j\ X_{jit} + \varepsilon_{it}$$

Where

P_{it}= log of transaction price of property *i* at time *t, t*=1981-2010,

X_{it}^T= a dummy for the second time period

X_{it}^{R}= a dummy for the treatment group within an identified radius

$X_{it}^{T} * X_{it}^{R}$= an interaction term for observations both in period 2 and the treatment group

Table 2 Difference-in-difference parameter description

	Before Mine Closure (B)	After Mine Closure (A)	Difference (A-B)
Treatment (C)	$\alpha + \beta_R$	$\alpha + \beta_t + \beta_R + \beta_{DD}$	$\beta_t + \beta_{DD}$
Control (D)	α	$\alpha + \beta_t$	β_t
Difference (C-D)	β_R	$\beta_R + \beta_{DD}$	β_{DD}

In this type of analysis, the difference-in-difference in parameter (β_{DD}) is the parameter of interest because it is the estimator of the policy effect. Ashenfelter and Card (1985) defined this parameter as;

(7) $$\beta_{DD} = (P_{treatment,after} - P_{treatment,before}) - (P_{control,after} - P_{control,before})$$

Table 3 Distribution of observations for DD estimation in Carburn Park

Classification	Observations	Classification	Observations
Before 1985	430 (6%)	Control & Before 1985	211(3%)
After 1985	6511 (94%)	Treatment & Before 1985	219 (3%)
Total	6941 (100%)	Control & After 1985	1989 (27%)
Treatment (within 2 KM)	4741 (68%)	Treatment & After 1985	4522 (65%)
Control (Outside 2 KM)	2200 (32%)	Total	6941 (100%)
Total	6941 (100%)		

2.23 Robustness Checks

A series of robustness checks are used to identify any potential misspecifications in the model. The inclusion of time fixed effects is an attempt to account for time-invariant unobservable effects in each of the analyses performed. To do this, year dummies from every year accounted for in the data set are included in the regression analyses. The analysis was done considering two "before and after" scenarios. The first focussed on the time period before and after mine closure, and the latter on when the reclamation certificate was issued in 2005. Though both scenarios were analyzed, only the first is included in this research. The park had already been functionally usable for residents in the community for approximately twenty years before the reclamation certificate was issued, and as a result the analysis provided positive results for the time periods before and after it was issued. In the case of mine closure and subsequent reclamation however, there were noticeable differences in the property value impacts from either the operating mine or the transformed park. It was decided that this time period better reflected the overall impact on the community from mine closure and reclamation. Breusch-Pagan and White tests for heteroskedasticity were performed, and found the presence of heteroskedasticity.

This was attempted to be corrected for by using robust standard errors in all of the following reported results.

The data are composed of communities located by a major highway, the Deerfoot Trail. To account for any impacts of dust or noise from this highway and to ensure that those impacts are not being combined with the impact of the gravel mine, an inverse distance parameter from each house to the nearest point on the highway was included in the analysis. The highway was not found to have had any impact on the analysis, and as a result is not reported in the results section below.

To formally investigate the issue of spatial autocorrelation, a non-spatial classic OLS regression with the inclusion of various spatial weights was run in GeoDa. This regression provides the results of a Moran's I test for spatial autocorrelation. The test result indicated that the null hypothesis of no spatial autocorrelation should be rejected. The results of the Lagrange Multiplier (LM) test then indicated that there is a presence of dependence among the error terms. Similar to the work of Neupane and Gustavson (2008) however, because there was a low level of statistical significance, and since spatial dependency does not create unbiasedness in the OLS results, the model was estimated without spatial effects[2]. Furthermore, because using DD modelling cancels out any spatial impacts, as discussed in Muehlenbachs et al (2012) and Gopalakrishnan and Klaiber (2013), additional spatial analysis was not conducted.

2.3 Results

2.31 Model 1 Results

The results of the analysis using Model 1, found in Table 4, show a decisive difference in the effect of the gravel mine before and after it closed in 1985. The sign on the coefficient for the variable representing the time period before closure is negative and significant. This result indicates that in that period, property values decreased with proximity to the site. The reverse effect is true in the time period following the closure of the mine, with property values increasing with proximity to what became Carburn Park. This result indicates a negative externality was generated by the operating gravel mine that put downward pressure on property values

[2] These tests were re run using various distance based spatial weights matrices, testing distances from 0.1 km – 0. 5 km, and all provided similar results.

surrounding it. The effect of reclamation moreover, has a significantly positive effect on property values once completed. The signs and magnitudes on the other variables are plausible and as expected, for example an additional bathroom results in an approximate 7% increase to property value while the presence of a garage increases value by approximately 6%.

To test the robustness of these results, time fixed effects were included in the model as aforementioned. Although the signs and significances on most of the variables do not vary much from the original model, the variable indicating the before time period becomes positive and insignificant, indicating some sensitivity around this result. The positive impact from reclamation is still supported by the positive and significant coefficient value on the variable indicating the 'after' time period. Upon a closer examination of the data, it is clear that there are few house sales within the area directly next to the gravel mine, which may account for some of the variability with the results. Furthermore, there is only one year of available data prior to the mine opening, compared with the twenty-five after. Finally, the preferences of the individuals moving into this area before and during production are unknown. It is possible that those choosing to move into this neighbourhood were aware not only of the operating gravel mine, but also of the imminent plans to reclaim it into a user-friendly park. For that reason, that the negative externalities may not have resulted a large impact. What is most important to note however, is the robustness of the result for the time period following reclamation. It is consistently positive, significant, and of noticeable magnitude.

Table 4 Hedonic analysis results using the basic Model 1 structure, indicating impacts of the gravel mine before and after the mine closed interacted with inverse distance from the site

	Model 1	
Attribute	OLS[1]	TFE[2]
Inverse Distance Before	-0.12229***	0.07840
	(0.0248)	(0.0518)
Inverse Distance After	0.056067***	0.04169***
	(0.0071)	(0.0055)
Presence of Air	0.05682***	0.03331***
Conditioning	(0.0098)	(0.0095)
Waterfront	0.07034	0.11573***
	(0.0553)	(0.0344)
Presence of Basement	0.09632	0.04181
	(0.0.0584)	(0.0342)
Presence of Garage	0.01758	0.05609***
	(0.0129)	(0.0108)
Size of Garage	0.06593	0.03733***
	(0.0082)	(0.0066)
Single Family House	0.15521***	0.18907***
	(0.0081)	(0.0064)
Deck or Balcony	0.05331***	0.02408**
	(0.0049)	(0.0040)
Area of Home	0.00232***	0.00189***
	(0.0003)	(0.0003)
Lot Size (m²)	'0.0007	-0.0001
	(0.0005)	(0.0001)
No. Bedrooms	0.01037***	0.00761***
	(0.0031)	(0.0026)

No. Bathrooms	0.08944***	0.06716***
	(0.0053)	(0.0043)
Fire Place	0.05969***	0.05909***
	(0.0059)	(0.0049)
Age of House	-0.00105***	-0.00331***
	(0.0003)	(0.0002)
Constant	11.89602***	11.89159***
	(0.0358)	(0.0508)
R^2	0.66	0.76
N	6941	6941

P<0.01=***, P<0.05=**, P<0.1=*

[1]OLS = Ordinary Least Squares

[2]TFE= Time Fixed Effects

A visualization of the impact estimated in Model 1 without Time Fixed Effects is provided in Figure 3. This figure shows the distinct negative impact with increasing proximity to the site in the time period during gravel extraction. The time period after mine closure shows the opposite, positive effect on property value with increasing proximity to the newly transformed Carburn Park.

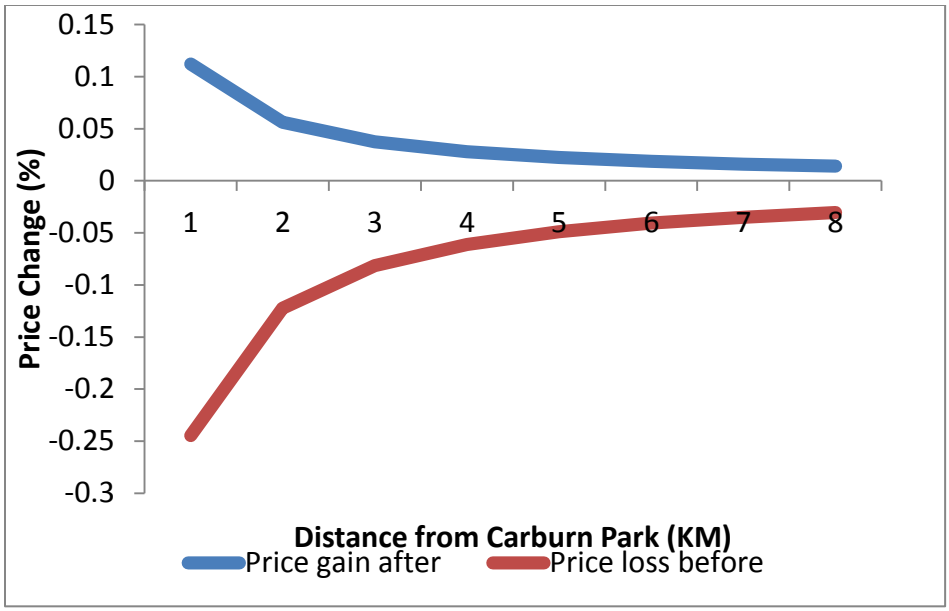

Figure 3 Percent price change in property values across varying distances from Carburn Park

Because this neighbourhood is actually composed of two separate housing types, Single Family Homes and Condos, all the models were estimated again separately for each segment of the market to investigate any potential differences. The analysis for Single Family Homes will be labelled Model 1 SFH and for Condos Model 1 CONDO. First reported are the results from Model 1 SFH in Table 5. The results of the analyses for this section are almost identical to the results reported above, likely because over 90% of the dwellings being examined fit within this category.

As with the whole data set above, the first analysis on only single family homes shows a clear distinction between a negative impact before the gravel mine ceases operations with a positive effect after. Once time fixed effects are included there is no significant effect for the before period, only a positive after. As a result of the market being composed almost entirely of single family homes, the results between this regression and the first reported are almost identical. For this reason, it is a fair assumption that the reasoning for the "before" variable becoming insignificant follows closely what was aforementioned.

Table 5 Hedonic analysis results using the basic Model 1 structure and only Single Family Homes (SFH), indicating impacts of the gravel mine before and after the mine closed interacted with inverse distance from the site

	Model 1 SFH	
Attribute	OLS[1]	TFE[2]
Inverse Distance Before	-0.13842***	0.10205
	(0.0273)	(0.0527)
Inverse Distance After	0.050122***	0.0336***
	(0.0091)	(0.0055)
Presence of Air	0.05627***	0.03340***
Conditioning	(0.0102)	(0.0098)
Waterfront	0.08276	0.14303***
	(0.0694)	(0.0425)
Presence of Basement	0.10118	0.04792
	(0.05488)	(0.0318)
Presence of Garage	0.00502	0.04239***
	(0.0129)	(0.0107)
Size of Garage	0.07085	0.04292***
	(0.0080)	(0.0064)
Deck or Balcony	0.05154***	0.0224**
	(0.0052)	(0.0042)
Area of Home	0.00231***	0.0019***
	(0.0004)	(0.0003)
Lot Size (m²)	0.0000	0.0000
	(0.0000)	(0.0000)
No. Bedrooms	0.01256***	0.00843***
	(0.0030)	(0.0026)
No. Bathrooms	0.08775***	0.06575***
	(0.0056)	(0.0658)
Fire Place	0.06231***	0.0601***

	(0.0059)	(0.0049)
Age of House	-0.00119***	-0.00192***
	(0.0003)	(0.0002)
Constant	12.05807***	12.06713***
	(0.03402)	(0.0553)
R^2	0.66	0.76
N	6361	6361

P<0.01=***, P<0.05=**, P<0.1=*

[1]OLS = Ordinary Least Squares

[2]TFE= Time Fixed Effects

The results of the analysis change for Model 1 CONDO are different, with a positive impact reported both before and after mine closure (Table 6). Inclusion of time fixed effects change the before effect to significantly negative and much larger than the positive effect in the second time period, the opposite of the case for the single family homes segment. This result suggests that the condos in this area may be more sensitive to the activity in the gravel mine than the single family homes surrounding it. This may be because condos generally lack yard space and residents of those dwellings would rely more on the space for recreation. While the gravel mine was operating they would not have been able to access the park. This may also be because during these years several condo units were closer to the mine than the single family homes (within the 1.4 km radius), and as a result may have experienced greater property value impacts.

Table 6 Hedonic analysis results using the basic Model 1 structure and only Condos, indicating impacts of the gravel mine before and after the mine closed interacted with inverse distance from the site

	Model 1 CONDO	
Attribute	OLS[1]	TFE[2]
Inverse Distance Before	0.17082***	-0.42510***
	(0.0637)	(0.1444)
Inverse Distance After	0.03224***	0.02509**
	(0.0074)	(0.0067)
Presence of Air	0.02525	-0.01005
Conditioning	(0.0285)	(0.0245)
Waterfront	0.12494	0.1154
	(0.0140)	(0.0229)
Presence of Basement	N/A	N/A
Presence of Garage	0.33499***	0.2310***
	(0.0535)	(0.0519)
Size of Garage	0.0070	0.04929**
	(0.0288)	(0.0272)
Deck or Balcony	0.04801***	0.0152
	(0.0171)	(0.0153)
Area of Home	0.00437***	0.0036***
	(0.0005)	(0.0004)
Lot Size (m²)	0.0000	0.0000
	(0.0000)	(0.0000)
No. Bedrooms	-0.03949***	-0.0005
	(0.0146)	(0.0134)
No. Bathrooms	0.08948***	0.06535***
	(0.0209)	(0.0654)
Fire Place	0.07022***	0.09524***

	(0.0172)	(0.0134)
Age of House	0.00796***	-0.0001
	(0.0012)	(0.0133)
Constant	11.64742***	11.94679***
	(0.0765)	(0.0917)
R^2	0.76	0.83
N	580	580

P<0.01=***, P<0.05=**, P<0.1=*

[1]OLS = Ordinary Least Squares

[2]TFE= Time Fixed Effects

2.32 Model 2 Results

A DD model was estimated in Model 2 to account for some of the limitations of the hedonic method, the results of which are presented in Table 7. As aforementioned, a 2 km treatment area was selected for the analysis. This treatment was interacted with a dummy for the second time period, after 1985 once the gravel mine has closed. The results of this analysis are approximately the same with regard to the magnitudes, signs and significances of the housing characteristics on property value as in Model 1. The DD parameter of interest, labelled 'Treatment*After', has the expected sign and significance as well. It is both positive and significant, indicating that there an impact on housing values from the gravel mine which becomes positive once it has been reclaimed into the park.

Again to test the robustness of this model time fixed effects are included. The magnitudes, signs and significance of the coefficients remain almost identical between the two models. The DD parameter also remains positive and significant though the magnitude decreased by approximately half, reducing what previously appeared to be a larger impact. Similar results in both the DD model and the DD model with time fixed effects suggests that the results from this analysis are robust, supporting the notion that the negative environmental externalities generated from gravel extraction may have had a significant impact on property values during production, but that this effect becomes positive once reclamation is completed.

Table 7 DD analysis results for Model 2 using a 2 km treatment area and 2 time periods (before and after mine closure)

	Model 2	
Attribute	OLS[1]	TFE[2]
Period 2: After	0.07019***	-0.16583***
	(0.0231)	(0.0397)
Treatment	0.01126	-0.00372
	(0.0259)	(0.0226)
Treatment *After	0.07168***	0.04379***
	(0.0262)	(0.0231)
Presence of Air	0.05691***	0.03470***
Conditioning	(0.0098)	(0.0096)
Waterfront	0.10740*	0.14472***
	(0.0570)	(0.0409)
Presence of Basement	0.12661	0.06083
	(0.0573)	(0.0357)
Presence of Garage	0.03718**	0.06930***
	(0.0129)	(0.0109)
Size of Garage	0.05924***	0.03377***
	(0.0084)	(0.0068)
Single Family House	0.12828***	0.17255***
	(0.0085)	(0.0069)
Deck or Balcony	0.05422***	0.02729***
	(0.0050)	(0.0041)
Area of Home	0.00241***	0.00197***
	(0.0004)	(0.0003)
Lot Size	0.0005	-0.0000
	(0.0005)	(0.0001)
No. Bedrooms	0.00796***	0.00515***

	(0.0030)	(0.0026)
No. Bathrooms	0.09294***	0.07176***
	(0.0054)	(0.0044)
Fire Place	0.05791***	0.05825***
	(0.0060)	0.0051)
Age of House	-0.00078***	-0.00328***
	(0.0002)	(0.0003)
Constant	11.82261***	11.94193***
	(0.0359)	(0.0455)
R^2	0.67	0.76
N	6941	6941

P<0.01=***, P<0.05=**, P<0.1=*

[1]OLS = Ordinary Least Squares

[2]TFE= Time Fixed Effects

The same process is repeated for the Single Family Home component of the market, reported in Table 8 (Model 2 SFH). The signs and significance on the housing characteristics are as expected including a positive sign on the DD parameter, though it becomes insignificant. This may because there are fewer observations, or because the SFHs are not located within 1.4 km of the mine whereas the Condos are. Within this radius immediately next to the mine, the impacts of both extraction and reclamation would be greater.

Table 8 DD analysis results for both Model 2 using a 2 km treatment area and 2 time periods (before and after mine closure) and only Single Family Homes (SFH)

	Model 2 SFH	
Attribute	OLS[1]	TFE[2]
Period 2: After	0.08542***	-0.10571**
	(0.0265)	(0.0460)
Treatment	0.01753	-0.00318
	(0.0291)	(0.0256)
Treatment *After	0.05994***	0.02803
	(0.0262)	(0.0262)
Presence of Air	0.05437***	0.03376***
Conditioning	(0.0102)	(0.0099)
Waterfront	0.13507*	0.17701***
	(0.0702)	(0.0464)
Presence of Basement	0.13136**	0.06610*
	(0.0556)	(0.0337)
Presence of Garage	0.00687	0.04136***
	(0.01297)	(0.0108)
Size of Garage	0.07081***	0.04481***
	(0.0083)	(0.0066)
Deck or Balcony	0.05031***	0.02310***
	(0.0050)	(0.0044)
Area of Home	0.00245***	0.00202***
	(0.0004)	(0.0004)
Lot Size (m^2)	0.0000	-0.0000
	(0.0000)	(0.000)
No. Bedrooms	0.01214***	0.00249***
	(0.0030)	(0.0025)
No. Bathrooms	0.08534***	0.06643***

	(0.0059)	(0.0048)
Fire Place	0.06445***	0.06189***
	(0.0062)	0.0051)
Age of House	-0.0008***	-0.00321**
	(0.0002)	(0.0003)
Constant	11.93923***	12.11109***
	(0.0355)	(0.0500)
R^2	0.64	0.74
N	6361	6361

P<0.01=***, P<0.05=**, P<0.1=*

[1]OLS = Ordinary Least Squares

[2]TFE= Time Fixed Effects

When the model is estimated using only the condo portion of the market (Model 2 CONDO), the DD parameter is again both positive and significant with and without time fixed effects, but the magnitude of the coefficient is much larger. In the case of the time fixed effects estimation, the value of the coefficient is about three higher than the value in model considering housing types supporting the notion of the higher sensitivity of condos to the activities in the gravel mine and land reclamation after. Also worth noting is that in this model, likely in part due to the few number of observations, many of the other parameters drop out of significance such as the impact of having a garage, basement or air conditioning. The number of bedrooms becomes a negatively significant parameter, contrary to common expectation. This sometimes happens as a result of the number of bedrooms not being indicative of a larger dwelling, simply meaning fitting more rooms into one of the same size. These results are presented in Table 9.

Table 9 DD analysis results for Model 2 using a 2 km treatment area and 2 time periods (before and after mine closure) and only Condos

	Model 2 CONDO	
Attribute	OLS[1]	TFE[2]
Period 2: After	-0.1239***	-0.28063***
	(0.0391)	(0.0740)
Treatment	-0.0797*	-0.07456**
	(0.0451)	(0.0331)
Treatment *After	0.11634**	0.15109***
	(0.0462)	(0.0348)
Presence of Air	0.01290	-0.01408
Conditioning	(0.0268)	(0.0231)
Waterfront	0.09385	0.06470
	(0.0248)	(0.0268)
Presence of Basement	N/A	N/A
Presence of Garage	0.40289	0.24350***
	(0.0526)	(0.0519)
Size of Garage	-0.00804	0.05071**
	(0.0319)	(0.0283)
Deck or Balcony	0.05298***	0.01521
	(0.0172)	(0.0150)
Area of Home	0.00403***	0.00243***
	(0.0006)	(0.0005)
Lot Size (m²)	0.00000	0.0000
	(0.0000)	(0.0000)
No. Bedrooms	-0.04621***	0.01038
	(0.0146)	(0.0133)
No. Bathrooms	0.11394***	0.08351***
	(0.0210)	(0.0196)

Fire Place	0.05437***	0.07675***
	(0.0178)	(0.0133)
Age of House	0.00709***	-0.00236**
	(0.0012)	(0.0013)
Constant	11.81409***	11.85309***
	(0.0772)	(0.0771)
R^2	0.72	0.84
N	580	580

P<0.01=***, P<0.05=**, P<0.1=*

[1]OLS = Ordinary Least Squares

[2]TFE= Time Fixed Effects

To further test the robustness of these results, and because of a limitation in the data with regard to the availability of data prior to the mine was built in comparison to many years available after, the regressions were run again using only the data provided up to 1995 rather than up to 2010. Table 10 shows the results of Model 1, which once again show a negative impact before reclamation which is reversed after. The negative impact is, however, much smaller and insignificant in this scenario. In contrast, the positive effect of reclamation has more than doubled, perhaps indicating that the positive impact is stronger in the early years since reclamation than later. In the fixed effects scenario, the before time period is insignificant as well, while the positive impact has once again doubled since the original model. The signs and significances of the property attributes are all appropriate, while the magnitudes of the values have in many cases decreased marginally.

Table 10 Hedonic analysis results using the basic Model 1 structure indicating impacts of the gravel mine before and after the mine closed with observations up to1995

	Model 1	
Attribute	OLS[1]	TFE[2]
Inverse Distance Before	-0.03556	0.05175
	(0.0136)	(0.0539)
Inverse Distance After	0.11270***	0.08031***
	(0.0104)	(0.0080)
Presence of Air	0.08251**	0.07351**
Conditioning	(0.0320)	(0.0031)
Waterfront	0.04942	0.05393*
	(0.0758)	(0.0310)
Presence of Basement	N/A	N/A
Presence of Garage	0.00554	0.05238*
	(0.0212)	(0.01769)
Size of Garage	0.08120***	0.05298***
	(0.0125)	(0.0101)
Deck or Balcony	0.05345***	0.03234***
	(0.0076)	(0.0042)
Area of Home	0.00160***	0.0014***
	(0.0005)	(0.0003)
Lot Size (m²)	N/A	N/A
No. Bedrooms	0.02751***	0.01783***
	(0.0049)	(0.0041)
No. Bathrooms	0.0774***	0.07066***
	(0.0056)	(0.0069)
Fire Place	0.09523***	0.08976***
	(0.0078)	(0.0065)
Age of House	-0.00304***	-0.0044***

	(0.0004)	(0.0003)
Constant	11.80073***	11.88994***
	(0.0503)	(0.0624)
R^2	0.60	0.72
N	2720	2720

P<0.01=***, P<0.05=**, P<0.1=*

[1]OLS = Ordinary Least Squares

[2]TFE= Time Fixed Effects

Table 11 provides the results for Model 2 once again only using observations up to 1995. In all of the following scenarios, the DD parameter is both positive and significant, corresponding with the previous results. The signs, significances and magnitudes in this model correspond closely to the previous results as well, however the presence of a basement and lot size both drop out, and the presence of a garage becomes insignificant. Although there are a few marginal changes, the results from this analysis have largely remained the same, indicating their robustness.

Table 11 Hedonic analysis results using the basic Model 1 structure, indicating impacts of the gravel mine before and after the mine closed with observations up to 1995

	Model 2	
Attribute	OLS[1]	TFE[2]
Period 2: After	0.01117	-0.18019***
	(0.0207)	(0.04003)
Treatment	-0.00448	-0.01309
	(0.0233)	(0.0214)
Treatment *After	0.08133***	0.05929***
	(0.0245)	(0.0224)
Presence of Air	0.06586*	0.06115*
Conditioning	(0.0336)	(0.0032)
Waterfront	0.12609***	0.11021***
	(0.0702)	(0.0206)
Presence of Basement	N/A	N/A
Presence of Garage	0.00445	0.03338*
	(0.0216)	(0.0181)
Size of Garage	0.08906***	0.05818***
	(0.0131)	(0.0105)
Deck or Balcony	0.05940***	0.03643***
	(0.0079)	(0.0044)
Area of Home	0.0018***	0.00147***
	(0.0006)	(0.0005)
Lot Size (m²)	N/A	N/A
No. Bedrooms	0.02354***	0.01460***
	(0.0050)	(0.0025)
No. Bathrooms	0.08114***	0.07332***
	(0.0083)	(0.0072)

Fire Place	0.09808***	0.09209***
	(0.0084)	(0.0070)
Age of House	-0.0035***	-0.0048**
	(0.0004)	(0.0004)
Constant	11.80493***	11.91516***
	(0.0568)	(0.0588)
R^2	0.59	0.71
N	2720	2720

P<0.01=***, P<0.05=**, P<0.1=*

[1]OLS = Ordinary Least Squares

[2]TFE= Time Fixed Effects

In summary, both models demonstrate an impact from the gravel mine on the property values surrounding it which are summarized in Table 12.

Table 12 Summary of key results from Model 1 and Model 2 for the regressions using the full sample, single family homes only, and condos only

	OLS[1]		TFE[2]	
	Before (IDB)	After (IDA)	Before (IDB)	After (IDA)
Model 1				
Full Sample	Negative, Significant	Positive, Significant	Not Significant	Positive, Significant
SFH	Negative, Significant	Positive, Significant	Not Significant	Positive, Significant
CONDOS	Positive, Significant	Positive, Significant	Negative, Significant	Positive, Significant
	DD Parameter (Treatment *After)		DD Parameter (Treatment* After)	
Model 2				
Full Sample	Positive, Significant		Positive, Significant	
SFH	Positive, Significant		Not Significant	
CONDOS	Positive, Significant		Positive, Significant	

[1]OLS = Ordinary Least Squares

[2]TFE= Time Fixed Effects

Model 1 shows a negative effect during extraction, however this becomes insignificant when time fixed effects are included. The impact of reclamation remains positive in significant in all scenarios however, indicating its robustness. In this analysis the impacts of extraction do not generate consistent significant results, though there is a consistent positive and significant impact generated by reclamation. The sensitivity of the results during extraction could possibly be due to the limited number of observations available during that time period, the small numbers of houses between 0-1.4 km of the mine, or the unpredictability of preferences of the homeowners. There may also be omitted variables relating to macroeconomic conditions that is causing the difference between the OLS and TFE models. All of the signs and significances from this model are as expected and make sense. When the observations are divided into single family homes and condos, the single family homes analysis had almost identical results to the original full analysis The condos were the only properties which indicated a negative impact

during extraction when time fixed effects are included, although they accounted for only a small portion of the sample.

Model 2 was a DD analysis which can be used to correct for some of the shortcomings of hedonic analyses. In this research it was used to check the robustness of the results from Model 1. Model 2 confirmed the findings of Model 1, indicating a significant positive gain from the reclamation of the gravel mine in 1986.

As a result of these analyses all providing indication of a negative impact of the gravel mine on proximal households and more significantly the positive impact of reclamation, the location choice of this mine is called into question. Had the mine been further away, perhaps the negative impacts on those properties never would have existed. As aforementioned, gravel operators argue that transporting gravel is too expensive and increases their environmental footprint dramatically. The next stage of analysis will take advantage of the results from these models, and use them in the construction of a gravel mine simulation. This simulation will be used to compare the costs of transportation, both direct and from externalities, with the social cost of extraction near households to determine if it is in fact more cost effective to maintain a mine so close to its market or if it would make more sense to mine further away.

3. Gravel Mine Simulation

3.1 Introduction and Background

Mining of sand and gravel is unwelcome near neighbourhoods and communities because of the negative externalities associated with it such as increased traffic, road damage, noise, and dust. Because of its low unit-value in comparison to high transportation costs it is frequently extracted in close proximity to its intended market. This often means that gravel pits are located within urban centers where new communities are being developed. In the hedonic property value analysis described above, a significant downward pressure on property values is measurable until extraction ceases. Furthermore, gravel mining companies have argued that by situating their operations closer to the market they are actually reducing their environmental foot print by decreasing the amount of traffic and kilometers their product must travel. According to the results of the previous analysis however, there is significant evidence suggesting that the externalities from a nearby mine are in fact generating a negative impact on the property values in the surrounding neighbourhood, or that reclamation will generate a positive effect. The purpose of this simulation is to compare the costs of transportation with the estimated cost of the externalities from the mine to compare the cost effectiveness of gravel extraction at greater distances from its market and to evaluate the impact of more rapid reclamation at the site.

Using the empirical hedonic price model findings in conjunction with gravel prices, freight travel costs and estimated values for the additional negative externalities generated from transportation, a simulation model of a hypothetical gravel mine is created. By capturing the externality effects in the simulation, the study compares mine operations with and without the incorporation of various externality effects. Without taking into account how social costs such as local property value effects, the high cost of transporting gravel is cost inefficient from the perspective of the mine operator. The model attempts to calculate the magnitude of the value of the externality when aggregated over an entire community to examine whether incorporating the social costs of extraction in addition to the private costs in the decision making process may result in it being more effective to move the mine away from its market.

The simulation model analysis is also an attempt examine the issue of optimal reclamation timing. If the negative externality of a mine extends through time until reclamation takes place,

then reclaiming sooner would have significant positive impact on the values of surrounding households. Currently Alberta is regulated by guidelines that do not provide strict reclamation timing schedules to mine operators. Furthermore, municipalities stand to gain tax revenues generated by property value increases once reclamation takes place. Demonstration of this fact may provide incentives to the municipalities to require timely reclamation to take place.

3.2 Literature Review

The low unit-value cost of gravel is one of the main barriers for relocating mines further from urban centers. Jaeger discusses the costs of relocating aggregate mines in the context of a program in Oregon to protect high-value farmland. Jaeger finds that the true cost of relocating gravel mines from the farmland being protected is equivalent to a $40,000.00 per acre cost, compared with the market value of that same farmland at $2000.00 per acre. Although farming culture in this region of Oregon will benefit from the policy, this price differential signals it to be extremely economically inefficient. Values used to calculate per-ton-mile cost of transporting gravel from Jaeger's paper are used in this simulation.

Aside from the direct costs of increasing the distance of aggregate transport, there are other external costs that must be considered. These costs include but are not limited to; health impacts, number of traffic accidents, noise, dust and road damage. In terms of health related costs, a report for Transport Canada by Marbek Resource Consultants Ltd. (2007) touches on the overall costs of air pollution from transportation in Canada. This report examines costs associated with several health conditions including acute exposure mortality, adult bronchitis, cardiac emergency room visits, asthma symptom days, etc. Muehlenbachs and Krupnick (2013) examine the connection between increased traffic from increasing Shale Gas development in Pennsylvania and traffic accidents. Their preliminary research indicates that heavy-duty truck accidents increase by 2% with each additional well drilled per month, and that fatalities increase 0.6%. Additionally, the Center for Disease Control and Prevention has found that of all of the fatalities related to oil and gas extraction in the U.S., approximately 27% of them are highway motor-vehicle accidents. In his hedonic analysis of the impact of traffic noise on property values, Wilhelmsson (2010) finds that single-family houses sell for approximately 30% less if they are located near a noisy road. Delucchi and McCubbin (2010) summarize the costs

associated with the externalities from transportation, including a per-ton-mile amount associated with freight trucking in the literature. The amounts from Delucchi and McCubbin's (2010) summary are averaged and used for this analysis.

Harris (1999) cites the work of Peiser and Smith (1985) in his analysis of how property values change based on socioeconomic and racial factors. Harris (1999) uses the methods of Peiser and Smith (1985) to annualize property values to perform his study. This same method will be employed in the simulation below to enable an accurate comparison and analysis of yearly costs from the various sources.

3.3 Methods

3.31 Calculating the Aggregated Externality Effect

To calculate the aggregate impact of the externality from resource extraction on the houses in the area, the values from the full sample scenario of Model 1 OLS in the previous section are used. This model is used because it provides coefficient values for both the time period during extraction as well as once reclamation took place. These values allow for an analysis of both scenarios within the following simulation, the negative impact of extraction on property values and the positive impact of reclamation. Although the results of Model 2's DD analysis could be considered more reliable to use in the simulation analysis, the results of Model 1 were used in large part to decrease the complexity of the required calculations. The steps to carry out this calculation are as follows;

- Using ArcGIS, the number of houses in gradually increasing intervals from the site are calculated during the years of production from 1982-1985.
- The coefficients for the different variables, except inverse distance, in the previous hedonic analysis are all multiplied by their means within the sample and summed.
- The coefficient on the inverse-distance dummy variable for before mine closure is multiplied by inverse distances at various intervals (1/0.5 km, 1/1 km, etc.), and added to the rest of the equation.
- This process gives a value for natural log of the value of the houses at various intervals so that the impact at different intervals can be determined.

- Exponentiation of this value and subtracting the values at the different intervals gives a value for the change in property value per house depending on location.
- This per house amount is then multiplied by the number of houses in the given interval at the time period to generate the aggregate impact.
- Finally, this totally amount is converted to annual value dollars by multiplying these values by 0.0785 (Harris 1999).

Several hundred new houses were built during the period of operation, resulting in an increasing aggregate impact of the externality through time. Table 13 provides the number of houses in each 0.5 km increment from the mine.

Table 13 Number of houses in each 0.5 km interval from Carburn Park

Year	0.5km	1km	1.5km
1982	1	263	312
1983	4	469	312
1984	8	588	316
1985	9	619	316
1990	193	1063	691
1995	312	1181	1227
2000	313	1187	1261
2005	314	1187	1261
2010	314	1187	1261

3.32 Transportation Costs

In order to calculate the cost of transporting the resource, it is first important to estimate the amount of gravel extraction of the years the mine was developed. This was done in two ways, described as Scenario 1 and 2 below;

3.321 Scenario 1 Costs

In lieu of the availability of the actual output of gravel at this mine, the quantities from a mine comparable in size and location were used for comparison (Badke Consulting Ltd. 2012).

These quantities extracted, approximately 27 500 tons annually or 82 500 tons over the life of the mine, are reported in Table 14. Though both mines covered a similar land area however, it is recognized as a significant assumption that both had the same sized gravel deposit.

Table 14 Approximate annual gravel output from a comparable gravel mine to Carburn Park in terms of size, duration of extraction and location (Badke Consulting Ltd. 2012.)

Month	Tons	Monthly Trips	Daily Trips
January	0	0	0
February	550.61	14	1
March	550.61	14	1
April	2202.46	57	3
May	2202.46	57	3
June	3303.69	86	4
July	5506.15	143	7
August	6056.76	157	8
September	4404.92	114	6
October	2753.07	71	4
November	0	0	0
December	0	0	0
Total Yearly	**27530.75**	**714**	

3.322 Scenario 2 Costs

Another method for estimating the amount of gravel deposited is by using a proxy for the amount of aggregate required to build an average home in Scenario 2, approximately 120 tons (Rogers Group Inc.), and multiplying it by the number of new houses constructed in the subdivision over the life of the mine. The amounts calculated in this way are reported in Table 15, and amount to approximately 109 000 tons total over the life of the mine, and are close to the quantities measured using the area based method described above. Scenario 2 requires the assumption that extraction at Carburn Park was solely for the purpose of developing the surrounding subdivision.

Table 15 Total amount of aggregate required over the period of operation of the mine to construct the new subdivision surrounding it

Year	Total Tons of Aggregate Required for Construction of New Houses
1982	55200
1983	39000
1984	15240
Total	**109440**

An estimation of the cost of transporting gravel from a further location is then calculated. These numbers are estimated to provide a comparison with the externality impact on housing property values to identify which value is greater. This cost was calculated at the maximum distance a gravel mine would likely be developed in Alberta from its market, about 42 KM (Richards and Peel 2003). Per ton-mile (tm) cost is estimated using the values from Jaeger's (2006) article at $0.21/tm, which has been converted, as have all other values, to the base year of 2007 of the Housing Price Index.

This value only accounts for the direct cost of transportation such as fuel and wear and tear on freight vehicles. Associated with increased traffic are a number of other externalities, such as those from congestion, accidents, pollution, etc. Delucchi and McCubbin (2010) estimate the various externality costs associated with freight transport by compiling those available in the literature. The ranges of the values they provide in their article are summarized in Table 16 below. These values are summed into a single value for per ton-mile in each case, considering the lowest, average and highest freight cost recorded in Delucchi and McCubbin's (2010) study. To evaluate the sensitivity of the results, transportation costs are calculated at each one of these levels. These additional externality costs are calculated once again at a 42 km distance, and added to the value reported above. The subsequent values are considered the total cost of the additional transportation, which will be compared to the impact of gravel extraction on housing

values. These transportation cost, reported in per ton-miles, are then multiplied by the tons of aggregated estimated to have been extracted in both scenarios.

Table 16 Range of costs of different externalities associated with gravel freight transport (Source: Delucchi and McCubbin 2010, pp. 24)

Externality Type	Lowest Freight Cost (per ton-mile in 2007 cents)	Average Freight Cost (per ton-mile in 2007 cents)	Highest Freight Cost (per ton-mile in 2007 cents)
Congestion Delay	0.55	0.55	0.55
Accident	0.11	0.97	2.04
Air pollution (health)	0.10	9.51	19.11
Climate change	0.02	3.00	6.03
Noise	0.00	2.71	5.42
Water Pollution	0.00	0.02	0.05
Energy Security	0.22	0.32	0.86
Total	**1.01**	**17.08**	**34.07**

A sensitivity analysis was then performed on the distance to the mine used in the calculation to determine at what distance the transportation costs begin to outweigh the property value impacts. To ascertain how the externality would have magnified over time, it is calculated as if reclamation never happened until the most recent data available in 2010 as well. To better understand the positive effect of reclamation, the benefit of reclaiming one year earlier is reported. Finally, assuming that the positive impact generated from reclamation could be considered the value change that the houses would have experienced had extraction never occurred, a comparison of foregone benefits and transportation costs is reported.

3.4 Results

3.41 Scenario 1 Results

The annual transportation costs during extraction, both direct and externality costs when calculated at 42 km, are significantly lower than the externality costs generated from gravel extraction that affect nearby households. The estimates calculated when using the values from the comparable mine are presented first in Table 17 below, as well as visually in Figure 4.

Table 17 A comparison of the freight transportation cost of gravel to 42 km based on hypothetical mine output and the externality cost of extraction on surrounding households

Year	Total Negative Externality Cost Calculated in Annual Value	Total Transportation Costs during Production to 42 km (lowest $tm)	Total Transportation Costs during Production to 42 km (average $tm)	Total Transportation Costs during Production to 42 km (highest $tm)
$1,982	$2,242,960	$317,073	$548,864	$793,332
$1,983	$3,377,625	$224,019	$387,784	$560,506
$1,984	$4,078,311	$87,540	$151,534	$219,028
$1,985	$4,257,407	$0	$0	$0
Total	$13,956,304	$628,632	$1,088,182	$1,572,866

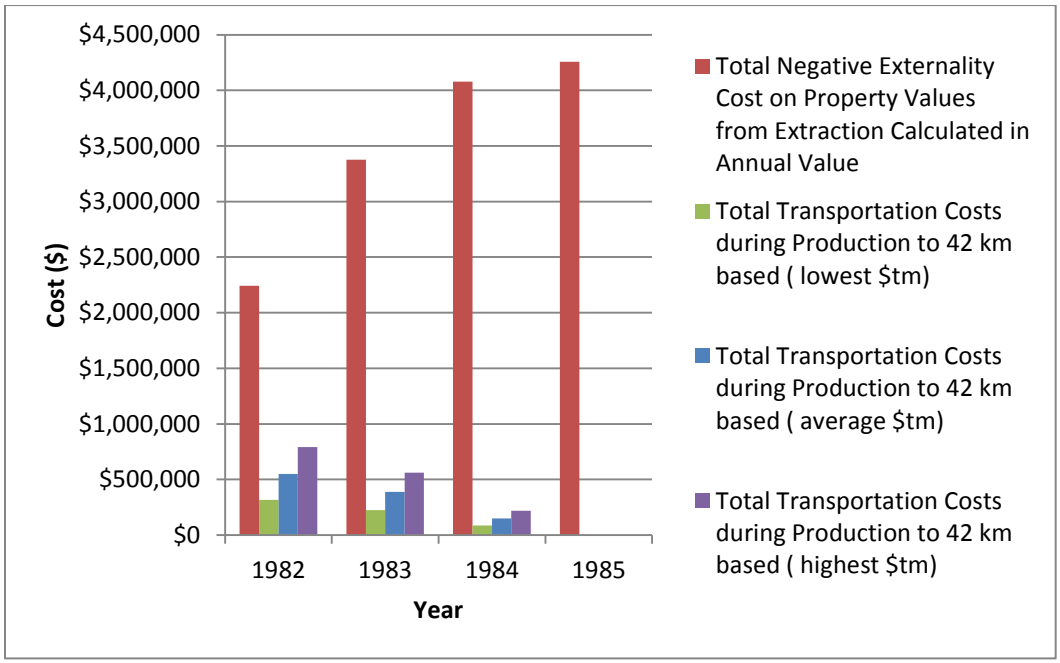

Figure 4 A comparison of the freight transportation cost of gravel to 42 km based on hypothetical mine output and the externality cost of extraction on surrounding households

The distance the mine would have to be from the market for the transportation cost to remain equal to the externality cost of extraction would be between 782 km away using the highest

freight cost and 1957 km away using the lowest by the final year of extraction in 1984. The values of these costs are reported in Table 18.

Table 18 Distance mine must be from market for transportation costs to equal externality cost of gravel extraction

Year	Distance that must be travelled (Low Cost Scenario) (KM)	Distance that must be travelled (Average Scenario) (KM)	Distance that must be travelled (High Cost Scenario) (KM)
1982	297	172	119
1983	633	366	253
1984	1957	1130	782

3.42 Scenario 2 Results

In the second scenario, where a proxy is used to estimate how much aggregate was required based on the number of houses constructed, the values do not differ much from the first scenario presented above. Table 19 shows that as a result of a larger amount of gravel being extracted, the transportation costs have increased by approximately $200,000 relative to Scenario 1. This increase makes the cost of transportation more comparable to the externality cost of extraction affecting properties, particularly in the first year when more houses were built, but still amounts to approximately only one fifth of the property value impact. As more houses are built and the externality cost of extraction continues to grow, and in this scenario the transportation cost is decreasing as fewer houses are being built. This makes it increasingly less cost effective to maintain the gravel mine in such close proximity to its market, as visualized in Figure 5. To make transportation costs equal the externality cost in this scenario, the resource would have to travel between approximately 400 and 1000 km in the last year of extraction depending on how the calculation is performed (Table 20).

Table 19 A comparison of the freight transportation cost of gravel to 42 km based on proxy for quantities required to construct new houses and the externality cost of extraction on surrounding households

Year	Externality Cost of Gravel Extraction	Total Transportation Costs during Production to 42 km based (lowest $tm)	Total Transportation Costs during Production to 42 km based (average $tm)	Total Transportation Costs during Production to 42 km based (highest $tm)
1982	$2,242,960.36	$158,294	$273,868	$396,059
1983	$3,377,625.10	$158,294	$273,868	$396,059
1984	$4,078,311.33	$158,294	$273,868	$396,059
1985	$4,257,407.09	$0	$0	$0
Total	$13,956,304	$474,882	$821,605	$1,188,177

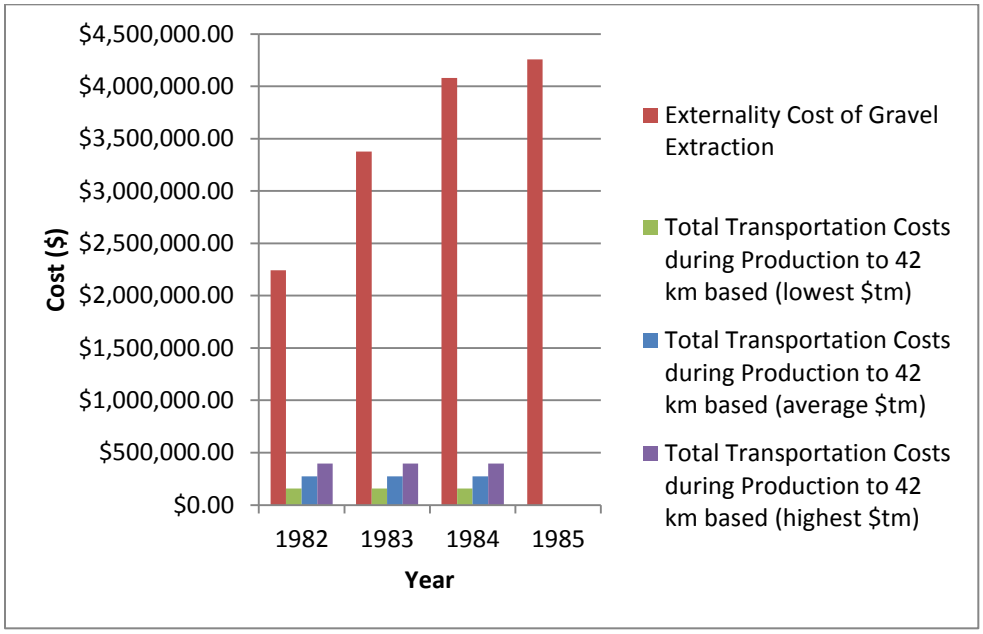

Figure 5 A comparison of the freight transportation cost of gravel to 42 km based on hypothetical mine output and the externality cost of extraction on surrounding households

Table 20 Distance mine must be from market for transportation costs to equal externality cost of gravel extraction

Year	Distance that must be travelled (Low Cost Scenario) (KM)	Distance that must be travelled (Average Scenario) (KM)	Distance that must be travelled (High Cost Scenario) (KM)
1982	595	143	238
1983	896	218	358
1984	1082	265	432

In the second scenario, where a proxy is used to estimate how much aggregate was required based on the number of houses constructed, the values do not differ much from the first scenario presented above. Table 19 shows that as a result of a larger amount of gravel being extracted, the transportation costs have increased by approximately $200,000 relative to Scenario 1. This increase makes the cost of transportation more comparable to the externality cost of extraction affecting properties, particularly in the first year when more houses were built, but still amounts to approximately only one fifth of the property value impact. As more houses are built and the externality cost of extraction continues to grow, and in this scenario the transportation cost is decreasing as fewer houses are being built. This makes it increasingly less cost effective to maintain the gravel mine in such close proximity to its market, as visualized in Figure 5. To make transportation costs equal the externality cost in this scenario, the resource would have to travel between approximately 400 and 1000 km in the last year of extraction depending on how the calculation is performed (Table 20).

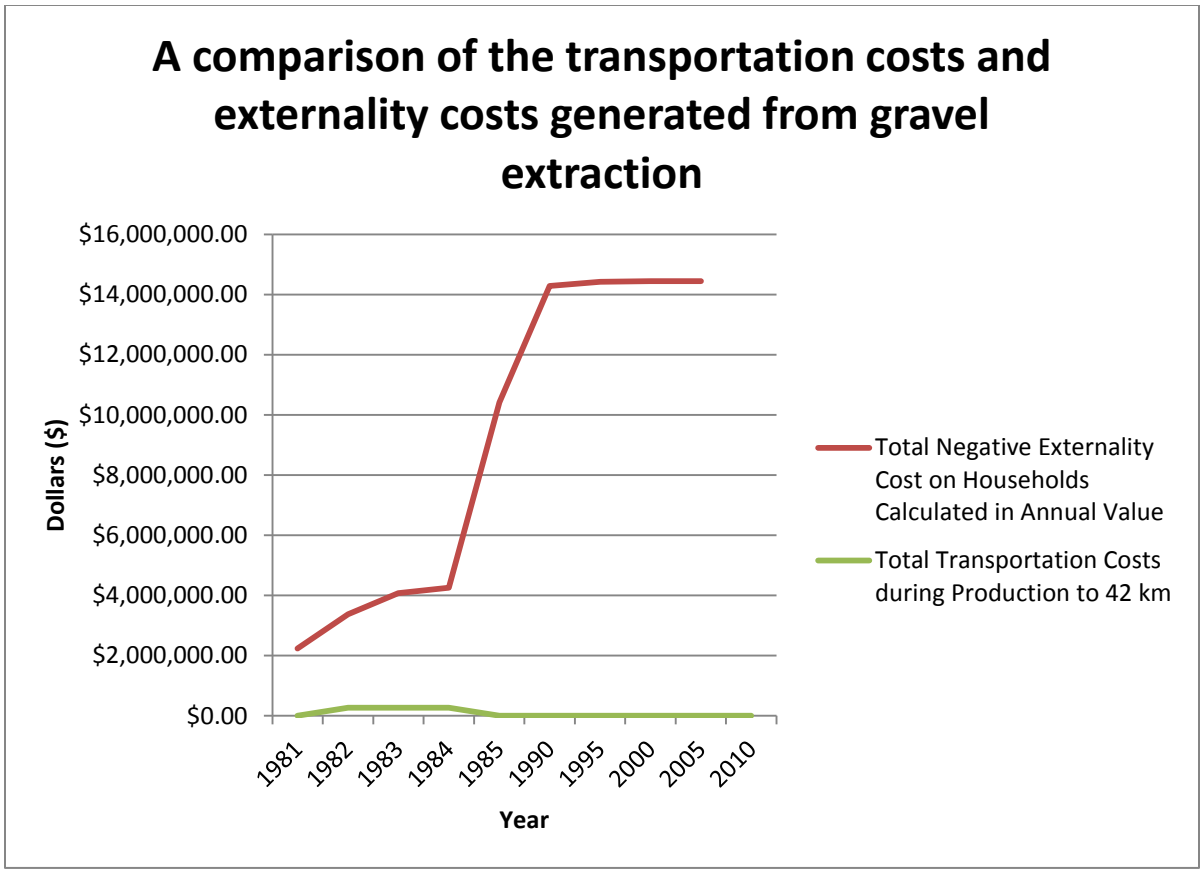

Figure 6 A comparison of the transportation costs and externality costs generated from gravel extraction until 2005

Finally, Table 21 is a summary of the estimated loss in tax revenue by the City of Calgary as a result of the gravel extraction. Though individually not a large value with reference to the total budget of a city during the years of extraction, if reclamation had failed to occur, this number would have increased substantially as did the number of houses in the community over the next 25 years.

Table 21 Municipal tax revenue loss as a result of gravel extraction from 1982-1984, and theoretical loss until 2010 based on houses up to 1.5 km away

Year	Municipal
1982	$7,593.43
1983	$11,434.90
1984	$13,807.23
1985	$14,413.59
1990	$35,253.21
1995	$48,370.25
2000	$48,838.12
2005	$48,889.68
2010	$48,889.68

3.43 Foregone Positive Benefit Results

These values for the simulation above are calculated using a coefficient value that becomes insignificant once time fixed effects were included in the model. Though Messer et al (2006) report similar results without having used time fixed effects, it was also deemed pertinent to examine the positive impacts generated from reclamation in another way. By using a hypothetical scenario where reclamation occurred one year earlier in 1984, it is possible to use the positive and significant values generated in Model 1with TFE to examine the benefits of reclaiming a mine more rapidly. The same steps as above were followed, but instead with the coefficient values for the time period after reclamation to calculate what the property values would have been in 1984 had reclamation occurred then. The negative externality value associated with the mine still being open is then subtracted from the positive value associated with reclamation to calculate the total value that would have been added to the approximately 1000 homes in the area at that time. This difference amounts to approximately $8,582,063 in additional value to the households (Table 22). Nonetheless, this number shows how significantly timely reclamation impacts the value of properties.

Table 22 Property value increase from reclaiming one year earlier

Year	Total Externality on Households in 1984 Calculated in Annual Value	Total Positive Externality for Households Generated from Reclamation in 1984 in Annual Value	Total Benefit of Reclamation One Year Earlier
1984	-$4,078,429	$3,816,149	$7,894,578

Another way to consider the problem in the context of this simulation is to consider foregone positive gains to property value during the years of extraction, instead of directly considering the negative impacts generated from extraction. This once again utilizes the more robust positive result reported in Model 1 as a result of reclamation. In doing this analysis, the assumption is made that the positive gains to property values post reclamation in fact reflect what the property values would have been during the time period of extraction had it never occurred. This was done in both the Scenario 1 and Scenario 2 contexts, as reported in Table 23, Figure 7, Table 24 and Figure 8.

Table 23 A comparison of the freight transportation cost of gravel to 42 km based on hypothetical mine output and the foregone positive benefits on property values of never having extracted on surrounding households

Year	Foregone Positive Benefit of Avoiding Damages	Total Transportation Costs during Production to 42 km based (lowest $tm)	Total Transportation Costs during Production to 42 km based (average $tm)	Total Transportation Costs during Production to 42 km (highest $tm)
1982	$2,210,190.08	$158,294	$273,868	$396,059
1983	$3,246,543.99	$158,294	$273,868	$396,059
1984	$3,816,149.09	$158,294	$273,868	$396,059
1985	$3,962,474.58	$0	$0	$0
Total	$13,235,358	$474,882	$821,605	$1,188,177

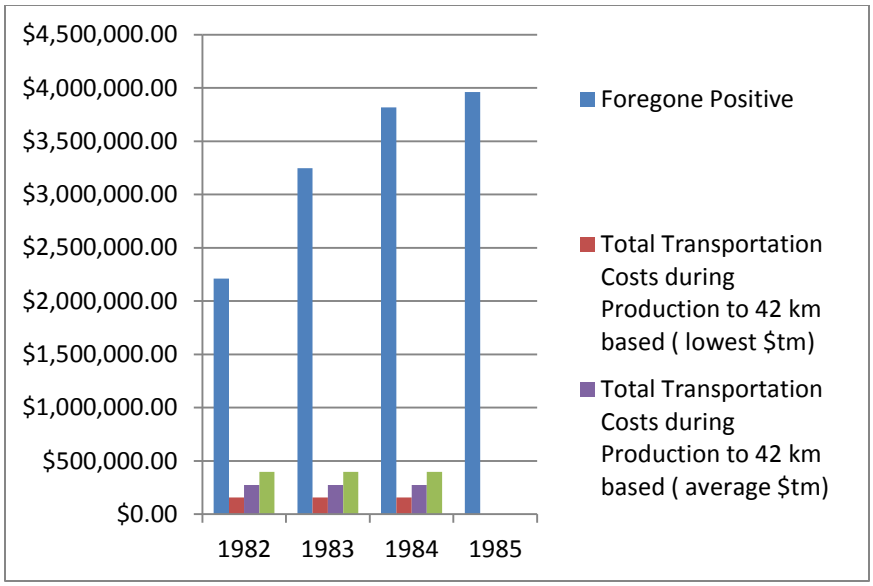

Figure 7 A comparison of the freight transportation cost of gravel to 42 km based on hypothetical mine output and the foregone positive benefits on property values of never having extracted on surrounding households

When the analysis is conducted once again using the hypothetical mine output in comparison with the foregone positive benefits, the difference between transportation costs and the foregone positive benefit is slightly smaller than those previously reported in sections 3.41 and 3.42 (Table 23 and Figure 7). Table 24 and Figure 8 provide the results of this analysis when using the proxy value for the amount of gravel the mine would have extracted below.

Table 24 A comparison of the freight transportation cost of gravel to 42 km based on proxy for quantities required to construct new houses and the foregone positive benefits on property values of never having extracted on surrounding households

Year	Foregone Positive	Total Transportation Costs during Production to 42 km (lowest $tm)	Total Transportation Costs during Production to 42 km (average $tm)	Total Transportation Costs during Production to 42 km(highest $tm)
1982	$2,210,190	$317,073	$548,864	$793,332
1983	$3,246,544	$224,019	$387,784	$560,506
1984	$3,816,149	$87,540	$151,534	$219,028
1985	$3,962,475	$0	$0	$0
Total	$13,235,358	$628,632	$1,088,182	$1,572,866

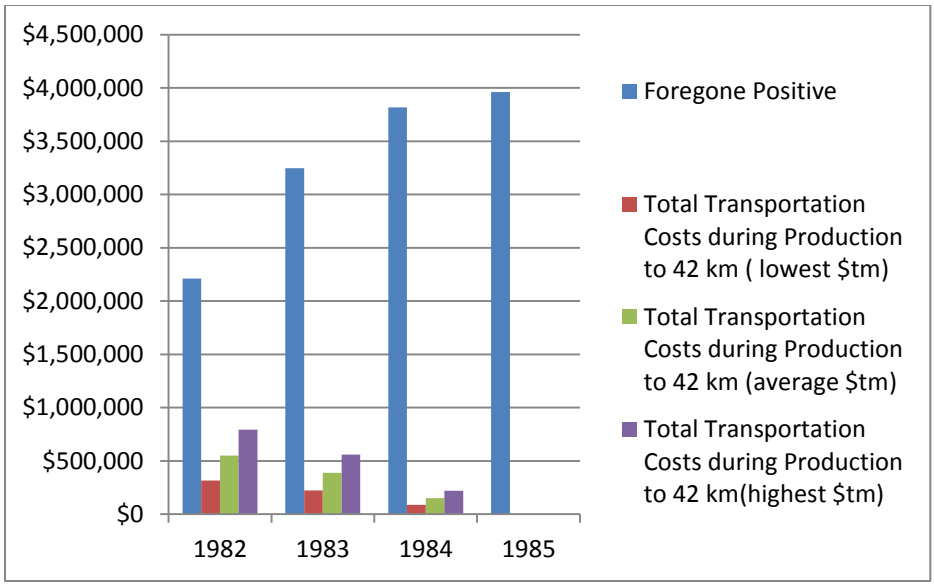

Figure 8 A comparison of the freight transportation cost of gravel to 42 km based on proxy for quantities required to construct new houses and the foregone positive benefits on property values of never having extracted on surrounding households

The results again reveal a smaller difference between transportation costs and the estimated positive benefit foregone as a result of extraction, though less though than when calculated using the hypothetical mine output. These results again contradict the argument held by gravel mine operators that continuing to mine in close proximity to the market reduces their environmental footprint.

3.5 Discussion of Simulation Analysis

In Alberta, gravel mines are typically no further than 42 km away from their intended market (Richards and Peel 2003). This is largely because it is not perceived to be cost effective to transport gravel further due to the combination of the weight of the resource and its low per-unit value. Furthermore, the gravel industry has claimed that they reduce their environmental footprint by extracting closer to their market by reducing the amount of trucking required. The results of this simulation suggest that when accounting for the social costs associated with extraction, attaining gravel from mine that is a greater distance away may be more cost effective. This finding is consistent in both simulation calculations, where the amount of gravel is estimated first by using values from a comparable mine and second by using a proxy based on how many houses were built each year. Although in Scenario 2 the cost of transportation is

closer to the social cost of extraction than in the Scenario 1, it still only accounts for less than half of the social cost in each year. Furthermore, when considering this problem instead in the context of foregone benefits as a result of extraction, it becomes cost effective to transport the aggregate to even further distances. Due to the consistency of the results from all of the scenarios, they can be considered robust in nature.

Although it is traditionally considered that the various aspects of trucking the resource have the largest impact on communities, these findings suggest the opposite. There is another externality generated by the mine that outweighs those generated by trucking, for example the aesthetic value. This research thus challenges the common perception that the low unit-value of gravel in combination with its high transportation cost necessitates its extraction in close proximity to its market.

There are some important limitations to take into account regarding this analysis. For example, the model does not consider the individual per tonne tax that municipalities can charge gravel companies to balance some of the negative impacts of the hauling, such as increased traffic and how that impacts road networks. This tax can vary by each municipality, and is something gravel companies may or may not be liable to pay. Companies are sometimes required to maintain the main roads and highways surrounding the mines they use as main access routes for their hauling trucks. The nature of gravel mining has changed over the years, moreover. For example, since 1985 it has become increasingly common practice to construct noise controlling berms around pits to reduce the disruption to nearby communities.

Furthermore, when calculating the externality cost beyond the year 1985, the model is assuming that the negative externalities from extraction such as dust and noise are transcending through time when in fact they would have ceased. Although the negative aesthetic value would have continued to generate a negative externality had reclamation not occurred, the model is likely overestimating this externality. The absence of the actual costs of reclamation in this analysis is also limiting, not allowing for a true cost/benefit analysis of the earlier reclamation. Another consideration not taken into account is that the impacts of trucking would have been higher along major trucking routes. Due to the limited nature of the data, it was not feasible to try to account for the varying effects of trucking throughout the community. It could have been interesting to do the simulation analysis based on only the condos in the community, as they

reported significant negative impacts generated during the time of extraction even with time fixed effects. However, they represent such a small percentage of the sample size that it again would not have provided an accurate comparison of the costs.

Finally, by using the values from Model 1, the results of all of the simulation analysis are somewhat compromised. Model 1's results become insignificant when time fixed effects are included, indicating their sensitivity. Though there are several data limitations that may explain this, placing confidence in such sensitive results may subsequently lead to inaccuracy and reliability in the simulations analysis results. Even the positive value from Model 1 to calculate foregone positive benefits due to extraction cannot be considered as robust as the positive value consistently generated in Model 2. In the DD analysis of Model 2, the DD parameter consistently indicates the benefits due to reclamation activities on the property values in the surrounding neighbourhood. The results from this model could have been utilized in a similar method to the analysis performed in the latter part of the simulation to demonstrate foregone additional increases to property values during the period of extraction. These estimated values could have then been compared to the costs of transportation to provide a basis for comparison. However, because the DD parameter does not contain information about the inverse distance to the site as results from Model 1 do, it would have been difficult to evaluate how the property values are affected with relation to their distance from the gravel mine. The analysis would have generated a value not for how those foregone property values change with distance to the site, but a consistent value for all households in the treatment area. Therefore, although the DD parameter provides more robust results with regard to the positive impact on property values generated from reclamation, using those values would not provide the same intuitive results of property values varying with distance to the site. Model 3 in the appendix does calculate the DD parameter with considerations for inverse distance to the site, but does not provide the same positive and consistent results as those in Model 2.

The results of this simulation analysis have potential policy implications. One such implication has to do with reclamation timing. If it is accurate that the negative impacts of extraction continue through time beyond mine closure until reclamation, then the incentive to reclaim becomes much greater. The estimated benefit from reclaiming one year earlier was calculated to be approximately $8,000,000. Again, as the number of houses increase in an area,

that benefit would continue to grow as it counters the negative impacts that would have otherwise existed. For the City of Calgary, it would mean a higher potential tax-base. If reclamation had not been completed so promptly, this negative impact could have continued to grow, creating an even larger negative impact on tax revenue as the population in the area increased. This monetary incentive could encourage more timely reclamation strategies.

Currently the Province of Alberta's *Conservation and Reclamation Regulation* under the Environmental Protection and Enhancement Act (EPEA) does not provide strict reclamation timeline regulation. Instead, the Director provides standards, criteria and guidelines for mine operation on a case by case basis. If for example the City of Calgary understood the true extent of negative impact that would be generated in the absence of reclamation, it could push to have necessary reclamation deadlines included in any future approvals passed. They may also choose to reject any future gravel pits on municipal land to prevent depression of property values because of extraction.

4. Summary, Conclusions and Limitations

The results of the analyses in this research provide further evidence to the already existing literature on the property value impacts from aggregate resource extraction. The externalities generated from extraction would have included dust, noise, increased traffic, deteriorating road conditions, as well as the loss of the aesthetic value of what was once agricultural land on the bank of the Bow River. The results of the hedonic property analysis in Model 1indicate there is a downward pressure on property values for those households surrounding the gravel mine that once existed in what is now Carburn Park. This impact is not robust however, as it becomes insignificant when time fixed effects are included in the analysis. In 1985 production ceased and the gravel mine was converted into a park as was the agreement with the City of Calgary when the approval was issued. By 1986 the new Carburn Park was announced by Ralph Klein signalling the full reclamation of the site, though it did not receive a reclamation certificate until 2005. Model 1's results consistently provide a positive and significant impact to property values generated from reclamation activities in all scenarios investigated. In the context of this model, the positive impacts indicate increasing property values with proximity to site. As a result of the positive impacts, there may be a significant incentive to planners to incorporate strict reclamation timelines into any approvals issued for gravel mines. These results do not align with the results found in the hedonic literature such as the hedonic price analysis of the impact of sour gas wells and shale gas development on property values, which find consistent negative impacts as a result of industrial activities (Boxall et al 2005, Muehlenbachs et al 2013).These results also conflict with those reported by Erickcek (2009) who stated that the negative impacts on property values from aggregate extraction exist indefinitely. They further do not support the theory of stigmatization effects produced by Messer et al (2006).

The results of this analysis were evaluated for their robustness using time fixed effects (TFE). By including these effects, the variable representing the time period before reclamation became positive and not significant, thus indicating its sensitivity. When examining only the condos in that area, however, the opposite is true and the negative effect is in fact much larger than when considering the whole data sample. After analyzing the properties of the data set, it was found that the majority of the properties immediately next to the mine were in fact condos,

while single family homes were situated further away. The reason the whole data sample may have been experience the sensitivity around the IDB or 'before' parameter may be because there are few single family home sale observations in the area directly next to the park (less than 1.4 km) prior to 1985, while they make up about 90% of the total observations. Another potential reason for this sensitivity is the lack of observations prior to 1985. Only approximately 400, or 6%, of the observations in the data are housing sales occurring before mine closure in 1985. Finally, the nature of preferences of the individuals moving into that area at that time is unknown, and may have countered expectations. For example, they may have been aware that although there was an operating gravel mine, there was a plan to immediately reclaim it. This may have caused the positive coefficient value in the first time period as those individuals anticipated positive externality values once reclamation completed, or were not affected by any externalities generated during extraction.

To further test the robustness of these results, a DD model was estimated using a treatment area of 2 km and two time periods; before and after 1985. Both when running the model without and then with TFE, the DD parameter was positive and significant as predicted in almost all scenarios. Using the DD model provided even stronger evidence to support the existence of a significant positive impact from the closure of the mine in 1985.

This elimination of the negative effect potentially generated during the extraction period could have significant policy implications. If the negative impact on property values transcends time until reclamation takes place, it means that up to that point there will be a significant social cost imposed upon residents. Persisting for years, this loss would become gradually larger as the number of houses in the area increase. This could have a significant impact on the total tax revenue for a municipality over time. Because this impact because insignificant over time, however, it is difficult to estimate with certainty the true negative impact generated from extraction.

The positive impact after reclamation is more consistent in the analysis, remaining positive and significant in all of the scenarios tested. Reclaiming the gravel pit into a park has quality of life impacts for residents, particularly those residing in condos that likely rely more heavily on public green space than those dwellers in single family homes with their own

backyards. By utilizing this consistent result, it was possible to demonstrate the potential benefits to more rapid reclamation and the foregone positive benefits as a result of extraction.

The simulation model provided results that contrast with common perceptions about gravel freight transportation. Property value impacts were included alongside the expected revenue and transportation costs, both direct and externality costs, to compare the true necessity of locating a mine near its market both from a cost and environmental perspective. Despite the direct costs of freight travel alongside the consideration of various levels of generated externality costs, it appears cost effective to move the gravel mine up to over 1000 km away depending on the scenario. When considering the foregone positive benefits instead of property value losses, the difference between transportation costs and losses is even greater. These results counter the general perception in the gravel mining industry that it is beneficial for all parties to extract from deposits closer to urban areas first before moving further away.

In summary, there appears to be most notably positive impact on property values as a result of the positive environmental externalities generated from reclamation. The first model indicated a negative impact generated from extraction, however once time fixed effects were included the effect became insignificant. Although this result is sensitive, there are several limitations to the data used in this analysis that may have caused this. As the population of Alberta continues to grow at an increasing rate, so will our need for gravel to expand our cities. Counties and municipalities need to take special precautions where approving gravel operations to carefully include precautions for reclamation. Reclamation appears to be crucial to generate an upward swing in property value following extraction.

This research was somewhat limited by its data. There is only one year of observations available in the data set prior to the beginning of the gravel extraction, whereas there are 25 available post mine closure. This is a difference of approximately 400 observations versus 6500 observations. This data limitation may have generated bias in the results. There is another potential site that could be investigated in the Calgary area, but because the reclamation project only began in 2009 and there are no observations beyond 2010 I was unable to analyze the impact generated from that site. It would be interesting to analyze these impacts with a mine

where there are more observations both before extraction and after decommissioning and subsequent reclamation.

Another interesting topic which could be examined would be the stigmatization impact mentioned by Messer et al (2006). Their results indicate that waiting longer to reclaim generates a stigmatization effect in a neighbourhood which causes property values to remain depressed even after reclamation has taken place. According to Erickcek (2009) this effect may exist as a result of gravel mining as well, but because this particular site was reclaimed rapidly, it did not make an ideal candidate to explore this phenomenon.

Finally, the results of this analysis are limited to an analysis of only one mine site. To truly understand the impact of gravel extraction on property values, a comparison across various gravel mines would be required. The impact that different mines would have on property values would depend on the size of mine, the length of time extraction occurs, the method of extraction, the mine's proximity to households and length of time once extraction ceases before reclamation takes place. This research only accounts for one scenario of multiple possibilities.

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Appendix

To test the robustness of the DD results, another model was run that this time interacted the DD parameter from the previous model with the inverse distance from the site. The results of this analysis, reported in Table 25, do not significantly differ from the previous DD model estimated. Again the DD parameter is positive and significant, providing evidence of the impact of the externalities generated by the mine on nearby property values. Including time fixed effects in this model does not significantly change the results, only the magnitude of some of coefficients including that of DD parameter change marginally.

Table 25 DD analysis results for Model 3 using a 2 km treatment area and indicating impacts of the gravel mine before and after the mine closed interacted with inverse distance from the site

	Model 3	
Attribute	OLS[1]	TFE[2]
Period 2: After	0.09915**	-0.15159***
	(0.0212)	(0.0389)
Treatment	0.03558	0.02154
	(0.0337)	(0.0315)
(Treatment	0.02226***	0.01946
*After)*Inverse Distance	(0.0340)	(0.0317)
Presence of Air	0.05541***	0.03306***
Conditioning	(0.0098)	(0.0095)
Waterfront	0.06837	0.11526***
	(0.0544)	(0.0343)
Presence of Basement	0.09933	0.04639
	(0.0661)	(0.0395)
Presence of Garage	0.01784	0.05618***
	(0.0127)	(0.0098)
Size of Garage	0.06491***	0.03709***
	(0.0081)	(0.0066)
Single Family House	0.1521***	0.18629***
	(0.0079)	(0.0062)
Deck or Balcony	0.05073***	0.02359***
	(0.0048)	(0.0039)
Area of Home	0.00229***	0.00188***
	(0.0004)	(0.0003)
Lot Size	0.0006	0.00009
	(0.0006)	(0.0001)
No. Bedrooms	0.01135***	0.00819***

	(0.0031)	(0.0026)
No. Bathrooms	0.08728***	0.06672***
	(0.0052)	(0.0043)
Fire Place	0.05948***	0.05903***
	(0.0058)	(0.0049)
Age of House	-0.00081***	-0.00310***
	(0.0003)	(0.0002)
Constant	11.80648***	11.92658***
	(0.03433)	(0.0446)
R^2	0.66	0.76
n	6941	6941

P<0.01=***, P<0.05=**, P<0.1=*

[1]OLS = Ordinary Least Squares

[2]TFE= Time Fixed Effects

In the single family homes case, Model 3 SFH, there is a similar impact in this model as in Model 2. The expected signs and significance are generated for all housing characteristics and the DD parameter. These values only change marginally with the inclusion of time fixed effects, and are reported in Table 26.

Table 26 DD analysis results for SFH in Model 3 using a 2 km treatment area and indicating impacts of the gravel mine before and after the mine closed interacted with inverse distance from the site

	Model 3 SFH	
Attribute	OLS[1]	TFE[2]
Period 2: After	0.06238**	-0.1626***
	(0.0116)	(0.0337)
Treatment	0.04518*	0.00812*
	(0.0056)	(0.0048)
(Treatment *After)*Inverse	0.04507***	0.03881***
Distance	(0.0032)	(0.0028)
Presence of Air	0.05440***	0.03307***
Conditioning	(0.0118)	(0.0101)
Waterfront	0.07609	0.116393**
	(0.0519)	(0.0443)
Presence of Basement	0.1101	0.04878
	(0.0944)	(0.0811)
Presence of Garage	0.02337***	0.05692***
	(0.0114)	(0.0098)
Size of Garage	0.06227***	0.03678***
	(0.0063)	(0.0055)
Deck or Balcony	0.04951***	0.02358***
	(0.0043)	(0.0037)
Area of Home	0.00229***	0.00188***
	(0.0001)	(0.0001)
Lot Size (m^2)	0.0000	0.0000
	(0.0000)	(0.0000)
No. Bedrooms	0.01160***	0.00827***
	(0.0028)	(0.0024)

No. Bathrooms	0.08666***	0.06675***
	(0.0040)	(0.0034)
Fire Place	0.05858***	0.05886***
	(0.0041)	0.0035)
Age of House	-0.00055***	-0.00304***
	(0.0001)	(0.0001)
Constant	11.8244***	11.9343***
	(0.0161)	(0.0335)
R^2	0.66	0.75
n	6361	6361

P<0.01=***, P<0.05=**, P<0.1=*

[1]OLS = Ordinary Least Squares

[2]TFE= Time Fixed Effects

The results change slightly in the condo segment of the market (Model 3 CONDO, Table 27). Again, some previously significant parameters such as the size of the garage and presence of a basement are no longer significant. The magnitude of the DD parameter is much smaller than for the single family homes; however it is still positive and significant. In all three cases then, there is an indication of the positive impact generated from completion of reclamation.

Table 27 DD analysis results for Condos inModel 3 using a 2 km treatment area and indicating impacts of the gravel mine before and after the mine closed interacted with inverse distance from the site

	Model 3 CONDO	
Attribute	OLS[1]	TFE[2]
Period 2: After	-0.09939***	-0.25896***
	(0.0296)	(0.0718)
Treatment	0.01098	0.06207**
	(0.0165)	(0.0136)
(Treatment *After)*Inverse	0.03122**	0.01714**
Distance	(0.0072)	(0.0058)
Presence of Air	0.02270	-0.00702
Conditioning	(0.0364)	(0.0292)
Waterfront	0.10937	0.07174
	(0.0944)	(0.0782)
Presence of Basement	N/A	N/A
Presence of Garage	0.32488***	0.20345***
	(0.0482)	(0.0391)
Size of Garage	0.0089124	0.05902**
	(0.0281)	(0.0227)
Deck or Balcony	0.04812***	0.01297
	(0.0149)	(0.0126)
Area of Home	0.00399***	0.00242***
	(0.0005)	(0.0004)
Lot Size (m²)	0.0000	0.0000
	(0.0000)	(0.000)
No. Bedrooms	-0.03699***	0.0148751*
	(0.0117)	(0.0103)
No. Bathrooms	0.09424***	0.07356***

	(0.0179)	(0.0146)
Fire Place	0.06791***	0.08344***
	0.0160)	(0.0129)
Age of House	0.00799***	-0.00173*
	(0.0009)	(0.0010)
Constant	11.77344***	11.82487***
	(0.0667)	(0.0770)
R^2	0.73	0.84
n	580	580

P<0.01=***, P<0.05=**, P<0.1=*

[1]OLS = Ordinary Least Squares

[2]TFE= Time Fixed Effects

SPC: Kiribati to End Beach Mining for Aggregates

By **Pacific News Center** - September 19, 2012

Suva, Fiji – Quarrying for sand gravel in Kiribati's most populated atoll island South Tarawa will soon be replaced by a safer and a more sustainable alternative – lagoon dredging.

The Kiribati Government, through its European Union-funded Environmentally Safe Aggregates for Tarawa (ESAT) project, implemented by the Secretariat of the Pacific Community's SOPAC Division, hopes to phase out beach aggregate mining on South Tarawa. The mining has caused severe coastal erosion problems on the already vulnerable atoll island.

[Beach mining causes severe coastal erosion problems for fragile atolls]

Beach aggregate is a combination of sand, gravel, pebbles and stones primarily used in making concrete, road maintenance, the building industry and most general construction.

Through its Oceans and Islands Programme, SOPAC has undertaken technical work on coastal vulnerability on South Tarawa for many years. During this time, a continuing stress highlighted since the 1980s has been the damaging impact of beach mining on shoreline systems, caused by intense and unsustainable extraction of aggregates.

The ESAT project, which was established to explore alternative sources of beach aggregates, has identified Tarawa's lagoon.

'Sustained research by SOPAC has revealed abundant aggregate deposits in the lagoon and further work has shown they can be safely exploited at low cost and, more importantly, with far lower environmental impacts than beach mining.'

'In the case of South Tarawa, the resource area we've examined is estimated to have the potential to last for some 50 to 70 years,' said Dr Arthur Webb, manager of SOPAC's Oceans & Islands Programme.

To facilitate the dredging, a purpose-built dredge barge is being constructed in Indonesia and is expected to arrive in Kiribati late 2012.

Dr Webb said the ESAT project has several ongoing tasks including overseeing the barge construction; continuing community outreach to explain the ills of beach mining and why there is an urgent need to find an appropriate alternative; finalising the aggregates work depot and processing facility; and working with the Government of Kiribati to establish the new state-owned Atinmarawa aggregates company to sell the aggregates.

The project has also devoted considerable resources to producing an Environment Impact Assessment, including a collaborative effort with SPC's Fisheries, Aquaculture and Marine Ecosystems Division to produce a specific study on the impact of lagoon dredging on fisheries in this location.

'Ultimately, there are always some impacts associated with development in urban areas,' said Dr Webb.

'There are no free rides, but in the case of this carefully designed aggregate dredging initiative, the impacts will be manageable, and certainly far less than the impacts of continued beach mining,' he added.

Pacific News Center

Managing and Protecting Aggregate Resources

by William H. Langer[1]

Open-File Report 02-415

2002

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

[1]Denver, Colorado

Managing and Protecting Aggregate Resources

Introduction

Over the past century the growth of American cities and towns, and the construction and maintenance of the highways and byways between those population centers, created a demand for enormous amounts of natural aggregate. Over that same period of time circumstances and events have taken place that have complicated the ability of producers to meet the increasing need for aggregate.

Products derived from rocks provide essential materials for society – materials that we need to maintain our current lifestyle. Rock products are used in one form or another for construction of highways, bridges, houses, and other buildings; in industry for making steel, glass, and other consumer products; for environmental applications such as filtering sewage and scrubbing flue gasses during generation of electricity; and for numerous agricultural, metallurgical, and pharmaceutical purposes (Langer and Glanzman, 1993). For many uses there is no readily available substitute.

Natural aggregate is the most valuable non-fuel mineral commodity in the world (Lüttig, 1994). The estimated value of non-fuel mineral commodities produced in the United States during 2001 was $39 billion. Natural aggregate (sand, gravel, and crushed stone) accounts for $14.5 billion, or over one-third of this value, and dwarfed the $5.5 billion value of copper, gold, and silver combined (U.S. Geological Survey, 2002).

Around the beginning of the 20th century, annual aggregate production in the United States was about 50Mt, or about 0.5t per person per year. By the end of the 20th century, annual aggregate production had increased over 50 fold, to more than 2.5 Bt, or about 10t per person per year. Today, over a third of the individual states in the United States each produce more aggregate than the entire Nation did at the turn of the century. The general trend over the past century has been for aggregate consumption in the United States to grow every year except during recessions, and it is projected that we will use as much aggregate in the next 25 years as we have used in the previous 100 years (Tepordei, 1997).

Aggregate occurs where Mother Nature put it, not necessarily where we need it, and even though potential sources of aggregate are widely distributed throughout the world, there are large regions where natural occurrences of aggregate are non-existent (Langer, 1988). Furthermore, even if sources of aggregate are present, they must meet certain quality parameters before they can be put to use. Those quality parameters are determined by the final application, and can restrict the development of otherwise high quality aggregate.

There are potential environmental impacts associated with aggregate extraction including the conversion of land use, changes to the landscape, loss of habitat, noise, dust, blasting effects, erosion, and sedimentation. Most of the environmental impacts associated with aggregate mining are relatively benign. However, extracting aggregate from some areas may alter the geologic conditions, which, in turn, may alter the dynamic equilibrium of the area, resulting in cascading environmental impacts (Langer, 2001). By employing best management practices, most environmental impacts can be controlled, mitigated, or kept at tolerable levels and can be restricted to the immediate vicinity of the

aggregate operation. Nevertheless, some otherwise high quality aggregate resources may not be developed because of environmental reasons.

Aggregate is a high-bulk, low unit value commodity that derives much of its value from being located near the market. Thus, it is said to have a high place value (Bates, 1969). Transporting aggregate long distances can add significantly to the overall price of the product (Leighton, 1991). For example, a city of 100,000 can expect to pay an additional $1.3 million for each additional 10 miles that the aggregate it uses must be hauled (Ad Hoc Aggregate Committee, 1998). Therefore, aggregate operations frequently are located near population centers and other market areas.

Despite society's dependence on natural aggregate, urban expansion often works to the detriment of the production of those essential raw materials. "Resource sterilization" occurs when the development of a resource is precluded by another existing land use. For example, aggregate resources that exist under a housing development or shopping center commonly will not be extracted.

Bauer (1993) stated that probably the most serious reason for the loss of aggregate resources is the fact that, while resources such as vegetation, soils, archeological sites, endangered species, and so forth are recognized in the community comprehensive planning process as resources of community value, aggregates are not.

Furthermore, citizens have their own ideas on how to use the land. Many citizens do not support mining, in part because they do not recognize the dependence of society on aggregate. Personal use is very little, if any, and individuals may not recognize aggregate mining as a necessary land use, even though the need for the commodity is constant. A survey conducted during 1994 (Bingham, 1994) concluded that the public in general believes mining exploits workers, harms the environment, harms the people in nearby communities, and has little personal benefit to the individual. For these and other reasons, citizens may prefer that stone and sand and gravel not be mined nearby (Langer and Glanzman, 1993). This "not in my back yard" syndrome may restrict aggregate development.

To protect citizens from the impacts of mining, governments may require permits or impose regulations to control aggregate development. Poulin and others (1994) concluded that permits and regulations restrict development or expansion of aggregate in established areas more than actual resource availability. Weaver (1995) reports that no new crushed stone quarries have been permitted in Connecticut in 15 years, and indications are that estimated sand and gravel supplies in New England could be reduced by at least 90 percent by reason of increased zoning and environmental restrictions (New England Governors' Conference, 1995).

As one approach to avoid the impacts of sterilization and encroachment, aggregate producers are turning to the development of superquarries, which are aggregate operations that produce over 5Mt of aggregate per year (Langer, 2002; Bliss and others, 2002). Superquarries can concentrate operations in remote areas away from public view, take advantage of lower production costs and, if appropriately located, utilize rail or water transport methods. During 2000, the U.S. had 19 crushed stone superquarries (Tepordei, 2000) and three sand and gravel superquarries (Bolen, 2000). Acquisitions are also expected to continue, especially as a means to obtain permitted reserves. The U.S. Bancorp Piper Jaffray Company expects that by about 2005, the top five aggregate producers in the United States will have 40 percent of the total market (Reilly, 2000).

Resource Sterilization

It is likely that we will continue to extract and consume large amounts of natural aggregate, and that much of the aggregate will come from large operations requiring large areas of land. This underscores the problems associated with aggregate resource sterilization and the necessity to maintain access to future supplies of aggregate resources.

When the aggregate industry was young, protecting access to aggregate resources was not necessary. During the late 1800's, the relatively low demand for aggregate combined with the lack of specifications allowed for the casual discovery of aggregate. Prospecting commonly was unnecessary, and aggregate frequently was identified through related activities such as building of railroads or canals, and digging cellars or wells for houses (Langer, 1998).

The growth of cities and the roads connecting those cities created a new demand for aggregate resources. At the start of the 20th century, there were only six metropolitan areas in the United States with a population over one million –Boston, Chicago, New York, Philadelphia, Pittsburgh, and Washington-Baltimore. At the start of the 21st century there were 49 metropolitan areas that exceeded one million residents. In the United States, the construction of good interurban roads began in earnest during the late 19th century. The first complete survey of America's roads, finished in 1904, reported two million miles of rural public roads in the country, fewer than 154,000 miles of which were surfaced with either gravel, stones, or paving materials. Today there are nearly four million miles of roads in the United States; nearly 2.5 million are paved and most of the rest have some type of stone or gravel surface. It is not surprising, then, that aggregate started to be used in large amounts at about the same time that the construction of cities and roads began to grow. Aggregate production in the United States doubled between 1905-1910, doubled again between 1910-1925, again between 1925-1950, and again between 1950-1960.

Geologists recognized that casual exploration was no longer an acceptable means to locate quality construction materials, and that a systematic study of the occurrence and quality of aggregate resources was necessary to support the growth of the highway system. During 1889, R.T. Hill prepared a report on road materials of the Black Prairie regions of Texas. This report was shortly followed by similar reports for North Carolina in 1892 and 1893, and Florida in 1893 (Kiersch, 1955). The Fifteenth Annual Report and Sixteenth Annual Report of the United States Geological Survey both contain reports by N.S. Shaler (1895, 1896) describing the geology of common roads and of road building materials. Shaler (1895) pointed out the need for geologic knowledge of aggregate properties and the necessity for having the resources located near the point of use to save transportation costs. Probably the most extensive investigation relating the composition of the rock to engineering characteristics was a 1913 statewide survey of aggregate resources in Ohio (Marshall and Maxey, 1950). By 1918, at least 49 reports describing road-building materials for at least 24 different states had been published by federal agencies and state geological surveys (Kiersch, 1955).

The rapid expansion of cities resulted in sterilization of aggregate resources. One of the first published descriptions of human encroachment causing sterilization of aggregate resources was in *Business Booming in the West,* (Lenhart, 1947). The paper

described how zoning accompanied sprawling growth, and how that situation created problems for access to aggregate. Seven years later, Thoenen (1954) reported that sand and gravel deposits near cities were becoming depleted and that operators were using portable plants to mine deposits near highway projects to preserve their supplies at city plants for city markets. Because of depletion of deposits, encroachment of residential areas, and increasing stringency of specifications, operators had to consider more adequate and accurate methods of exploration.

Across the country the problem of sterilization worsened, and by 1957 sterilization had reached such serious proportions in Denver that the Colorado Sand and Gravel Producers Association produced an air photo publication to call attention to the diminishing sand and gravel reserves. By 1960, the Third Edition of *Industrial Minerals and Rocks* (and all subsequent editions) identified encroachment as an issue limiting aggregate (Lenhart, 1960). In the paper *Quarry Site Surveys in Relation to Country Planning,* Shadmon, (1968) pointed out that there were many countries where opening new quarries was practically impossible, and that the impacts of sterilization severely impacted aggregate availability. He called for countrywide planning to forecast long-term quarry product needs.

Geologists and engineers became concerned with the situation and documented the effects of sterilization in various parts of the country including Anne Arundel County, Md. (Kuff, 1984), Boulder, Colo. (Crosby and others, 1978), Chicago, Ill. (Mikulic and Goodwin, 1984), Connecticut (Siebert, 1969), Denver, Colo. (Soule, 1974), Los Angeles, Calif. (Goldman, 1959), metropolitan New York, N.Y., (Hudec, 1969), and Ontario, Canada (Guillet, 1980).

Resource Protection

During the 1970's some state and local governments realized that a readily available supply of quality aggregate was necessary to maintain the infrastructure and recognized that sterilization and citizen opposition were threats to aggregate availability. A number of attempts were made at protecting aggregate resources from sterilization (Werth, 1980). Some local governments created special extraction districts where extraction was allowed by right, and all other uses were controlled through a conditional use. In other areas, aggregate properties were placed in overlay zones where resource extraction is allowed while simultaneously preserving the long-term land use for the area. Some local governments zoned aggregate properties as agriculture or industrial, and permitted extraction as a conditional or special use.

The problems associated with encroachment of developments on aggregates operations, and one how one county responded to those problems, can be illustrated by Tooele County, Utah (Nicole Cline, Division Manager and County Planner, Division of Planning and Zoning, Tooele County, Utah, oral commun., 2002). Between 1990 and 2000 the population in Tooele County, Utah, increased 51.3 percent to 40,735 residents. Construction in many of the subdivisions started during the 1960's and 1970's stopped during the 1980's, but was rejuvenated during the 1990's, creating a great increase in demand for aggregate. At the same time the expanding neighborhoods began encroaching on the existing aggregate operations. The new residents considered the noise, dust, unsightly appearance, and traffic associated with the aggregate operations, and the odors

from the asphalt plants, to be a nuisance. Pressure was brought on operators and county leaders to restrict operations. In many instances the local operators departed the site for deposits farther away from development, and found themselves leap-frogging away from the persistently encroaching developments. The situation reached critical limits during the late 1990's when residents, producers, and the county became entangled in litigation. During 2001, the Tooele County Commission approved the addition of *Chapter 27 – Mining, Quarry, Sand and Gravel Excavation Zone (MG-EX)* to the Uniform Zoning Ordinance of Tooele County. The new zoning district allows and protects the crushed stone and sand and gravel industry while protecting the environment. The zone was designed to assure that aggregate operations do not impact adjoining uses, and are not encroached upon by surrounding non-compatible land uses.

The new zoning approach provides public input, and includes strict requirements for the application, operation, and reclamation of pits or quarries. Once the zoning is in place the process of getting final approvals for operation is streamlined, and producers are assured the opportunity for continual operation (renewable every five years), as long as they follow best management practices. The advantage is aggregate extraction and related activities are separated from other non-compatible land uses.

It is too early to adequately assess the effectiveness of the new ordinance, but in general, the industry appears satisfied with the new approach to zoning. The Associated General Contractors of America - Utah Chapter has presented the ordinance to other jurisdictions to consider as a model for creating a new mineral extraction zone. To date, aggregate operators have submitted applications to have three properties rezoned as MG-EX; two have been approved and the third is in process. Tooele County initiated an action to rezone approximately 10,000 acres containing extensive aggregate deposits, but the application was withdrawn when it became obvious during the public hearing process that the county would not be able to reach consensus among the citizens. As a result the County has decided to refrain from making large-scale rezoning of the MG-EX zone on its own.

Some state governments, including Colorado (Schowchow and others, 1974), California (Beebe, 1998), Minnesota (Ad Hoc Aggregate Committee, 1998), and Washington (Lingley and Jazdzewski, 1994), have enacted legislation to help maintain access to prime aggregate resources. Legislations have met with variable success, in part because the legislation may not have given the authority to make requirements binding.

Colorado - During 1973, the Colorado legislature recognized that sand and gravel resources in the Denver area were rapidly being sterilized by conflicting land uses, and passed House Bill 1529. That act declared: 1) the State's commercial mineral deposits were essential to the State's economy, 2) the populous counties of the State faced a critical shortage of such deposits, and 3) such deposits should be extracted according to a rational plan, calculated to avoid waste and cause the least practical disruption to the ecology and quality of life of the citizens. The Colorado Geological Survey published an atlas of maps showing the quality and availability of aggregate resources in the populous Front Range counties (Schwochow and others, 1974). But in spite of the availability of these maps, H.B. 1529 did not succeed at protecting aggregate resources in the Denver area (Schwochow, 1980). Many of the plans prepared by the counties protected citizens from mining, but did little to protect mineral resources from citizens. The U.S. Department of Labor (1981) pointed out that resource availability in

the Front Range continued to decline, and blamed the decline on adverse zoning, noncompliance with H.B. 1529, increased demand, inadequate grain size to meet specifications, and environmental and visual concerns. Although a number of permits have been granted to expand existing quarries, there have been no permits to open new crushed stone quarries along the Colorado Front Range since 1978 (Wilburn and Langer, 2000).

California - In 1975, California implemented the Surface Mining and Reclamation Act (SMARA) (Beeby, 1998). Under SMARA, the California Division of Mines and Geology is mandated to classify specified lands within the State on the basis of mineral content. SMARA does not require that aggregate resources be permitted, but it provides decision-makers with the information upon which to base various land-use evaluations. Having the State, an unbiased third party, prepare the classifications has a distinct advantage in that accurate, objective, quantified mineral-resource data reduces the ability of special interest groups to influence the process. Anecdotal evidence indicates that use of SMARA has been effective at facilitating the permitting process, increasing the life span on renewed use permits, and in the discovery and opening of new deposits. Furthermore, SMARA maps and reports have been used in consideration of proposed permits (as opposed to a planning approach) to prevent a change of land use that would preclude aggregate development. For example, the loss of a significant section of alluvial gravels that were a county's sole source of Portland cement concrete grade aggregate was prevented through use of SMARA information (Beebe, 1998).

Minnesota - During1984, Minnesota Statute 84.94 was enacted to protect aggregate resources; to promote orderly and environmentally sound development; to spread the burden of development; and to introduce aggregate resource protection into local comprehensive planning and land use controls. The legislation initiated county-level identification and characterization of aggregate resources, and directed county planning authorities to use the information to consider the protection of identified aggregate resources in their planning decisions. Substantial progress was made regarding the identification and mapping of aggregate resources, but by the late 1990's, little progress had been accomplished to protect aggregate resources (Ad Hoc Aggregate Committee, 1998).

During 1998, the Minnesota Legislature created the "Aggregate Resources Task Force" to examine issues concerning the need for and use of the state's aggregate resources, (Laws of Minnesota 1998, Chapter 401, Section 50). The Task Force Final Report (Aggregate Resources Task Force, 2000) made a number of recommendations designed to facilitate the task of making wise use of aggregate resources. The actions recommended are typical of those used for sustainable resource management, and include: 1) Best Management Practices, 2) reclamation standards, 3) mine planning and permits, 4) native prairie conservation, 6) aggregate planning and protection, 7) registration of commercial aggregate deposits with the State Department of Natural Resources, 8) aggregate resource mapping, 9) leasing aggregate reserves by State Department of Transportation, 10) compensating host communities, 11) incentives for recycling, and 12) encouraging transportation of aggregates by bulk carriers.

Progress continues to be made regarding the identification and mapping of aggregate resources, as exemplified by the *Aggregate Resources Inventory of the Seven-County Metropolitan Area, Minnesota* (Southwick and others, 2000) as well as other

county aggregate resource inventories. The aggregate mapping program provides citizens, local government land use planners, the construction industry, and environmental groups with specific county-wide information on the location and quality of aggregate resources.

Washington - The Washington Growth Management Act (Revised Code of Washington 36.70A), adopted in 1990, requires county and municipal governments to undertake comprehensive land-use planning. Counties that do not comply risk losing some sources of funding from the state. To balance their planning goals, local governments are required to map and designate mineral resources of long-term commercial significance because exploiting these resources generally will have the lowest environmental, economic, and social costs (Lingley and Jazdzewski, 1994). The State Department of Natural Resources, or counties following the Department's methodology, are preparing maps detailing the distribution, thickness, and quality of aggregate resources. Yakima, Klickitatt, and Clallam Counties are using aggregate resource maps to zone a 20-year supply of aggregate and protect them from conflicting land uses. The protections include notification of adjacent landowners, recognition that aggregation extraction is the highest and best use of some lands, and other measures (William Lingley, Jr., Washington Department of Natural Resources, written communication, 07 Oct 02).

When the planning community ignores aggregate, management of those resources is left to chance. Management by default commonly results in unintended consequences including sterilization of resources, juxtaposition of incompatible land uses, negative impacts to traffic, unacceptable changes to the landscape, and undesirable environmental impacts. Today, we are in a situation where it is extremely difficult to obtain necessary permits to initiate new aggregate operations. Bauer (1991) concluded that local units of government were unwilling or seem unprepared to deal objectively with the conflict between regional needs and local opposition.

Dunn (1983) attempted to explain, and bring reason to, this conflict in his paper *The Dispersed Benefit Riddle.* The context of the riddle is: The benefits of aggregate development are dispersed over very large areas, but the community where extraction occurs suffers most of the adverse consequences of resource development. The regional benefits are not usually considered in the local permitting process, and if the resource operation is denied there usually are additional broader costs such as longer haul routes resulting in more truck traffic, noise, accidents, and more hydrocarbons released to the atmosphere. Any gain by the local community is usually at the expense of the greater public and greater environment. The riddle is "When a political entity is evaluating whether or not to develop or improve a resource, how can we as a nation be sure that the dispersed [regional] benefits of use of that resource are adequately weighed in the final decision?" (Dunn, 1983, pg. 1). Sustainability may provide the answer to that decades-old question.

Sustainable Management of Aggregate Resources

The term "sustainability" dates back to the 1980 World Conservation Strategy, and was given prominence in *Our Common Future,* otherwise known as the "Bruntland Commission Report" (World Commission on Environment and Development, 1987).

That report defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (World Commission on Environment and Development, 1987, pg. 43).

In the simplest sense, the "manufactured capital" and "natural capital" (i.e. natural resources) that one generation passes on to the next must be maintained or enhanced in order to achieve sustainable development (World Commission on Environment and Development, 1987). In terms of non-renewable resource such as natural aggregate, their use reduces the natural resources, but unlike many non-renewable resources, the potential supply of aggregate resources on a worldwide scale is so large that "finite" has no practical meaning.

But this does not mean aggregate can indiscriminately be exploited. Aggregate is in short supply in many localities, and should be carefully managed. Furthermore, development of aggregate resources must not endanger the natural systems that support life on earth – the atmosphere, the waters, the soils, and biota. Consequently, having an accessible regional supply of aggregate resources takes on great significance because transporting aggregate long distances not only adds to the overall cost of the product, but as described above in the "Dispersed Benefit Riddle," it also adds to the overall cost to the environment.

The government, industry, and the public must cooperate at the regional and local planning levels for sustainable aggregate extraction to be successful. To ensure the sustainability of aggregate resources, each of the primary stakeholders – government, industry, public, and other non-governmental organizations – must accept certain responsibilities (Langer and others, in press). The government has the responsibility to develop the policies, regulatory framework, and economic incentives that provide the climate for success. The industry must work to be recognized as a responsible corporate and environmental member of the community. The public and non-governmental organizations have the responsibility to become informed about aggregate resource management issues. All stakeholders have the responsibility to identify and resolve legitimate concerns, by constructively contributing to a decision-making process that addresses, not only their own, but a wide range of objectives and interests.

Governments have a variety of tools that they can use to encourage sustainability including laws, policies, guidelines, and incentives. Many countries, at different levels (e.g. national, state, regional, provincial, municipal) have enacted laws to protect water, air, endangered species and other aspects of the environment. These laws are an integral part of sustainability.

Governments of many provinces or territories in Canada and Australia, and many of the countries within the European Union and elsewhere, have elaborated national minerals policies that recognize minerals and mining in general, and the aggregate industry in particular, as key sectors contributing to jobs, wealth, and a high quality of life for its citizens. For example, *Planning for the Supply of Aggregates in England* (Department of the Environment, Transport, and the Regions, 2000), identifies nine key issues: 1) defining the need for aggregates, 2) assessing the supply of aggregates, 3) estimating the future demand for aggregates, 4) considering imports and exports, 5) considering inter-regional supplies, 6) considering multimodal transportation of aggregate, 7) assessing and mitigating environmental impacts of aggregate development,

8) identifying preferred areas for aggregate extraction, and 9) planning for future development of aggregate resources.

There is no specific process that must be followed when applying sustainable management of aggregate resources but, in general, the processes followed are iterative, and consist of a number of steps including: 1) identification of the key issues, which generally are elaborated in policy documents, 2) elaboration of the objectives that describe what you want to accomplish, 3) establishment of specific targets that express the desired results, 4) development of specific actions that describe the steps to reach the target, 5) identification of indicators that measure progress as well as the affect of your efforts on the natural and human systems, and 6) monitoring, feedback and regular reconsideration of requirements as events develop. The hierarchy of Sustainable Resource Management (modified from Langer and others, in press) is as follows:

Key issue(s)
- Objective(s)
  - Target(s)
    - Action(s)
      - Indicator(s)
        - Feedback

Indicators deserve special mention. Indicators are specific to the target and actions, but the indicators applied to sustainable development of aggregate resources tend to be similar and can be represented by seven indicators from Department of the Environment, Transport, and the Regions (2000), which include: 1) proportion of supplies coming from preferred areas for extraction, 2) proportions coming from environmentally sensitive areas, 3) proportion of primary (natural) aggregates compared to secondary and recycled, 4) amount of aggregates per unit of construction output, 5) area of land undergoing extraction, 6) area of land restored, and 7) proportion of sites covered by modern operating planning conditions.

The *Intra-Regional Plan for the Extractive Industry (PIAE)* for the Province of Modena, Italy, can serve as a specific example of sustainable management of aggregate resources (Langer and others, in press). Modena Province is updating the PIAE, and has included many elements common to sustainability in the revised plan. The plan is based on the *polo estrattivo*, which is an area typified by the prevalence of quarrying activities, including the intervening and surrounding territory that is exposed to quarrying impacts. The objectives of the PIAE include guaranteeing the availability of aggregates for present and future generations, maximizing the use of alternative materials, minimize the impacts from quarrying, and guaranteeing the reclamation of quarries in a manner consistent with the existing landscape. Various actions are encouraged to reach these objectives including the identification and protection of existing resources, concentration of future quarry development activities in the poli estrattivi, development of more efficient methods to extract resources, use of substitutes and recycled material, and reclamation that is in harmony with the landscape.

Some aggregate companies in the United States have begun implementing some of the concepts of sustainability without waiting for government intervention. This movement involves international aggregate companies, large American aggregate

companies, as well as smaller companies who have included environmental responsibility in their corporate philosophy and have initiated aggressive environmental management systems. But actions by the aggregates industry are only part of the process, and sustainable management of aggregate resources should included planning efforts for sustainability.

Minnesota is a pioneering state in both areas of aggregate resource mapping and sustainable community management. During the last decade, Minnesota has taken actions that have won it recognition as one of three leading States in applying principles aimed at achieving environmental and economic sustainability in the United States (Resource Renewal Institute, 2001). Perhaps it will also lead the way in instituting measures for sustainable aggregate resource management.

Minnesota's Governor and the Minnesota Environmental Quality Board convened the Minnesota Sustainable Development Initiative in 1993. The group's final report, *Redefining Progress: Working Toward a Sustainable Future,* included the recommendation to inventory the State's natural resources. The Minnesota Round Table on Sustainable Development (MRTSD) grew out of the initiative, and was the main forum for advancing its goals and principles. Its flagship report *Investing in Minnesota's Future,* (MRTSD, 1998), elaborated five principles of sustainable development, the third of which – Conservation – makes note of the need to make wise and efficient use of Minnesota's renewable and non-renewable resources. Minnesota Statutes 2001 4A.07 mandated the preparation of a planning guide for local units of government to plan for sustainable development. That guide, *Under Construction – Tools and Techniques for Local Planning* (Minnesota Planning, 2002) describes aggregate as a potential community asset, and recommends that a county's natural aggregate resources should be recognized in a land use element.

Sustainable resource management, and finding an answer to the "Dispersed Benefit Riddle," would be less difficult if all conflicts between regional aggregate resource needs and local impacts had solutions that would leave everyone better off. This is seldom the case, and there are usually winners and losers. Furthermore, experience gained through the application of Integrated Resource Management, which is another form of consensus-driven planning, indicates that integrated resource management is most successful when the governing bodies have the authority to set direction and establish order (Walther, 1987).

But as the amount of accessible land that is underlain with suitable aggregate resources diminishes, inequalities increase. Therefore, our inability to promote the common interest in sustainable development is often a product of the relative neglect of economic and social justice. The longer we *wait* to implement sustainable resource management principles, the more difficult it *becomes* to implement sustainable resource management. (World Commission on Environment and Development, 1987; Walther, 1987)

Summary

Throughout the first half of the 20th century, a relatively low demand for aggregate combined with a general unawareness of society's place in, and responsibility

to the environment, created a situation where aggregate producers in the United States were highly successful, and equally unfettered, in their efforts to meet America's demands for quality sand, gravel, and crushed stone resources. However, changes that have taken place throughout the last half of the 20th century have resulted in a situation where aggregate producers are finding it extremely difficult to locate and permit accessible, economically developable resources. This situation has come about for a variety of reasons including resource sterilization, environmental concerns, citizen involvement in land-use decisions, and variable planning attitudes and requirements toward aggregate resource availability. There is no going back.

There have been a limited number of attempts to identify and protect quality aggregate resources for future use, and these attempts have met with mixed success. Those that have been most successful have an associated incentive or enforcement capacity. In spite of those efforts, local decision-makers commonly are in a quandary when it comes to balancing the regional needs for aggregate with local concerns for the health, safety, and comfort of their constituents.

The management of aggregate resources through the application of sustainable resource management principles might provide a solution to the decision-makers' dilemma. Sustainable management is a highly flexible tool, and it commonly consists of six general steps: 1) elaboration of key issues in policy documents, 2) elaboration of objectives, 3) establishment of specific targets that express the desired results, 4) development of specific actions that describe the steps to reach the target, 5) identification of indicators that measure progress and the affects of actions on the natural and human systems, and 6) monitoring, feedback and regular reconsideration of requirements as events develop.

In order for sustainable resource management to be successful, government, industry, and the public must cooperate at the regional and local planning levels. To ensure the sustainability of aggregate resources, each of the primary stakeholders – government, industry, public, and other non-governmental organizations – must accept the responsibility to identify and resolve legitimate concerns, by constructively contributing to a decision-making process that addresses, not only their own, but a wide range of objectives and interests.

Epilog

James Coxey spoke about the need for a mineral policy at the Fifth Forum on Geology of Industrial Minerals (Hoover, 1970). He said,

> "It is a national disgrace that in a country as talented and affluent as America we should lack a clearly defined concept for the well-being of our natural resources – a concept that could be accepted and uniformly applied to all levels of government, by all of industry and by all of our people."

Over thirty years later we still have not found that elusive concept for the well being of our natural resources. The time to act is now!

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Administrative Setting
5GCA Ch.1 Article 2

Central Planning

Section 1203. Responsibilities and Authorities

(a) Prepare the Guahan 2050 Sustainability Plan
(b) Assist Planning. To harmonize, improve and assist in implementing comprehensive planning activities at all levels of government;
(c) Insure Consistency. To insure that the current planning programs and projects are consistent with the comprehensive development plan and the comprehensive program and financial plan (set out in the Executive Budget Acts)…..

Federal Consistency

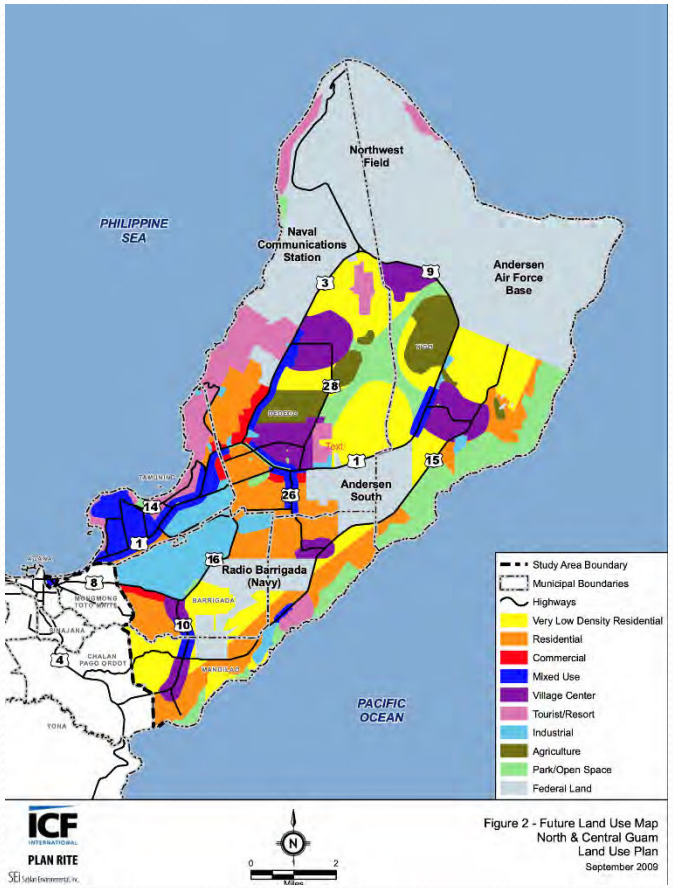
See CZMA § 307 (16 U.S. Code § 1456).

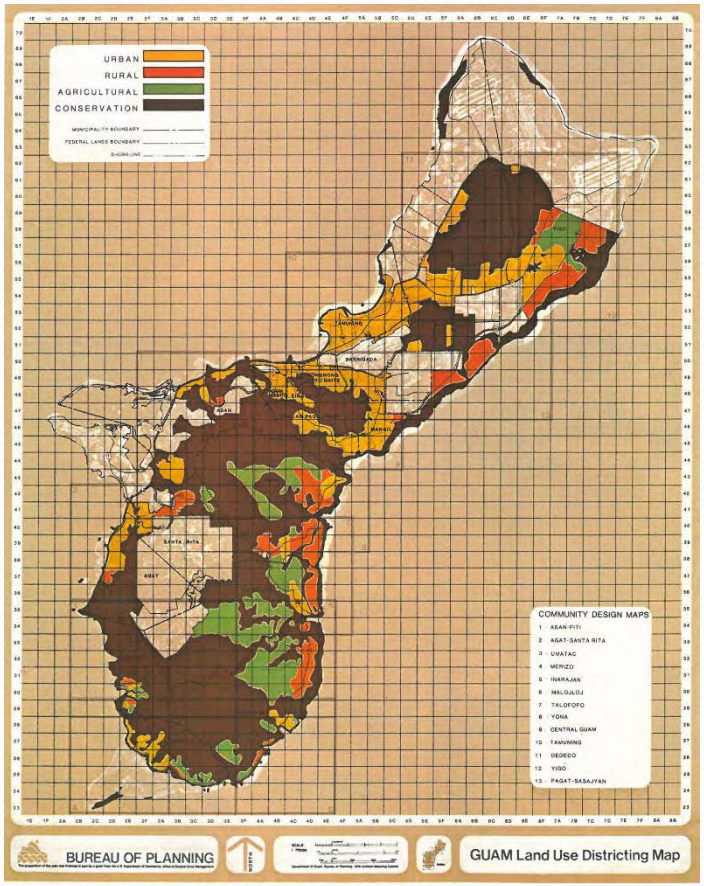
The Coastal Zone Management Act (CZMA) requires that all federal actions that may have reasonably foreseeable effects on the uses or resources of a state's coastal zone be consistent with the enforceable policies of the state's coastal management program

ARC and Federal Actions

Central Planning

Land Use District Maps 1979 Kabales Na Planu Para Guahan
2009 North and central Guam Land Use Plan





Key To Community Design Kabales (EO 78-23)

Urban

- **Residential (Low Single Family**
- **Residential Multifamily**
- **Resort**
- **Commercial**
- **Industrial**
- **Airport**
- **Public Buildings**

Rural

- **Residential, Agriculture**
- **Limited residential Use**

Agriculture

- ***Cultivation of Land***
- ***Aquaculture***

Conservation

- ***Open Space***
- ***Low Density***
- ***Parks***
- ***Recreational Areas***
- ***Wetlands***
- ***Lowland Basins and Sinkhols***
- ***Southern Watersheds***
- ***Wildlife Reserve***

EO 78-37 GCMP Enforceable Polices
5GCA Ch.1 Article 2 Central Planning

				Current Law		
Policy No.	**CMP Polices**	**Authorities**	**GCG Section (old law)**	**GCA Section**	**Citation**	**Agency/ Commission**
DEVELOPMENT POLICIES						
	More effective administration of natural resource related laws, programs, and policies shall be achieved through: •revision of unclear and outdated laws and regulations •improved coordination among local agencies •improved coordination between territorial and federal agencies •educational and training programs for local government personnel, and refinement of supporting technical data	Comprehensive Planning Enabling Legislation (P.L. 20-147), as amended	§62013 - 62024	§1203 - 1214	5 GCA Chap 1, Article 2 (Centralized Planning)	ALL
DP1	Shore Area Development	PL 20-147	§62019(d) §62020(a),(k),(l)	§1209(d) §1210(a),(k),(l)	5 GCA Chap 1, Article 2 (Centralized Planning)	BSP
	Only those uses shall be located within the Seashore Reserve which: -Enhance, are compatible with or do not generally detract from the surrounding coastal area's aesthetic and environmental quality and beach accessibility; or -can demonstrate dependence on such a location and the lack of feasible alternative sites.	Territorial Seashore Protection Act	§13416 (PL 12-108,12-210) §13417 (PL 12-108)	§63107 §63108	21 GCA Chap 63 (Guam Territorial Seashore Protection Act of 1974)	BSP DLM GTSPC

				Current Law		
Policy No.	**CMP Polices**	**Authorities**	**GCG Section (old law)**	**GCA Section**	**Citation**	**Agency/ Commission**
DP1	Continued	Territory Beach Areas Act	§13454 §13456 (P.L. 12-19)	§64105 §64107	21 GCA Chap 64 (Ocean Shores: Territory Beach Areas)	DLM DPR
		Zoning Law	§17203(b) (P.L. 12-019)	§61504(b)	21 GCA Chap 61 (Zoning Law)	TPC, DLM
		Ocean Shore Law	§112 (P.L. 19-05)	§65101-65109	21 GCA Chap 65 (Public Access to the Ocean Shore)	DLM, DAg, TLUC
		Guam Safe Drinking Water Act (protect public water supplies)	Title 10, Ch. 53 (P.L. 14-90)	§53101-53117	10 GCA Chap 53 (Safe Drinking Water Act) (P.L. 14-90)	GEPA
		Land Conservation Act	§12603(c) (P.L. 12-225)	§655103(c)	5 GCA Chap 65, Article 1 (General Provisions) (P.L. 12-225)	DAg
		Territorial Parks	§12609 (P.L. 12-225)	§655206	5 GCA Chap 65, Article 2 (Agricultural Preserves) (P.L. 12-225)	DAg
		Public Rights Provision	§13980-§13982 (P.L. 12-061)	§60701-60703	21 GCA Chap 60 (Land Management)	DLM
		Conservation Areas	§12350 (P.L. 3-103)	§63401	5 GCA Chap 63 (Fish, Game, Forestry & Conservation)	DAg DPR
		Public Lands Leasing	E.O. 87-19			DLM, BSP, DAg, DPR
		DRC (ARC)	E.O. 90-09, 90-15	E.O. 96-26	18 GAR Article 7	DLM, BSP, DAg, DPR, GEPA
		Wetlands Rules and Regulations	EO 78-21	§3501-3507	18 GAR Chap 3, Article 5 (Wetland Areas)	TPC
		Wetland Map of Guam	E.O. 90-13			GEPA, BSP, DAg, DLM, TLUC
		Flood Hazard Area Rules & Regulations	EO 78-20	§3401-3407	18 GAR Chap 3, Article 4 (Flood Hazard Areas)	TPC DPW

				Current Law		
Policy No.	**CMP Polices**	**Authorities**	**GCG Section (old law)**	**GCA Section**	**Citation**	**Agency/ Commission**

				Current Law		
Policy No.	**CMP Polices**	**Authorities**	**GCG Section (old law)**	**GCA Section**	**Citation**	**Agency/ Commission**
DP2	Urban Development	PL 20-147	§62011(A),(C),(D) § 62017	§1201(b)(1),(3),(4) §1207	5 GCA Chap 1, Article 2 (Centralized Planning)	BSP, DLM, TPC
	Uses permitted only within commercial, multi-family, industrial and resort-hotel zones; and uses requiring high levels of support facilities shall be concentrated within urban districts as outlined on the Land-Use Districting Map.	Zoning Law	§17100	§61301	21 GCA Chap 61 (Zoning Law)	TPC DLM
		Subdivision Law	§18005(f) (Title XIX Chap 1)	§62108(f)	21 GCA Chap 62, Article 1 (General Provisions)	DLM, TLUC, DPW
		Land-Use Districts	EO 78-23 and 37			BSP, DLM
		Development Review Committee (nka ARC)	E.O. 90-09, 90-15	E.O. 96-26	18 GAR Article 7	BSP, DLM, GEPA, DAg, DPR
		Toilet Facilities & Sewage Disposal	§57061		10 GCA Chap 48 (Toilet Facilities & Sewage Disposal)	GEPA
		Guam Safe Drinking Water Act (protect public water supplies)	§1424(c)	§53101-53117	10 GCA Chap 53 (Safe Drinking Water Act) (P.L. 14-90)	GEPA
		Air Pollution Control Act	10 GCA, Chap 49	§49101-49120	10 GCA Chap 49 (Air Pollution Control Act)	GEPA

21 GCA REAL PROPERTY CH. 61 ZONING LAW

§ 61310. M2 Heavy Industrial Zone.

(a) Use Permitted.

(1) Any uses permitted in the M1 zone, excepting residential use.
(2) Junk Yards. Under the special provisions set forth in Subarticle 6, Article 5 of this Chapter.
(3) Any other uses not specifically prohibited by law, including those which are or may be objection able, obnoxious, or offensive by reason of odor, dust, smoke, noise, gas fumes, cinders, vibration, or water-carried waste.
(4) Uses customarily accessory to any of the uses herein permitted, and accessory buildings and structures.

Planning Controls

- Building Permit/Clearing and Grading
- Guam Land Use Commission
- CLTC Leases
- Legislative Spot Zoning

Gmail **Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com>**

Thank you! RE: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Dr. John Jenson <jjenson@triton.uog.edu> Wed, Apr 6, 2022 at 10:44 PM
To: "senatorterlajeguam@gmail.com" <senatorterlajeguam@gmail.com>, "senatortcnelson@guamlegislature.org" <senatortcnelson@guamlegislature.org>, "office@senatorperez.org" <office@senatorperez.org>, "senatortelot@gmail.com" <senatortelot@gmail.com>, "officeofsenatormoylan@guamlegislature.org" <officeofsenatormoylan@guamlegislature.org>

Dear Speaker Terlaje and Senators Nelson, Perez, Taitague, and Moylan,

I want to thank you for having extended to me the privilege of taking part in your committee's informational briefing on mineral extraction this afternoon. I learned a lot! I hope what I had to share was helpful. I was in a bit over my head—I have had no experience with some of the enormous complexities that you are confronted with, such as defining the distinction between clearing and grading on the one hand, and quarrying on the other! As I mentioned, however, I would be happy to help craft useful definitions, and contribute in other ways, to finding solutions to environmental problems. Thank you for your commitment and leadership, and for including WERI in your team.

Below is the link to our WERI website, which describes, better then I can, all of our current (and past) research, education, and service activities. I'm also attaching our 2020 activities summary. (Preparation and publication of 2021 and 2022 reports have been delayed because the project periods were delayed and then extended because of the pandemic.) Also below is the link to our publications page, from which any of our recent and historical WERI Technical Reports can be downloaded.

We are drafting plans now for the coming fiscal year, and I would be pleased to get your suggestions. One top priority goal is development of a suitable aquifer protection approach for our aquifer.

https://weri.uog.edu/

https://weri.uog.edu/reports-and-publications/

Best regards,

John W. Jenson, Ph.D.

Director, Water & Environmental Research Institute of the Western Pacific

Chief Hydrogeologist & Professor of Environmental Geology

Water and Environmental Research Institute of the Western Pacific

University of Guam

Mangilao, Guam 96923

Ph. (671) 735-2689, GMT + 10

"Trustworthy and timely research, instruction, and advice to support scientifically informed development and effective management of the freshwater resources of Guam, CNMI, and FSM."

From: Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com>
Sent: Thursday, March 31, 2022 6:06 PM
To: Dr. John Jenson <jjenson@triton.uog.edu>
Subject: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

[EXTERNAL EMAIL - Please use caution when opening attachments or clicking links.]

March 31, 2022

Transmitted via Electronic Mail:

John W. Jenson, Ph.D., Director

Water & Environmental Research Institute of the Western Pacific

Chief Hydrogeologist & Professor of Environmental Geology

University of Guam

jjenson@triton.uog.edu

SUBJECT: Invitation to an Informational Briefing on Mineral Extraction on April 6, 2022

Håfa Adai Dr. Jenson,

The 36th Guam Legislative Committee on Health, Land, Justice and Culture will convene a virtual informational briefing on Wednesday, April 6, 2022, beginning at 3:00 p.m., to receive information on existing laws and agency regulatory, permitting, and environment guidelines to mineral extraction on Guam.

The Committee would like for your agency to provide information on the types of permits applicable to mineral extraction, the processing of permits, and the regulatory and enforcement responsibilities for respective agencies under federal and local law, whether through grading, excavating, quarrying or any other means to extract minerals on Guam.

Your participation will assist the Committee in gaining a better understanding of the guidelines currently in place, to discover any possible gaps in law or rule, and if you believe these are adequate to protect Guam's health, welfare, and environment. The goal will eventually be to ensure best practices for private industry and appropriate government processes to mitigate any potential negative impacts from mineral extraction on Guam, especially over Guam's aquifer.

I respectfully request for your RSVP by April 4, 2022. In addition, please forward any guidelines or standards used by your agency to evaluate permit applications related to mineral extractions. We look forward to your presentation, discussion, and insight from your particular field of expertise.

Respectfully,

Therese M. Terlaje

Office of Speaker Therese M. Terlaje

Committee on Health, Land, Justice and Culture
I Mina'trentai Sais na Liheslaturan Guåhan

36th Guam Legislature

Guam Congress Building, 163 Chalan Santo Papa, Hagåtña, Guam 96910

T: (671) 472-3586 F: (671) 989-3590 Email: senatorterlajeguam@gmail.com

website: www.senatorterlaje.com

Annual+Summary+of+Activities+including+GHS+activities+18-19+KKB.pdf
9188K

Gmail **Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com>**

Quarry Definition for Guam (email from Dr. Sam Mabini)

Brian Bearden <brian.bearden@epa.guam.gov> Wed, Apr 13, 2022 at 4:32 PM
To: "S.Mabini" <drsamabini@gmail.com>
Cc: "Speaker Therese M. Terlaje" <senatorterlajeguam@gmail.com>, Melvin N Young <mnyoung@ecc.net>, Walter Leon Guerrero <guam_binadu@yahoo.com>

Hafa adai Dr. Mabini, Thank you for reaching out and providing the additional information concerning MHSA's role. From my role at Guam EPA, we are primarily focused on mitigating the environmental damage and risks that are caused by surface mining, currently through our Soil Erosion and Sediment Control regulations. The gaps that I pointed out in my statements were primarily related to the land use permitting side of the situation, which is not Guam EPA's role. Guam EPA's regulations require that an applicant provide a copy of their land-use approval as a condition of Guam EPA approving the grading or building permit, but there have been many instances where applicants are clearly engaged in quarrying, but claim that they are not, and the land use permitting body has stated to us that they do not know how to respond or to make that determination themselves. As I stated, a definition of quarrying (and/or surface mining) would help resolve this issue and place it back into the realm of land-use determinations.

The issues with steepness of rock slopes is also of interest to me and I'd be interested in learning how and if MSHA regulates that issue, as well as reclamation requirements for surface mining sites post-closure.

Thanks again,

Brian

On Sat, Apr 9, 2022 at 4:22 PM S.Mabini <drsamabini@gmail.com> wrote:

> Hafa Adai Mr. Bearden and Senator Terlaje,
>
> In reference to the GPDN article (4/7/22) regarding Mineral Extraction Regulations, please note that you have a local expert on the island who is trained and certified on this topic.
>
> Note that individuals (including myself) have been trained and certified in this area, specifically by the **Mine Safety and Health Administration (MSHA** -- see Title 30 of the CFR, Mineral Resources, Chapter I.)
> MSHA is a separate entity from OSHA. One of the local contacts can be reached at ECC (see below)
>
> **MSHA jurisdiction extends to the *quarry* *(referenced as "surface mines" / above ground mines, open pit mines)*, crusher and stockpiles**, but it does not include areas functionally distinct from mining.
> In addition, MSHA regulates roads leading to mines unless they are public (federal, state or county).
>
> Under MSHA, mines are defined as underground or above ground, such as **quarries or surface mines.** Quarries are inspected no less than twice a year and underground mines are inspected no less than four times a year. Following is additional information for your reference.
>
> The quarries (or surface/above ground mines) are subject to MSHA regulations. Mines include land from which minerals are extracted from natural deposits in non-liquid form for their intrinsic value, unlike construction and landscaping. Oil and gas operations are not subject to MSHA. Neither are operations that dissolve minerals for extraction. However, placer mining, dredging and creation of slurries for extraction are subject to MSHA. In such operations, minerals are suspended in liquids, but they are not converted to liquid form.
>
> Mine properties are defined by function, not by metes and bounds. (ex: A company may own 10,000 acres of land in Yigo, but perhaps part of it is farmed, part is a quarry, a crusher and stockpiles – and yet another part is an asphalt facility. MSHA jurisdiction extends to the quarry, crusher and stockpiles, but it does not include areas functionally distinct from mining.)
>
> In addition, MSHA regulates roads leading to surface or undeground mines unless they are public (federal, state or county). Roads privately owned are under MSHA jurisdiction if they serve the mine, even though they may also provide access to farm, asphalt areas or other private properties.
>
> Mining includes “mineral milling,” even if not co-located with an extraction site. A cement plant is subject to MSHA even if it ships in the limestone and other minerals that go into making the cement. Mineral milling is deemed to include the kiln, cooling and processing of clinker, and storage of finished cement. But there are limits. If the finished cement is used to manufacture concrete structures, such as culverts, this is no longer mining under MSHA, but manufacturing under OSHA. Similarly, a gypsum mine will extend through product milling, but when product is transferred to a wallboard manufacturing plant on the same property, it goes from MSHA to OSHA.

It is important to note that all employers on mine property are subject to MSHA requirements. This includes specific training required of employees of such companies, as well as extensive reporting requirements.

Note that there are a number of local companies who are already subject to MSHA. Also, if a company or person is utilizing property to extract non-metals for business, they are subject to MSHA compliance and fines for violations. This needs to be examined more closely here in Guam and CNMI.

MSHA may hold some employers directly responsible if they are independent contractors deemed to be operators at the mine. By law, mine operators are responsible for all compliance, but independent contractors may be held jointly or separately liable as "operators" in their own right. Visitors, outside truckers, outside delivery, repair and service providers are all under MSHA jurisdiction. If they are exposed to hazards or if they commit violations, they will not be held responsible. The mine operator will be responsible. Such visitors may be subject to OSHA everywhere, but at a mine everything is under MSHA.

I appreciate the concerns raised by local citizens, as unregulated operations may pose direct hazard and impact to the community. Please let me know if you have any additional questions.

In the meanwhile. I highly recommend you contact the local certified MSHA professional, Mr. Melvin N. Young, at ECC (ph# 671-685-5233 or mnyoung@ecc.net).

Thank you for your kind attention and consideration.

Sam Mabini, Ph.D.
Cellular: (671) 797-1966
Email: drsamabini@gmail.com

"Come to the edge," he said. They said, "We are afraid."
"Come to the edge," he said. They came. He pushed them
And they flew. *--- Apollinaire*

--

CAPT Brian G. Bearden, MS, PE, BCEE
US Public Health Service
Chief Engineer / Water Division Director
Guam Environmental Protection Agency
(671) 300-4779

Gmail **Speaker Therese M. Terlaje <senatorterlajeguam@gmail.com>**

Quarry Definition for Guam (email from Dr. Sam Mabini)

S.Mabini <drsamabini@gmail.com> Wed, Apr 13, 2022 at 5:00 PM
To: Brian Bearden <brian.bearden@epa.guam.gov>
Cc: "Speaker Therese M. Terlaje" <senatorterlajeguam@gmail.com>, Melvin N Young <mnyoung@ecc.net>, Walter Leon Guerrero <guam_binadu@yahoo.com>

I just wanted to mention that I've just completed training on the Guam and CNMI Erosion and Sediment Control regulations. Thank you for all you do for our environment. -- smy :)

On Wed, Apr 13, 2022, 4:33 PM Brian Bearden <brian.bearden@epa.guam.gov> wrote:
[Quoted text hidden]

public works
DIPATTAMENTON CHE'CHO' PUPBLEKO
Government of Guam

BUILDING SAFETY
IS NO ACCIDENT

BUILDING INSPECTION & PERMITS SECTION

APPLICATION AND PERMIT FOR CLEARING AND GRADING

PERMIT NUMBER

LOCATION			ENG. SOLID REPORT		Est. Quantity	Permit Fee	Fee Received
District	Block	Lot	Tract	Date Filed	Excav. Cu. Y.D.	$	$
					Fill Cu. Y.D.	$	By: Date:

Located at _____

Lot Area: _____ Sq. Ft.: _____ Acres Overall Dimensions: _____

Description of Soil: Fill Material: _____

Existing Ground: _____

Estimated Starting Date: _____ 20 ____ Estimated Completion Date _____ 20 ____

Remarks: _____

_____

Owner: _____ Address: _____ Phone: _____

Engineer: _____ Address: _____ Phone: _____

Contractor: _____ Address: _____ Phone: _____

License Number: _____

Date of Application: _____ 20 ____ Applicant: _____

Application Revised By: _____ Date: _____ 20 ____

TO THE APPLICANT: Permission is hereby given to the above work according to the conditions hereon and according to the approved plans and specification pertaining thereto, subject to compliance with Chapter 70 of the U.B.C. No burning allowed on site unless a burning permit has been issued by the Fire Department.

REMARKS: Not valid without the approval of the Department of Public Works

_____

_____

Issued By: _____

APPROVAL BY OTHER AGENCIES (Route as indicated)

AGENCY	DATE	SIGNATURE	COMMENTS
Land Management, Zone			
Parks and Recreation			
Guam Power Authority			
G.E.P.A.			
Dept. of Agriculture			
GGN Survey Division			
Contractor's License Board			
Dept. of Public Works - D/A			

The owner of this building and the undersigned agree to conform to all applicable laws of this jurisdiction.

Zenon Belanger, Chief Engineer, DPW
Randy Romero, Building Permits Administrator, DPW
Brian Bearden, US Public Health Service Chief Engineer, Water Division Director, Guam EPA
Roland Gutierrez, Program Manager, Guam EPA
Edwin Reyes, Administrator, Guam Coastal Management Program, BSP
Christian Benitez, BSP
Chelsea Muna-Brecht, Director, Department of Agriculture
Christine Fejeran, Chief, Forestry Division Department of Agriculture
Mauryn McDonald – Acting Chief Engineer, GWA
Patrick Lujan – State Historic Preservation Office
Dr. John Jenson, Director, WERI
Jeffrey Quitugua, Technical Guidance Section, Department of Agriculture

II. SUMMARY OF TESTIMONY & DISCUSSION

The informational hearing was Called-to-Order at 3:03 PM. The Government of Guam agency representatives answered pertinent questions from the Committee and commented on their findings and recommended resolve to some of the issues concerning mineral extractions.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: We are live streaming this hearing via the Guam Legislature's YouTube channel. Individuals participating shall first be recognized by the Chair before speaking and begin by stating their names for record keeping purposes.

I would like to acknowledge the presence of my colleagues here today beginning with Senator Perez, who is the Vice Chair of the Committee on Land, Senator Taitague and Senator Moylan. Thank you, colleagues, for being here today.

I want to thank all of you who have accepted our invitation to be here today. It looks like we have 100% of those who showed up. In the interest of time, I will introduce you as you are called upon to speak. Today's informational hearing is scheduled for the Committee on Land to gather and receive information on existing laws, agency regulatory permitting, and environmental guidelines for mineral extraction on Guam.

We've invited your agencies here today to provide information on the types of permits applicable to mineral extraction, the processing of permits, the regulatory and enforcement responsibilities of your respective agencies under federal and local law, and whether through grading, excavating, quarrying, or any other means to extract minerals on Guam.

Your participation will assist the committee in gaining a better understanding of the guidelines currently in place to discover any possible gaps in law or rule and if you believe these existing laws and rules are adequate to protect Guam's health, welfare, and environment. The goal will eventually be to ensure best practices for private industry and appropriate government processes to mitigate any potential negative impacts from mineral extraction on Guam, especially over Guam's aquifer.

In the face of these concerns regarding mineral extraction, there have been several offers to government agencies such as the CHamoru Land Trust and the Ancestral Lands Commission for additional mineral extraction on those properties, including the raceway, Lajuna, and adjacent properties on that side of northern Guam.

And so that is why these matters for our committee are quite urgent. There have been various terms used, and perhaps your agencies can also clarify, but we have found that what we call mineral extraction is also in the law under extractive industry, rock quarrying, mining and grading. So, we'll try to clarify those terms, but at this point it looks like these terms are interchangeable for our purposes today.

We've discovered that under Guam Law mineral extraction termed "extractive industry "is under the zoning code allowed under M-2 zones in accordance with 21 GCA 61310(a)(3) and as a conditional use in agricultural zones.

There's Chapter 60 under Title 21, also dealing particularly with mining of minerals and it details that "all proposals for the use, lease, or purchase of government land for the purpose of commercial mining or removing there from any minerals, rocks, or sand for processing, shall be presented to the Guam Natural Resources Board. The board shall determine if the proposal is consonant with the public interest. And in keeping with proper conservation practices, the board may recommend any such use lease or sale of

and 62 of this Title of the Guam Code Annotated or by common usage within Guam.

(c) a map incorporating proposed highway and street names of all the streets and highways of Guam (except such streets and highways as are located upon military reservations of the United States), including in such map both those names already established and accepted and the new names proposed by the Commission.

(d) in determining highway and street names, the plan shall include as far as practical Chamorro or Spanish words for the terms street, drive, avenue, alley, and similar words, utilizing in lieu thereof Chamorro words as *chalan* or Spanish words as *camino*.

SOURCE: GC § 13210. Subsection (d) added by P.L. 10-051. Amended by P.L. 24-171:4 (Apr. 17, 1998). Reenacted by P.L. 25-020:2 (May 26, 1999).

2017 NOTE: Reference to "Territory" and "territory" removed and/or altered to "Guam" pursuant to 1 GCA § 420.

§ 60408. Same: Same: Legislative Action.

Upon the transmittal to the Legislature of the approved plan as provided in § 60406, the Legislature shall hold at least one (1) public hearing in order to permit the public to present its views as to the proposed street and highway names. The legislature, upon the conclusion of such hearing may, by statute, adopt the plan as submitted or may amend the same in whole or in part. Upon adoption, the names so approved shall be the official names of the streets and highways of the territory.

SOURCE: GC § 13211. Amended by P.L. 24-171:4 (Apr. 17, 1998). Reenacted by P.L. 25-020:2 (May 26, 1999).

NOTE: Street and highway names enacted by legislation are compiled in 1 GCA Ch. 8.

§ 60409. Guam Natural Resources Board.

The Guam Land Use Commission shall serve ex-officio as the Guam Natural Resources Board. It shall be the function of the Board to study and evaluate any plans or proposals for the utilization of government land for natural resource development or exploitation.

SOURCE: GC § 13251 added by P.L. 10-116. Amended by P.L. 24-171:4 (Apr. 17, 1998). Reenacted by P.L. 25-020:2 (May 26, 1999).

2017 NOTE: Reference to "Territorial removed and/or altered to "Guam" pursuant to 1 GCA § 420.

§ 60410. Minerals: Mining.

All proposals for the use, lease or purchase of government land for the purpose of commercial mining or removing therefrom any minerals, rocks or sand for processing shall be presented to the Guam Natural Resources Board. The Board shall determine if the proposal is consonant with the public interests and in keeping with proper conservation practices. The Board may recommend any such use, lease or sale of government land to the Governor including any such conditions that may be necessary such as bonds for compliance with the proposals presented.

SOURCE: GC § 13252 added by P.L. 10-116. Amended by P.L. 24-171:4 (Apr. 17, 1998). Reenacted by P.L. 25-020:2 (May 26, 1999).

§ 60411. Rules and Regulations.

It shall be the duty of the Guam Natural Resources Board to formulate such rules, regulations and procedures as are necessary to effectuate the aims and intents of this Act and no government land shall be leased or sold for the purpose of commercial mining or removing therefrom any minerals, rocks or sand for processing until the rules, regulations and procedures herewith authorized shall have been adopted and promulgated pursuant to the provisions of the Administrative Adjudication Act; and provided, further, that such regulations and procedures shall include, among other provisions, the following:

(a) a public hearing on the proposed lease or sale of government land must be conducted by the Board;

(b) a notice for said hearing shall be published in a newspaper of general circulation at least ten (10) days before the day set for the hearing; and

(c) the notice for hearing shall contain a summary description of the proposed mining operations.

SOURCE: GC § 13253 added by P.L. 10-116. Amended by P.L. 24-171:4 (Apr. 17, 1998). Reenacted by P.L. 25-020:2 (May 26, 1999).

ARTICLE 5
UNIFORM TRIANGULATION SYSTEM

Office of the Speaker
Therese M. Terlaje
I Mina'trentai Sais na Liheslaturan Guåhan | 36th Guam Legislature
Committee on Health, Land, Justice and Culture

COMMITTEE REPORT DIGEST

I. OVERVIEW

The Committee on Health, Land, Justice and Culture convened an informational hearing on Wednesday, April 6th, 2022, at 3:08 PM utilizing *I Liheslatura*'s Public Hearing Room. The item on the agenda is for the Committee on Land to gather and receive information on existing laws, agency regulatory permitting, and environmental guidelines for mineral extraction on Guam.

Public Notice Requirements

In compliance with the Open Government law, notices for this Public Hearing were published in the Guam Daily Post and the Government of Guam Public Notice Portal on Wednesday, March 30, 2022 and again on Monday, April 4th, 2022.

The informational hearing is being live streamed via the Guam Legislature's YouTube Channel. Public Notices were also disseminated via email to all senators and all main media broadcasting outlets.

Senators Present

Speaker Therese M. Terlaje, Chairperson
Senator Sabina Perez, Vice-Chairperson
Senator Telo T. Taitague, Committee Member
Senator Telena Nelson, Committee Member
Senator James Moylan

Appearing before the Committee

Nonito Blas – Member, Guam Land Use Commission
Celine Cruz – Chief Planner DLM
Joe Borja – Director DLM
Vincent Arriola, Director, DPW

Zenon Belanger, Chief Engineer, DPW
Randy Romero, Building Permits Administrator, DPW
Brian Bearden, US Public Health Service Chief Engineer, Water Division Director, Guam EPA
Roland Gutierrez, Program Manager, Guam EPA
Edwin Reyes, Administrator, Guam Coastal Management Program, BSP
Christian Benitez, BSP
Chelsea Muna-Brecht, Director, Department of Agriculture
Christine Fejeran, Chief, Forestry Division Department of Agriculture
Mauryn McDonald – Acting Chief Engineer, GWA
Patrick Lujan – State Historic Preservation Office
Dr. John Jenson, Director, WERI
Jeffrey Quitugua, Technical Guidance Section, Department of Agriculture

II. SUMMARY OF TESTIMONY & DISCUSSION

The informational hearing was Called-to-Order at 3:03 PM. The Government of Guam agency representatives answered pertinent questions from the Committee and commented on their findings and recommended resolve to some of the issues concerning mineral extractions.

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I would like to acknowledge the presence of my colleagues here today beginning with Senator Perez, who is the Vice Chair of the Committee on Land, Senator Taitague and Senator Moylan. Thank you, colleagues, for being here today.

I want to thank all of you who have accepted our invitation to be here today. It looks like we have 100% of those who showed up. In the interest of time, I will introduce you as you are called upon to speak. Today's informational hearing is scheduled for the Committee on Land to gather and receive information on existing laws, agency regulatory permitting, and environmental guidelines for mineral extraction on Guam.

We've invited your agencies here today to provide information on the types of permits applicable to mineral extraction, the processing of permits, the regulatory and enforcement responsibilities of your respective agencies under federal and local law, and whether through grading, excavating, quarrying, or any other means to extract minerals on Guam.

Your participation will assist the committee in gaining a better understanding of the guidelines currently in place to discover any possible gaps in law or rule and if you believe these existing laws and rules are adequate to protect Guam's health, welfare, and environment. The goal will eventually be to ensure best practices for private industry and appropriate government processes to mitigate any potential negative impacts from mineral extraction on Guam, especially over Guam's aquifer.

In the face of these concerns regarding mineral extraction, there have been several offers to government agencies such as the CHamoru Land Trust and the Ancestral Lands Commission for additional mineral extraction on those properties, including the raceway, Lajuna, and adjacent properties on that side of northern Guam.

And so that is why these matters for our committee are quite urgent. There have been various terms used, and perhaps your agencies can also clarify, but we have found that what we call mineral extraction is also in the law under extractive industry, rock quarrying, mining and grading. So, we'll try to clarify those terms, but at this point it looks like these terms are interchangeable for our purposes today.

We've discovered that under Guam Law mineral extraction termed "extractive industry "is under the zoning code allowed under M-2 zones in accordance with 21 GCA 61310(a)(3) and as a conditional use in agricultural zones.

There's Chapter 60 under Title 21, also dealing particularly with mining of minerals and it details that "all proposals for the use, lease, or purchase of government land for the purpose of commercial mining or removing there from any minerals, rocks, or sand for processing, shall be presented to the Guam Natural Resources Board. The board shall determine if the proposal is consonant with the public interest. And in keeping with proper conservation practices, the board may recommend any such use lease or sale of

government land to the Governor, including any such conditions that may be necessary for compliance with the proposals presented."

The Guam Natural Resources Board, according to 21 GCA 60409, well that's where it's established in Chapter 60, says that the Guam Land Use Commission shall serve ex-officio as the Guam Natural Resources Board. It shall be the function of the board to study and evaluate any plans or proposals for the utilization of government land, for natural resource development or exploitation. And then they have some rules and regulations for the Natural Resources Board.

The Bureau of Statistics and Plans has a Guam Flood Plain Management Ordinance from 2007, where mining or mineral extraction is included in the definition of development under that flood plain management ordinance.

And the CLTC also has rules regarding mineral extraction under the definition of commercial use, which explicitly authorizes mineral extraction only with the approval of the Guam Legislature. It also mandates that land returned after lease or license must be returned in better or higher end state that was agreed upon after the mineral extraction.

There is a BSP, the 2020 Guam guidebook to development cites different requirements.

I'm sure we'll hear from each of your agencies regarding these including Guam EPA's requirements for an air pollution source, construction, and source operating permit for rock quarrying, which does not require a permit fee.

Guidebook also lays out guidelines for the application review committee, which cites specifically that they must determine if the housing is located in or near a man made hazard area, such as an oil refinery or a quarry.

So the application review committee agencies, again, I think they're all here, are DPW, EPA, BSP, Department of Ag, GPA, GWA, and the Department of Parks and Rec., State Historic Preservation Office.

The BSP notes in the guidebook that mineral extraction is cited as an area of concern for development, as outlined in the 1978 Guam Comprehensive Development Plan or "Kabalis Na Planu Para Guahan." The comprehensive plan notes that mineral extraction is essential for construction, landfill, and pavement purposes. However, operations must be monitored closely to ensure adherence to air, water quality erosion standards, compatibility with land forms, adjacent uses in population density, and that land with historical, agricultural, or scenic value is not used for mineral extraction. Offshore coral and other dredging operations require further study. Beach sand mining is clearly an unacceptable use of the shoreline. In the future, an officially designated 200-mile off-shore economic zone may suggest the need for studies relating to deepwater mining, such as for manganese nodules."

Little else is known about the regulatory framework for which those wishing to extract aggregate on Guam must comply other than through the standard application process for grading through the Department of Public Works. Through this process, all applicants must clear the following agencies before the issuance of a grading permit by DPW. DLM, Land Management, SHPO's Office, GPA, EPA, Department of Ag, GGN Survey Division at Department of Land Management, and Contractors License Board. So, we'd like to gain some clarity on each of the agencies' guidelines or standards that they use in granting these grading permits and how quarries are regulated under grading, if that is how your agencies are regulating quarries.

We're aware of EPA soil erosion and sediment control regulations and air permit, that we'll allow you to speak on that. I think I'm going skip the rest of those.

Alright, so some of the other concerns that were brought to our attention are just what has happened in some other places. For example, in 2012, Kiribati announced that they implemented by Secretariat of the Pacific Community's SOPAC Division, hoping to phase out specifically beach aggregate mining in South Tarawa, which caused severe coastal erosion problems on the already vulnerable atoll island.

A 2014 study on mining aggregate done in Alberta titled Aggregate Resource Extraction examining Environmental Impacts on Optimal Extraction and Reclamation Strategies, found three main concerns, including air pollution, noise and water pollution and the long term effects of contamination of aquifers and poisoning of surface water bodies

that present the largest issues. In Alberta, most of the sand and gravel deposits are sealed from surface contamination by a layer of impermeable clay rich glacial tills, which once removed the permeable materials below to easily conduct contaminants such as fuel oil spills, runoff containing fertilizers, pesticides, herbicides, and sewage directly into the aquifer below.

We've invited WERI here today to hopefully get their input in regards to the aquifer and best protection practices. In 2002, USGS also had a report titled Managing and Protecting Aggregate Resources. There are potential environmental impacts associated with aggregate extraction, including the conversion of land use, changes to the landscape, loss of habitat, noise, dust blasting effects, erosion and sedimentation.

Most of the environmental impacts associated with aggregate mining are relatively benign. However, extracting aggregate from some areas may alter the geologic conditions, which in turn may alter the dynamic equilibrium of the area, resulting in cascading environmental impacts. By employing best management practices, most environmental impacts can be controlled, mitigated, or kept at tolerable levels, and can be restricted to the immediate vicinity of the one aggregate operation.

It goes on, to protect citizens from the impacts of mining, governments may require permits or imposed regulations to control aggregate development. They concluded that permits and regulations restrict development or expansion of aggregate in established areas more than actual resource availability. And Weaver 1995 reports that no new crush stone quarries have been permitted in Connecticut for 15 years. And indications are that estimated sand and gravel supplies in New England could be reduced by at least 90% by reason of increased zoning and environmental restrictions.

In Tooele County, Utah, a specific zoning was created for mineral extraction. This approach provides for public input, strict requirements for application, operation, and reclamation of pits or quarries. The Associated General Contractors of America, Utah Chapter, presented the ordinance to other jurisdictions to consider as a model for creating a new mineral extraction zone.

Other states, including Colorado, California, Minnesota, Washington, have taken additional steps to address depleting aggregate supply, zoning, land use, and environmental issues caused by mining.

So we're just going to present these five questions for all of the agencies and you can answer them as you see fit: What is your understanding of your role in regulating mineral extraction? Does your agency believe that our current regulatory framework is sufficient to protect the health, welfare, and safety of our land resources and the people of Guam? What types of permits are issued by your agency and what guidelines do you use? What is the enforcement authority of your agency relative to mineral extraction through grading or quarrying? What suggestions do you have to improve how mineral extractions are per permitted and regulated on Guam?

So, I'd like to begin. Again, I want to thank all of you for being here and we'll begin. I know your time is very valuable, so we're going to begin with the Guam Land Use Commission, and I think we have Nonito Blas, one of the members here. Mr. Blas, There you go.

NONITO BLAS, MEMBER, GUAM LAND USE COMMISSION: Actually Senator, I was hoping either Celine Cruz or Joe Borja from the agency was on this call.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Yes, they are. Okay. So, if you don't mind, then we'll come back to you later.

Department of Land Management, Celine Cruz is the Chief Planner. She's online, I'm told now. So, Ms. Cruz? Oh, there. And I see the director there also. Håfa Adai Director Joe Borja.

JOE BORJA, DIRECTOR, DLM: Speaker, we have here, on our table here, Celine Cruz, who's the Chief Planner and the Director of the Department of Land Management and also the Executive Secretary of the Guam Land Use Commission. Also present with us is Planner III, Grace Vergara. And these are the people, actually, the Planning Division.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Okay.

JOE BORJA, DIRECTOR, DLM: We didn't catch all of the questions Speaker, when you were....

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Well, they're pretty much the same as what I sent you in the invitation. And in general, what are the guidelines that you've used in reviewing applications for quarrying or mineral extraction? Do you believe those are sufficient to protect the lands and resources and the people of Guam? And do you have any suggestions? What are your enforcement capabilities, and do you have suggestions? And in your case, you're the Natural Resources Board, so we'd like to know how your enforcement capabilities are.

CELINE CRUZ, CHIEF PLANNER, DLM: So, if I may, Mr. Borja. So, to start with, you asked for us to provide information on the types of permits applicable to mineral extraction, and the types of permits would be a conditional use permit in an A Zone from the Guam Land Use Commission. We know that there's only one reference to extractive industry within the zoning law and that's under section 61304 (b)(7) where it describes extractive industry as a conditional use in an A zone.

In our records, we noticed that the TPC, TLUC, GLUC has only approved a few quarries. In 1989, Guam Rock Products was approved the conditional use to permit extractive industry on Lot 7092-3, Yigo. In 1993, Western Pacific Rock Inc. received a conditional use permit for extracted industry operation of a quarry construction operation, barracks, and cement batching facility with accessory activities in an A zone on Lot on 7030-New-2. I don't have the year, but they received three additional extensions for the quarrying activities. Guam Rock Products received three additional extensions for their quarrying activities on Lot 7092-3 in Yigo. And then under… I'm sorry, those three extensions were under the Hawaiian Rock Products Company. And then finally in 2011, Smithbridge, Guam received a conditional use to allowing quarry operations to continue on Lot 7027-5, in Yigo. We know that their activities are being conducted as accessories to permit uses in an M-1 zone.

And then finally our role in providing clearance to a clearing and grading permit is mainly to identify and ensure that the applicant's proposed land alteration activity complies and conforms with the standards and requirements of the respective zone, and that proper ownership or authorization is secured. So, in our review of clearing and grading permits, unless the clearing and grading permit states that it's a quarry, for extractive that they're doing mineral extraction, we can only review the permit based on the ownership authorization, and then the zoning. And I think that covers all of the questions then.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: All right. Thank you. Yes. If it was stated on the permit it's for quarrying, do you review it differently?

CELINE CRUZ, CHIEF PLANNER, DLM: We will not sign off on it unless they have a conditional use permit from the Guam Land Use Commission.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Alright, thank you. That's the Department of Land Management and the Guam Land Use Commission, thank you for that summary. We'll go now to some of the ARC Agency Review Committee members beginning with DPW, Director Arriola?

VINCENT ARRIOLA, DIRECTOR, DPW: Hi. Thank you very much Madame Speaker and thank you for having this hearing. We're glad to be a part of it. With me, I have our Chief Engineer, Zenon Belanger, and also online we have our Building Permits Administrator, Randy Romero.

You know, in a nutshell, when we looked at this we said it looks like it's finally coming to a head to start more, intensely monitor these mineral extraction areas throughout the island.

As you know, DPW, we operate our government quarry facility up there in Dededo. And just for your information we are overseen by MSHA, the Mining Safety and Health Administration. They were here not too long ago because of an incident that actually happened at the quarry several years ago. As a result of that, I know they visited not just our quarry and made some… they actually mandated some changes there at the quarry. And I understand, they also visited a few other quarries throughout the island.

Some of the things that we had to do at the quarry site in Dededo, which is right off YSengsong Road is we had to fence the entire facility. And so by the time I came in, you know, we asked, it's always a fence, and it wasn't fenced. So, we had to find the money and so today as we speak, that the quarry itself is totally fenced and in case for safety and health reasons.

The other thing that they required is that all employees working there go through specific training. And, that has been done. Everyone that that works at the quarry has gone through specific training as required by MSHA.

And then let's see. You know, one of the other things that's also critical there to running the quarry is our equipment. So, we have purchased equipment with the COVID issues,

and just in the automobile and heavy equipment industry, they're such a backlog for the equipment that we're looking for. But we do have an order, some bulldozers and excavators because as required by MSHA, we are no longer supposed to operate those types of equipment unless they have enclosed cabins, fully air- conditioned, enclosed cabins. And that's for health and safety reasons from the dust that emanates from the type of work that's down there. So that has to do with our own quarry that we operate down there. And we operate that five days a week.

I could have Randy Romero speak to the permitting process. And as just stated by DLM, we don't move on a permit for any type of mineral extraction unless it's been approved by GLUC. So, it really starts with them. They need a conditional use permit is needed from GLUC before we can move forward. And then, once that moves forward, then we involve all the other agencies who are basically on the same call here. So that's basically where we stand. And I can have Randy expound a little bit further on the permit process, if you don't mind.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Yes, Randy, if you don't mind, especially what guidelines you use to review the permit at DPW.

VINCENT ARRIOLA, DIRECTOR DPW: Thank you, Speaker.

RANDY ROMERO, BUILDING PERMITS ADMINISTRATOR DPW : Okay. Hi, Senator. So, of course, when we do get a, a customer coming in and applying for a clearing grading permit, we do require them to provide all the necessary information, any designs, any requirements. And if it does come identified as a mining or quarry, we would actually have them go through the Guam Land Use Commission to go through the process and receive approval or notice of action to continue forward.

Once they provide all that information, then we'll process the permit and go through the regulatory agencies again, starting with the DLM, Parks and Rec., Guam Power Authority, EPA, Guam Geodetic Network Survey Division, Department of Agriculture, and then back to Public Works again.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Does DPW apply any standards or guidelines that they must meet in their design?

RANDY ROMERO, BUILDING PERMITS ADMINISTRATOR DPW: Yes. Well, we do require them to provide an engineering design stamped by a certified engineer. Then

we go through the review process, in-house to our engineering section to validate and verify the type of proposed work that's being requested.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Alright. Are there any risks that you look for?

RANDY ROMERO, BUILDING PERMITS ADMINISTRATOR DPW: Of course. We make sure that with the help of Land Management and the GLUC to ensure the property to be excavated or worked on is not within a residential area or, you know, pose a hazard to the public. So we work closely hand in hand with DLM and all the other agencies to ensure that nothing will adversely affect the public and especially adjacent property owners.

VINCENT ARRIOLA, DIRECTOR, DPW: Yeah, Madame Speaker, if I could add also, some of the other issues we look for is, water runoff from the property; how it's either going to be graded or dug into; noise issues that may emanate from the property; the air quality, as Randy was saying to the surrounding properties; if there's going to be any type of blasting, we have to take a look at that; and we're very concerned and aware of the surrounding areas because that's a lot of heavy equipment that's being used. We know exactly what it takes to operate a mineral extraction or quarry such as the one that we have up in Dededo. Those are some of the issues. And I know the other agencies are also involved with especially up north with the water lens and with the type of environment that may be cleared so, that may have agricultural concerns.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Alright. Thank you. So I'm going to leave it there for now. Maybe they'll be more questions, but we'll come back. We're going to go to Guam EPA now. Captain Brian Bearden, US Public Health Service Chief Engineer, Water Division Director at Guam EPA.

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: Thank you, Speaker Terlaje. Guam EPA fits into both the ARC and the DPW grading permit and building permit process, and I'd like to speak about the grading permit process. So, Guam EPA has its soil erosion and sediment control regulations, which lay out a number of very specific requirements for any kind of excavation and that's specifically defined to include excavations created as part of quarrying activities.

But there's one particular section of our regulations that seems to have caused probably the greatest, I guess you would say, controversy over the last couple years. And that's

under 22 GAR §10104(c)(10)(C), and that's under permit application contents. And one of the permit application requirements is that the applicants include a copy of their conditional use approval from the GLUC. And I'll quote from this directly "when the area to be graded or excavated will be used as a quarry and extracted materials used to fill a different area or sold as a fill material by the owner".

And so, when I first got here about three years ago, and in fact I remember Speaker, you and I went on a tour at one of these facilities, I think my first week that I was on the island. After that, I started to learn these regulations. And this particular regulation at the time, you know, our understanding as an agency was that that was something that the DLM would decide on. So, if we got the permit that had been approved by DLM already, the application, that we would move forward and just review it from our perspective.

After we received a complaint from a resident who lived right next to one of these quarry facilities that had vertical walls, and it was a safety hazard, we re-reviewed that again with our legal counsel and this was about late 2019, I believe. And after that, we started to require that letter for any activity that appeared to be either a quarry or being used for the extraction of materials to be used as fill at different areas or sold as fill, just as it says in our regulations.

And as a result of that in FY 2020, we received three quarry permits, one of which we approved just before we had that legal review, and then two of those afterwards, we put a hold on those because of lack of having that GLUC permission. In FY 2021, we received four quarry permit applications. Two of those were renewals for two of the ones that DLM mentioned already. Hawaiian Rock and Smithbridge and the other two were also held because of the lack of the GLUC approval.

And we received a lot of push back and complaints, I guess you would say, from the applicants and even from DLM saying, well, you know, we don't know what a quarry is and who decides what a quarry is? Does Guam EPA decide what a quarry is? And I think that really raises one of the problems that does need to be addressed. One of the gaps in the regulatory system right now is how do we identify these operations?

I worked in CMMI for, as a regulator for about 13 years, saw the same thing happen there. Once you put requirements on quarrying as an activity, what you see is the applicants come in and they say, it's not a quarry, we're just grading the property to prepare it for a future subdivision or future farm plots, in the case of some projects in Rota that I saw occur.

And the problem with that of course is, you know, there's a number of problems, you know, from the Guam EPA side of things there's some significant environmental impacts associated with that. There's the noise, there's the change to the landscape, there's the removal of the soil, which then affects the groundwater protection. But more significantly, which is where I think the real gap occurs here is, is that we don't have that, that ability for the land use to get approved, and that's where it seems like all the complaints come from on both ends, that we get. We get the complaints from the people who live next to the quarries and we get the complaints from the quarriers who say, "I'm not building a quarry, you have to let my permit go through". And so that's something that really needs to be determined.

In CNMI when we have that issue, one of the biggest issues that revolved around that was there was no definition of what a quarry was in the law and I don't believe there's a definition here in Guam either, because we've looked at that for the last couple years and we haven't been able to find anything. I was an expert witness in, in a case in the CNMI for an administrative hearing where the CNMI did prevail against a construction company that wanted to dig down a property supposedly to use as a construction yard. And the administrative judge did agree with us that it was a quarry because for a lot of reasons. But it really brought to light the fact that there, there's some real subtleties in that definition. It's tough to define and it's something that I would really recommend be taken on and it may have to occur at the statute level.

Let's see, other comments that I had. So, some of the comments or some of the conditions or the standards that we have in our regulations as well is on the steepness that you can cut a slope into the land and the maximum steepness under our regulations is two horizontal to one vertical. So, you know a steepness of about that so it's not a cliff. And as everybody knows, you can drive around Guam and you can see quarrying activities where there's a sheer vertical cliff, which is a real hazard to neighbors, it's a real hazard to homes that might be right alongside these. And I think one of the issues we have is that even our regulations allow an exemption for that as long as a professional engineer signs off on a report saying that they believe that that's stable. And there are no standards for what that engineer is allowed to use for, you know, constants and such and those calculations or what kind of calculations they're supposed to use.

And that's something that we should really try to establish. Because I have seen those come through our office where an engineer will just pick the values to make it work for their client. And we need to make sure that we're holding the engineers accountable because a vertical slope, I think you could talk to any geo-technical engineer on Guam

and I think they'll all tell you that's not safe. Even the limestone especially if you have any kind of structures up above that or down below that.

And the other questions you had were, as far as enforcement. With this particular provision, the enforcement's really limited on to our ability to approve the permit, right? So, like I said, over the last two years, we have two of these permits that are just sort of held indefinitely and that might increase as people come in to renew other activities that we know are quarries but that don't have that Land Use Commission. So right now, that's really the only enforcement. It's hard to go after someone and give them a fine, I guess, for them not having a conditional use permit when they claim that it's not a quarry.

And with that said, we do have Roland Gutierrez who can give you some information on our air quality permit requirements for quarries as well.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Alright. Thank you, Captain Bearden. Roland, please.

ROLAND GUTIERREZ, PROGRAM MANAGER, GUAM EPA: Yes, there's no specific regulatory requirements in regards to quarrying or anything like that and basically when it comes to quarrying, we mainly deal with the equipment and the fugitive dust emissions. And the fugitive dust emissions is covered under our enforcement ability for particulate matter. And so a lot of times these quarrying operations, they're not listed as quarrying operations. And so, there's no specific regulation in air program that says we must permit quarries. And we basically base it on their potential to emit. And so what they do is they do a calculation in regards to the amount of dust that they'll generate, whether it's from the equipment they're using to actually break the rock or the equipment they're using to process the rock. And most times that we look at the requirements and the sides of the equipment they're using, in order for us to permit them, they literally need to be a certain standard. And basically the law states that if they produce two tons or more of pollutant per year that is regulated, they need to get a permit.

In most of these instances, when it comes to the generation of particulate matter, the equipment is not of such size or the projects themselves are not of such size that they'll meet that standard for most of it. So you have your quarries such as your Smithbridge, your Hawaiian Rock, and those are large enough for us to permit. A lot of the smaller ones fall way between the level of us giving them a permit. So, one of our main requirements when it comes to those things is that they submit what's called a fugitive

dust control plan. And that fugitive dust control plan ensures that they basically limit the amount of dust that comes out of the site.

The problem with that is, and if you know, when it comes to enforcement, I mean at Guam EPA, we currently only have two people that are enforcing fugitive dust around the whole island. So, we mainly go into what's called complaint mode, where somebody actually makes a complaint, we'll go out and we'll address that complaint. But for us to go out on a regular basis to conduct compliance inspections. And literally we do our due diligence, we go out there, we make sure they have the plan, they make sure we follow the plan, and we make sure they're enforcing the plan. But the problem is the continued enforcement is not possible because we can't spend our time watching one or two different companies that, you know, are violators or that are doing this type of activity.

So, I believe our regulations are adequate. I just believe that we don't have the capability to enforce the regulations properly. And as Brian alluded to earlier, there's no actual definition of what a quarry is and what requirements that we're supposed to do with them other than regulating the particulate matter that comes out of them or any other equipment that's there. And so we're limited to that. I mean, if we're just going to regulate every single operation, then we'd need to either lower the standard or we'd need to increase the enforcement capability.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Alright. Thank you. Anything else on behalf of Guam EPA?

ROLAND GUTIERREZ, PROGRAM MANAGER, GUAM EPA: No. I did submit, gave to Brian just a short paper on what other requirements basically, quarries, and he'll probably just send that over to you. And if you have any questions, you can direct them back to us.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Okay. Thank you.

ROLAND GUTIERREZ, PROGRAM MANAGER, GUAM EPA: You're welcome.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Alright. Now we'll go to the Bureau of Statistics and Plans Administrator, Edwin Reyes of the Guam Coastal Management Program and Christian Benitez of the Bureau ARC member.

EDWIN REYES, ADMINISTRATOR, GUAM COASTAL MANAGEMENT PROGRAM, BSP:_ Yes, thank you Madame Speaker, and I'll be handling most of the presentation, but I'll certainly be on Christian for any technical input that he would like to share.

If it's okay with you Madame Speaker and Honorable Senators, I do have a presentation and I would like to provide you an update in the context of both our role as the ARC and as the central planning authority for the territory. I think this is important because it does touch upon the different policy and regulatory actions that we also adhere to under the Coastal Zone Management Act.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Sure. Please proceed.

EDWIN REYES, ADMINISTRATOR, GUAM COASTAL MANAGEMENT PROGRAM, BSP: Okay. And I'll share my screen… Once I'm able to share my screen, I'm not able to right now.

Thank you for allowing me to share my screen. This is quite a nebulous process and so I just want to make sure that I communicate to you what our role is in terms of providing guidance and regulatory information that would govern the mineral extraction activities on Guam. Okay, thank you. I have control now and I'm going to share. So can you guys see this okay? Alright, fantastic.

So, as you know Coastal Management was established in 1979. We do grant, we do get our authorities from the Coast Zone Management Act. So, when you ask them what our regulatory nexus is, this is an Act of Congress, which does provide us some authorities when it comes to federal actions.

In terms of administrative setting, we are under the governor's office, Chapter One, Article Two. As you know, Article One is the governor's office herself, as well as other key staff such as Clearinghouse and other key positions with the government office, the Bureau of Stats and Plans is Article Two, in which, and as you are probably more familiar with, the Bureau of Budget and Management usually kind of outshines us in terms of the importance and the focus of the two classified line agencies at the governor's office. But statutorily, we are quite high. And I mentioned that because the authorities under central planning really requires us to prepare the Guahan 2050 Sustainability Plan and to ensure that there's consistency among agencies that should need to reference that plan in order to make decisions. And I believe that there is information within these planning documents that can be valuable to understanding

how to better manage and interpret the allowances of mineral extractions and I'll go through that in my presentation.

The other interface with mineral extraction is under our provisions under federal consistency, and as you know, federal consistency is a process in which we have to ensure that any federal action is consistent with Guam's enforceable policies. And so federal actions could be actions that are funded with federal dollars, local actions that require a federal permit, or any general action conducted by a federal agency.

We also contribute to the ARC discussion and deliberations of the GLUC in which you provide position statements for their consideration. The difference between the two here, Madame Speaker, is at the federal consistency, our program under the CZMA gives us full authority to make a decision whether or not to object to a determination or to concur with the determination. If we object to it, the federal action, the federal agency must deny the permit without prejudice, or the federal agency must not provide the funding. So, if there's an application that comes before us that would require a federal permit or has a federal action, we have more strength in terms of ensuring that the action, whether it's, you know, disruptive mineral extraction does not get approved. Of course, we have to justify that based on a set of standards that we have in our comprehensive development plan and our north and central land use plan and executive orders.

So, in terms of central planning, here are our authorities that we draw on. We look at the land use district maps in the1979 Kabalis Na Planu Para Guahan, and this is enforceable under Executive Order Number 78-23, and 37, as well as the north and central land use plan district maps as approved by Public Law 30-224.

When we're looking at land use, this is really the classifications and description of allowable uses in land use categories and land use categories are established for a reason, and that reason is to try to avoid conflict. And so when I hear that mineral extraction is allowable in agricultural land, that is, I think, strongly grossly misinterpreted. Because agricultural land is meant to produce agriculture. And the term 'extractive material', in my mind, I don't see that as extracting geological resources because that's just totally contradictory to the agricultural land itself. Because it's zoned agriculture to produce agriculture, when you extract geological resources, you permanently create a situation and you permanently damage that parcel in which it will no longer serve as a function of agriculture. So, what I think, that's just could be interpreted, you know, extremely wrong. But during this assessment, I never read that statute to mean that the act that mineral extraction could be allowed in as a conditional

use under agriculture, but I stand corrected, as it has been done in the past. So, looking across our community design maps and I'm paying attention drawing attention to our community design maps because these are the boundaries in which we determine where mineral extraction could be potentially compatible based on the M2 designation.

So, as you know, in our Kabalis, we do have four different land use designations which is urban, rural, agriculture and conservation. And M-2, which is a land use zone is under urban. And so how we interpret this is we look at what our enforceable policies dictate in terms of applying the interpretation of where exactly M2 activities would fall in the urban category because if you look at this map above Madame Speaker, the urban categories or land use designations are quite extensive in these two maps. But when we look at our policies, I'm going to skip down to the urban development policy, it says that uses permitted only within the commercial multifamily industry and resort, hotel zones and uses requiring higher levels of support facilities shall be concentrated in urban districts.

So, this term, industrial, this is where we refer to the zoning law and how we enforce these authorities here. And also, I apologize, as it is quite small, is that we enforce these through the different authorities in this table here. So, this could be useful in terms of your matrix in compiling the different policies that we look at in terms of enforcement. I would say that these enforceable policies is supposed to be adhered to by all agencies and instrumentalities of the government. So, when the GLUC is conducting their reviews or, you know, other agencies, it should be referenced as something usable by all instrumentalities of the government.

So, in terms of when mineral extraction is allowed we all agree that it is allowed under other heavy industrial zone. So the position of the bureaus that we would not concur with any proposed conditional uses or zone changes that would be non-consistent with other land use types other than what we recognize as M2 zone in our district maps.

Some suggestions for your consideration; We talked about the permit clearing and grading, but I think one of the major issues that was brought to light here is the Guam Land Use decision and interpretation of allowable uses within agriculture, I don't think there should be any approval to geological extraction. I believe that term extraction refers to biological extraction. So, for example, if you wanted to grow mahogany trees or whatever, you know, you would have to actually extract, you know, those kinds of biological resources. But once you once remove the geological resources, then you render the agricultural lot non-functional.

Other issues is the, and as you know, is the CLTC leases and the legislative spot zoning. That's my presentation, Madame Speaker and I'll step back for questions.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Thank you very much Administrator Reyes.

So, we'll go now to the Department of Agriculture. I know we have the director here, Director Chelsea Muna-Brecht. Also, we have the Forestry Division Chief Christine Fejeran and we have Jeffrey Quitugua, the Technical Guidance Section of Department of Ag. Director?

CHELSEA MUNA-BRECHT, DIRECTOR, DEPARTMENT OF AGRICULTURE: Thank you very much, Speaker Terlaje, I have to say it's always kind of a little bit intimidating to follow Mr. Reyes in his presentations, he had a whole PowerPoint for you, but it was very well done. He actually touched on points that I wanted to address as well, or bring up, which was the spot zoning and sometimes the zoning changes for agricultural properties. I know that was an issue for Mr. John Borja who will be joining us shortly.

But I will discuss our permit process and some of the areas that we cover. And at any time if Chief Fejeran or Mr. Quitugua want to jump in to correct me or point something out, with your permission, I would also invite them to do so. Our permit process that would address or be relative to mineral mining would be clearing and grading and construction permits and to some extent, cutting permits as well. And I want to also point out that we've been discussing issues surrounding aquatic or ocean based mineral mining as well. Because I know that there have been corporations seeking to mine in and around the trench.

But right now, with clearing and grading permits, our authority primarily derives from enforcing, and it's also based on funding, Federal Endangered Species Act, Migratory Bird Treaty Act. There's several; the Sikes Act our US Fish and Wildlife Services Cooperative Agreement, the Guam Endangered Species Act, the protection of wild animals, the Marine Mammal Protection Act, that's if the mining were to travel into the water as well.

And with the clearing and grading act, if the project area is greater than one acre, then we require a biological survey to be obtained. But then the biological survey, as in its name, will primarily focus on the existence of endangered species or species of greatest conservation need and then we would apply conditions based on those inclusions.

Tree cutting permits are only applicable from our agency for Government of Guam properties, unless it is listed or endangered species on private property, we can provide input and recommendations based on that.

Our permitting process is typically follows that applicants submit their permits for review, the permits are logged and assigned to staff and initial review of background information is conducted. Then a site inspection and permit conditions are generated to minimize impacts of protecting habitats. The chief reviews it and then the director signs off on the permits and the conditions.

Our enforcement authority is limited to the issuance of the permit with conditions, although we also have issued notices of violations or cease and desist orders at times when required. And then we meet with the applicant to review conditions and make recommendations that they are to follow.

We are in the process of working on assigning not only charges to our permit review process because the agency has not to this day ever had collected fees for this service, but also deputizing the Jeff's section which is the... oh my gosh, what's your section called again? Technical, technical guidance, sorry, the technical guidance section with regulatory authority which are those of Rev & Tax officers so that they can also issue citations for violations that are not corrected in a timely manner. Is there anything you would like to add, Jeff or Christine?

CHRISTINE FEJERAN, CHIEF, FORESTRY DIVISION DEPT. OF AG.: Apologies. I think between both you and Edwin, you covered it pretty well. My concern that I threw into the quick notes, because I heard about this meeting rather late in day, was any extraction that takes place anywhere on island, I mean, whatever that footprint is, whether above ground or below it, the damage to root systems, we don't have that measurement yet, right?

You could have a footprint of two acres, we'll say, for land clearing, for extraction. And within that two acre footprint, you might see tree death, tree canopy decline, but people don't consider the impact to the forest adjacent to and surrounding that parcel. So, these are takes, you know, this is impact that we have to consider, that it's never just that one footprint. And we talk about sediment and erosion, but what about the rest of tree health and tree canopy health overall in habitat? So that was just one more quick add,

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Ms. Fejeran, so are you able to deny a permit if you believe that that impact is too much?

CHRISTINE FEJERAN, CHIEF, FORESTRY DIVISION DEPT. OF AG.: We can but that's right now I think we still need more survey work. So, for a property, depending on the required environmental assessments and species found there, a lot of this is really going to be when we start making observations. So, a biologist assigned to the project, so big projects like this should have a biologist on site and considerations on who's paying for that biologist, really. But you think about their monitoring would be both monitoring that's taking place on land, on that property and looking out at the neighboring properties as well. But this is, it's a very, very tricky slope.

CHELSEA MUNA-BRECHT, DIRECTOR, DEPARTMENT OF AGRICULTURE: And Speaker, if I may, what Christine's referencing is the authority of the tree cutting permit. It would only really intercede in a clearing or grading permit if it's affecting an endangered species or a species of greatest conservation need. And rarely, I think, do the biological assessments even cover the loss of tree canopy or root systems unless it's impacting a specific endangered species or the tree itself is an endangered species.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Okay, so currently your guidelines are pretty much whether it's impacting an endangered species or not. Okay. Alright.

CHELSEA MUNA-BRECHT, DIRECTOR, DEPARTMENT OF AGRICULTURE: Yes, ma'am.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Thank you. Thank you very much, Department of Ag. GWA, I think we have the General Manager, Miguel Bordallo, and the Chief Engineer Mauryn McDonald.

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: Good afternoon Speaker. I apologize, General Manager, Miguel Bordallo had to leave the meeting.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Okay.

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: But I can certainly provide some information on behalf of GWA. And to start off, basically for quarries water service requirements or similar to typical developments and available water capacity analysis is required to determine if service can be provided without adversely impacting existing customers. So, we're looking at how much water is actually in the pipes and how much pressure the water system has in that area that the quarry is being proposed in.

I believe, on the wastewater side, I believe that processed wastewater or wastewater use or wastewater produced from dust control activities would typically be maintained onsite. But as far as sewer service goes, this would be typical for any industrial activity. It would require a GWA industrial wastewater permit and potentially require the customer to install a pre-treatment system before they discharge into the GWA sewer system. Sewer service would also require an available sewer capacity analysis.

Both water and sewer service connections would require a DPW building permit as well as GWA utility connection permits. So that said, while GWA regulations are focused primarily on the water and sewer service, we are very concerned about activities that can potentially impair aquifer water quality. Since the aquifer is our primary source of drinking water, we know that acquiring too close to the water table or creating new pathways for contaminants to reach the ground water are certainly concerns when we're looking at protecting our source water.

Case in point, one of GWA's wells, which is located near a quarry at one point produced cloudy water and had to be shut down. Now, we couldn't point directly to that quarry's activities, but when that quarry was closed down, the water produced from this well cleared up and we were able to put that well back in operation. So, you know, we just want to make sure that activities surrounding water wells are not impacting the water quality that we're pumping out and distributing to our customers.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Thank you, Acting Chief. It says acting. Are you the Acting Chief or the Chief Engineer? I thought you….

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: I have the acting role at this point in time.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: All right. Thank you so much.

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: You're welcome.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Does GWA impose any restriction as to the depths of quarrying?

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: We don't have regulations that govern the depths of the quarries. Guam EPA may be able to speak to that.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Okay. So we'll get back to them. I'm going to proceed now with our State Historic Preservation Officer, who is a member of the Department of Parks and Recreation, who's also part of the Agency Review Committee and the DPW Permitting Committee, or review process. Mr. Lujan?

PATRICK LUJAN – STATE HISTORIC PRESERVATION OFFICE: Yes. Good afternoon Speaker and good afternoon senators, all the other stakeholders. I'm glad to be here this afternoon on this important topic. Just to add to what all the other regulating agencies have said on top of the regular permitting process within the Historic Preservation Office, we still have the Section 106 undertaking process for federal lands and that is unique to the Historic Preservation Act. So, in that case, every undertaking within federal properties goes through this federal law, and in this case, especially with recent findings of human remains in the Northern Plateau and several attempts to enlarge quarries on Andersen Air Force Base, we have not concurred with the findings of no historic properties affected until future archaeological studies are conducted. So that's kind of within the parameters that we can regulate, so to speak, on federal lands.

On local lands, we follow the same process for permitting. Just a couple of examples of what has occurred in the past, something that we can learn from on lessons learned, is one particular mining or quarry since we haven't defined what the definition of quarry is, is significant loss of a historic site on 35 acres of mining up in the Yigo area.

This occurred where the company basically mined coral without contacting the appropriate archaeologist who was supposed to be monitoring that property. So what we did in that instance was issue of a Notice of Violation. So, we are still working with that company for mitigation efforts.

As far as suggestions are concerned, possibly a separate mining or chlorine permit for the Government of Guam since that would give a total unique and focused review of such request. Those are my comments this afternoon.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Thank you very much Mr. Lujan, our SHPO, and welcome back. And can you just tell us where is this 35 acres in Yigo?

PATRICK LUJAN – STATE HISTORIC PRESERVATION OFFICE: It's northeast.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Is this, are you talking about the raceway or the solar farm?

PATRICK LUJAN – STATE HISTORIC PRESERVATION OFFICE: Further north.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: For neither of those?

PATRICK LUJAN – STATE HISTORIC PRESERVATION OFFICE: For the north, yes.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: You're not able to disclose?

PATRICK LUJAN – STATE HISTORIC PRESERVATION OFFICE: For the sake of the company, I'd like to say that off record.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Alright. But they've been issued notice of violation and you're trying to work with them on mitigation, right? Is that correct?

PATRICK LUJAN – STATE HISTORIC PRESERVATION OFFICE: Yes, ma'am.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Okay. Thank you very much. We're going to proceed with Dr. John Jenson, the Director of WERI. Dr. Jenson? Thank you very much Dr. Jenson for being here today.

DR. JOHN JENSON, DIRECTOR, WERI: Sure. I'm a little slow with the switch here. Thank you, Madame Speaker. Well, of course, WERI is not a regulatory or authoritative type of agency. Our mission is to provide policy makers and to share with you some of my experience in looking for definitions of these terms. I've had occasion to look for an authoritative definition, for instance, of an aquifer. For instance, I researched the US EPA regulations to see if there was any indication, and I have not been able to find an official sort of definition with legal state status now. And my suggestion is that if you need a definition of an aquifer or a definition of quarry as Captain Bearden mentioned, is that you may have to write one of your own. The legislature for instance, or Guam EPA through whatever process, it would make something official or something, a legal definition. You might have to adopt a statutory definition of your own after researching it out. So, I offered in the chat here what I do if I'm asked to provide expert advice, as I have been from time to time in, in legal matters or, and certainly in doing good science, you always have to start with the definition so that you're talking about the same thing.

And I've written my own definition of an aquifer that I use for… I make my students memorize it, and it's on the exam. And that is a body of natural geologic earth material that is capable of capturing, storing, discharging, and releasing economically significant

quantities of water. And you can see embedded in that is a human definition. You have to then define what's economically significant but if you don't, you're left with questions.

Like I was involved once in providing expert testimony on discussion of whether some activity that was proposed was being done over an aquifer and one side claimed, well, this is an aquifer or another side claimed it isn't. And you have to work through several layers in order to come up with a definition. And ultimately, it's something that left to itself, would be decided case by case by a court after appealing to expert testimony. So, the authoritative sources that I go to, and I have a whole shelf full of references, I use the Oxford Dictionary of Construction, Surveying and Civil Engineering and I put the definition of… their definition of a quarry is "an open pit mine used for extraction of rock or minerals such as stone or other building aggregates.

And you even sometimes have to dig down to, into the definition of a mine, for instance, to come up with a suitable working definition to give you an idea of how much it varies. And these are the authoritative professional references. The American Geological Institute produces, this is the glossary of geology, which is this big volume that is often given as a graduation gift for geology majors. Everybody keeps that handy and their definition is of a quarry is "open workings, usually for the extraction of stone." That's really broad. And so, you can see the challenge there.

So, coming back to the definition of an aquifer, because the question is here, you know first you got to define quarrying or mineral extraction, and then you got to define whether it's over the aquifer. And one of the questions you get into there is for instance, based on the criteria that you have to, that it has to be able to provide economically significant quantities of water. You can see immediately one of the dilemmas is where do you draw the line? If you're going closer and closer to the coast where the water's getting thinner and saltier, you eventually get to a point where it's not economically significant, because it's not drinkable or usable. Although it might be for a fishery for what do you call it… that raises aquaculture… It might be useful for aquaculture, but it's not useful for drinking. And some places you want a saltwater aquifer for aquaculture. And so, it really gets down to, you know, in defining the aquifer, how do you define where our aquifer is no longer producing economically significant quantities of water. You'd have to draw an arbitrary line. And that gets really difficult to deal with from a legal or regulatory standpoint. So, I extend the aquifer out to the coast, but make the point that it's utility changes and there are portions where you wouldn't be extracting economically significant quantities of water.

And it really comes down to a question of what parts of the aquifer do you want to protect and protect for what? And, and this is a question that Guam EPA has asked us to explore and we've actually got a project going on that.

So anyway, I don't know how useful that is but I just wanted to share with you some of the insights that I've gained in the course in my career and in working with these questions.

And I guess I'd end with my best advice would be to identify application that you need to address and then draft your own definition of an aquifer and make it official, and your own definition of quarrying and make it official.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Alright. Thank you, Dr. Jenson. If I could just ask you if you could expand on if it was determined it was over an aquifer, a usable part of the aquifer, a significant economic….

DR. JOHN JENSON, DIRECTOR, WERI: Right. You got it.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: …amount of water. Let's say mineral extraction was going to occur there, have you seen in your work some kind of guidelines that you would want to be put in place over that aquifer in regards to grading?

DR. JOHN JENSON, DIRECTOR, WERI: Yeah. Well, you know, the standards that Director Arriola referred to really covers it. I think if you're following good industrial practices of safety and management you are not really going to have any problems. You know, one of the interesting things, and I guess one of the things that's worth pointing out, I actually just came from visiting some of our quarries, because I'm taking my students out this weekend to visit the DPW quarry in Dededo and Smithbridge Quarry. But those are all on the… close to the… well, the DPW quarry is inland and that's a different kind of situation, but the Hawaiian Rock and Smithbridge are on the coast for the reason that's where the best rock is. And that's the hardest rock, the industrial grade rock.

And it's on a part of the aquifer that's outside of the zone where there's economically significant quantities of water. You know, what GWA defines is economically significant, and they don't put in a well unless they can get at least 150 gallons are in it. And you can't get that kind of yield close to the coast. So our industrial quarries are

located in places that are no threat to the part of that you would want to protect for water production.

Now, the Dededo quarry, you know, has an interesting history because it's used for fill, but you know, it's a really clean operation. You just go in there, and all these quarries are. You go in there with an excavator. There are no chemicals or smelting or anything like that has to take place. And it's in a central location of the aquifer, but it's a clean and sort of naturally simple place to operate with so, it's no threat to the aquifer, even though it's certainly over the central portion of the aquifer for the reasons that Director Arriola mentioned.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Alright. So, you're saying that WERI has no interest, I guess, or…

DR. JOHN JENSON, DIRECTOR, WERI: No concerns.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Yeah. No concern in quarrying over the aquifer because there are no chemicals that are being used and you don't agree with the earlier statement that chlorine exposes that aquifer more to those types of contaminants?

DR. JOHN JENSON, DIRECTOR, WERI: No, not any more than any other industrial activity, like building a road or construction actually. You know, constructing buildings in urban locations involves a lot of activity that has a certain amount of risk. But we live with that risk and we have to. You know, people live over the aquifer. Dededo and Yigo are right over the core of the aquifer. And some of the most prolific parts of the aquifer are under subdivisions where people live and there's sewer lines and septic tanks, and of course everybody knows those. Those are another issue.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Yes, but most of that development does not disturb…. I'm looking at your definition here, "the natural earth material that stores and discharges the water" or cleans it.

Okay, I'm going to go back the SHPO Lujan, you wanted to add one more point? And I'm going to open it up to the senators after… Is Patrick here?

PATRICK LUJAN – STATE HISTORIC PRESERVATION OFFICE: Sorry. I was talking too fast. So, I did note on the chat that one important point was the cultural landscape that would be affected. Again, it depends on the actual location and the

severity of, and the size of such a project. And unlike buildings where you can build a building and then you know, not build a building, or knock it down, something like this could be very detrimental to the cultural landscape and irreversible. So that's a severe impact from that perspective. I just wanted to include that.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Alright, thank you. And when I think of those cultural landscapes, I think of the cliffs and the ancient villages that are normally adjacent to them. What about the Guam EPA? Captain Bearden, you had something you wanted to add?

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: Yeah, I would like to just ask a clarifying question of Dr. Jenson, because my understanding of the removal of that upper… because with the quarry, we're talking about removal of 20, 40, 60 feet of limestone. And, you know, my understanding of the way contaminants especially migrate down through the soil, through the vadose zone, is they pass through that upper layer, which I believe Dr. Jenson, you, you've termed the *epikarst, right?*

DR. JOHN JENSON, DIRECTOR, WERI: Yes.

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: And I think that's where all of that biological activity occurs that can help remove contaminants. So our point of view at Guam EPA is that, that's where we see what little treatment there does occur for things like septic tanks and for infiltration of storm water. So when you remove all of that in a massive excavation like a quarry, my assumption is that you've stripped that protection away from the aquifer below it.

DR. JOHN JENSON, DIRECTOR, WERI: Yeah, that's a good point. And I guess when a quarry is active and being maintained and industrial standards are being applied to keep it clean, you've got no problem. You know, the one thing you might want to think about is when these quarries are closed you know, if they become, if water drains into them and they collect water and become, you know, a nasty frog pond or something like that, you could certainly have an environmental threat. So I assume there are standards about closing quarries and keeping them. But if they're not, then that's something that should be looked into for the longer term.

You want to keep them de-watered and that's going to cost somebody something. But, I don't, you know, that's unless water comes, contaminated water comes flooding into the quarry is not necessarily going to be a problem.

Depends on the good storm water management and drainage around the quarry. The, so the closure of quarries would be something of a matter of concern. If the quarry is over the, like if the Dededo, DPW ever closes the Dededo quarry, then you'd want to look into what sort of measures would be appropriate for keeping it from filling up, or, you know, another thing to think of is like sinkholes. People tend to throw trash and garbage into holes in the ground. Then an old quarry that's been abandoned is ripe for that sort of thing. So those will be the kinds of things that you need to manage but that's a good point.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Thank you. Captain Bearden, was there another point that you wanted to bring up?

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: Yes. I did put into the chat there was a mention about whether there were limits on excavate, the depth of excavations.

And we do have something in the wellhead protection requirements. It's very confusingly written and we've had trouble even interpreting this ourselves. But within a thousand foot radius of any public utility, portable water supply well, it says the excavation will not exceed a depth of 40 feet below the existing but there's a lot of other language that comes right before that that seems to sort of throw that into question. So that's something that really would need to be clarified in our regulations. Dr. Jenson, just to clarify what I was getting at, there was, you know, we have seen some proposals recently where people are proposing basically to quarry for the purpose of creating future development.

And so, you know, our point of view is that if somebody comes in there after that and they've removed all that *epikarst* and they put in septic tanks and they put in your normal stormwater ponding basins and such, it is not the same as building septic tanks and ponding basins under, you know, an undisturbed land condition, I guess.

So that was really what I was getting at because I don't think that we are talking about situations where a quarry just sits there pristine, unused after it's finished. And also to clarify what you had asked, we don't have requirements in our regulations for restoring a quarry after it's completed and that is something that's also necessary, in my opinion.

DR. JOHN JENSON, DIRECTOR, WERI: Yeah, those are good points. I'd agree.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Thank you very much Captain Bearden. DPW director, if you're still here, I'm sorry. And Land Management, if we could just clarify one more time, if it's on an M-2, GLUC approval is not necessary?

VINCENT ARRIOLA, DIRECTOR, DPW: Oh, that would be DLM,

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Yes. Joe, Director Borja.

JOE BORJA – DIRECTOR DLM: Yes, I'll let the Chief answer that.

CELINE CRUZ – CHIEF PLANNER DLM: Yes, it would be under any other uses, not specifically its permitted use.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Okay. So if it doesn't require GLUC approval in an M-2, then it only requires a DPW permit. Is that correct? Or do all...do you agree with that Director Arriola or do you, are you saying that all quarrying, no matter whether they're on M-2 or not, requires GLUC approval?

VINCENT ARRIOLA, DIRECTOR, DPW: That's correct, ma'am. That's the way, that's our understanding.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Okay. So I guess we'll discuss that later. There seems to be a little gap there. Alright. Thank you all.

VINCENT ARRIOLA, DIRECTOR, DPW: That's probably where we need some clarification now.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Okay. I agree. I'm going to open it up now for the senators beginning with Senator Perez.

SENATOR SABINA PEREZ: Thank you, Madam Speaker and thank you to all that have come here today. So just for clarification, so there's a different method I guess. Is it true that you treat things differently if an applicant is requesting a clearing, grading permit versus a quarrying permit? If you can clarify that. If they're treated differently.

VINCENT ARRIOLA, DIRECTOR, DPW: That's correct. Yeah. So if an applicant comes in for clearing and grading, we can take that through our process because there's a certain process and there's rules for that. But our understanding is mineral extraction, quarrying has to go through, that's a certain zoning issue that has to go through GLUC. So once it goes through GLUC, then it'll come to us. Then we'll take it through the permitting process.

SENATOR SABINA PEREZ: Okay. So have you seen cases where there's a clearing and grading permit, but they're actually using it for filling and they're selling it off as quarry product? Have you seen cases like that?

VINCENT ARRIOLA, DIRECTOR, DPW: We've had inquiries where there from a clearing and grading permit that turns into a quarry and they sell the material?

SENATOR SABINA PEREZ: Yes.

VINCENT ARRIOLA, DIRECTOR, DPW: No Senator, I haven't. I'm not aware of that. Randy might, our Permits Administrator might have seen something that, but I'm not aware of that, anything like that.

SENATOR SABINA PEREZ: So, is Randy here?

VINCENT ARRIOLA, DIRECTOR, DPW: Randy. Is Randy still on? Shows he's still on.

RANDY ROMERO, BUILDING PERMITS ADMINISTRATOR DPW: Yeah. There was one case that there was an actually clearing and grading permit applied for, and we did discover they were actually doing some minor quarrying. So we actually issued a violation and told them to stop work and up to today we have not heard back from that operation. But I know they've actually stopped.

SENATOR SABINA PEREZ: Okay. So what type of enforcement, besides a cease and desist, are there any penalties involved with that or any kind of …

RANDY ROMERO, BUILDING PERMITS ADMINISTRATOR DPW: Well, we're going to have to seek more clarification on that because this is just something recent. So we're actually looking into that to try to see how far our reach is as far as penalties.

VINCENT ARRIOLA, DIRECTOR, DPW: But right now, I think senator, in our review of the laws and what's on the books right now. I, at least in our review, the law is silent on that. So we can hopefully get clarification based on this discussion that's going on today.

SENATOR SABINA PEREZ: Okay.

ROLAND GUTIERREZ, PROGRAM MANAGER, GUAM EPA: Senator this is Roland Gutierrez at the Guam EPA. So when we go out and do our inspections to determine the compliance with the fugitive air emissions, we encounter on a daily basis that exact scenario where they do clearing and grading and as we're there, we see. Because basically they're cutting and sloping and the excess material on site that they don't need, it's common practice that we see, they basically sell the excess material offsite. I mean…

SENATOR SABINA PEREZ: Okay. So does that now qualify it as a quarrying versus a clearing and grading?

ROLAND GUTIERREZ, PROGRAM MANAGER, GUAM EPA: As a Director said our regulations don't have any requirements that would prevent them from taking the items offsite. Our requirements only require them to ensure that they're doing their dust control and all equipment that emits any type of air emissions are permitted. So we don't have any say or not whether it goes offsite, but your question was, is it a common practice? And I'm going to tell you yes, it is almost every single site I've been to. If they have excess material, they either use it at another site or they'll sell it to somebody for use at another site.

SENATOR SABINA PEREZ: Okay. So I guess this question goes back to I guess Director Arriola. So, you know, when they send in their permit application, is there anything in the application that basically they would have to describe what they're doing with that material? And is there like a trigger for DPW to identify it as an actual quarrying versus a clearing grading permit?

VINCENT ARRIOLA, DIRECTOR, DPW: And again, Senator, what we focus on is clearing and grading. If we focus on clearing and grading, you know, it's exactly that. It's clearing a piece of land, it's grading it typically for construction of homes or a commercial building or whatever the design calls for. But if we're taking it a step further and we're delving into the area, you know, if there's excess material or they just want to sell some of the material as part of their clearing and grading, my reading of the law is, it's absent on that. There's nothing that really covers that area.

SENATOR SABINA PEREZ: Okay. So that's definitely something that we need to work on.

VINCENT ARRIOLA, DIRECTOR, DPW: Yes ma'am.

SENATOR SABINA PEREZ: This is for Captain Bearden. You were talking about basically, if I can probably paraphrase what you were saying earlier correctly, you were talking about clearing and grading only applies up to two horizontal, to one vertical. And that as of now, there's no standards for determining that. Yeah. So we can provide more clarity on that and yeah, really is responsible for ensuring that this you know, the project does not exceed these limitations.

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: Yeah. So these are in our soil erosion sediment control regulations. There's maximum slopes for both cutting and filling for stockpiling or for filling. And we review that with every application, and we often send back plans to have them revise to meet those requirements. So we are the ones that enforce that. But sometimes because the regulations also allow for an engineer to certify a steeper slope than that and we will sometimes get an engineer come in and provide calculations, geo-technical calculations as such that will justify a steeper slope.

I've only seen one since I've been here that came in to try to justify a vertical slope. And again, that's where I feel like we need to have limits and guidance on what an engineer is allowed to do with those calculations, because those start to get questionable, in my opinion, in my professional opinion as an engineer.

SENATOR SABINA PEREZ: Okay. So Guam EPA probably will be the ideal, perhaps the ideal agency to….

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: You know, maybe, I'm not sure. I think that kind of falls kind of in between Guam EPA and DPW that starts getting into more of the hard engineering side of things like DPW does. But right now it's in our regulations that does fall on us.

SENATOR SABINA PEREZ: Okay.

RANDY ROMERO, BUILDING PERMITS ADMINISTRATOR DPW: If I may, I'm sorry.

SENATOR SABINA PEREZ: Go ahead. Randy, you had something to add?

RANDY ROMERO, BUILDING PERMITS ADMINISTRATOR DPW: So, IBC 2009 Section J108 Setbacks, there are actually slope recommendations that are actually spelled out. So Captain Bearden, if you want to go ahead and take a look at that.

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: Okay. Yeah, I mean we enforce the rules that we have right now, so I guess there's a conflict there if the IBC is different than that, but I'm not sure the IBC always applies, because most of the time we're dealing with our grading requirements is for these clearing and grading projects where there's no construction. But we also look at it for construction projects as well.

And just to fill in on what Roland had told you as well, Roland Gutierrez, yeah, we do see a lot of products that come in just for grading and clearing and they're very large cuts with no reuse of that fill on site. So it is pretty obvious that there's a lot of contractors out there that are using, you know, the clearing and grading of people's properties as a way to get material.

Sometimes they're pretty small. Sometimes they're less than an acre, sometimes they're bigger than that. It's only when they become very obvious, like when they come in to us with a 20 to 50 acre project with really large cuts, that we flag it as a quarry. And again, it's because of that lack of a definition and the way our particular provision in our regulations is written, it is just so unclear, right?

It's excellent at finding quarries, but not so good at excluding what is not a quarry. So it makes it real tough to make that call.

SENATOR SABINA PEREZ: Yeah, I think for me, yeah, if we can take a look at that a little closer, because there is a way to predict, you know, based on the steepness of a property, how much material's going to be available. And maybe that could be one of the potential criteria for triggering a quarry versus just a clear grading permit. The other thing that I see, you know….I've passed by this almost every day. There was a property on the side of the cliff that was cut and graded, and it was clearly not two to one you know, slope.

And now it, it initially had like these beautiful breadfruit trees, and now it's taken over by you know, I guess other trees. And so I think what's really important is if there's a

way to prevent some of this clearing and grading that would, you know, irreparably harm some of the plant life that's there.

So I guess if Christine, if you're still on, if you could maybe provide some recommendations. How would you, I guess, improve regulations or statutes?

CHRISTINE FEJERAN, CHIEF, FORESTRY DIVISION DEPT. OF AG.: Wow, Senator, that's a big, that's a big question right now. Just applying all the best BMPs that we know I mean, for a fast, a fast response, but what I'd like to do is be able to take the notes I have and form an actual narrative that I can share with you later.

SENATOR SABINA PEREZ: Sorry, which act is this?

CHRISTINE FEJERAN, CHIEF, FORESTRY DIVISION DEPT. OF AG.: No, I'm saying I would prefer to have an opportunity to form my thoughts better and be able to submit something in writing to address that question.

SENATOR SABINA PEREZ: Yeah, I think, yeah. Thank you. I appreciate it, I definitely look forward to that. You know, it seems to me that there seems to be no one person in charge. And that's what makes it difficult, right, to really enforce this. Everybody has a piece of this, but you know, who's really kind of overseeing the overall impact, right? So yeah.

JEFFREY QUITUGUA, TECHNICAL GUIDANCE SECTION, DEPARTMENT OF AG. : Excuse me, Senator if I may, can I go ahead and answer, try to answer your question from under my purview with the program here at Department of Agriculture?

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Could you please identify yourself for the record?

JEFFREY QUITUGUA, TECHNICAL GUIDANCE SECTION, DEPARTMENT OF AG. : This is Jeffrey Quitugua.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Department of Agriculture?

JEFFREY QUITUGUA, TECHNICAL GUIDANCE SECTION, DEPARTMENT OF AG. : Yeah. Yes. And to answer your question, Senator Perez, with clearing and grading

permits, especially like in this scenario you provided, if there are trees in those areas, that's one of the things that we go out and do site inspections for.

Granted that if it's less than one acre, we go out, do the site inspections and then we determine what species they are. In 2015 Fish and Wildlife, proposed several plant endangered native plants that were put into the federal endangered species. Some of them are found in the cliff areas. Like an example would be the bianii is there, is the species name Eugenia Bianii. It's known to be like in the face walls of areas. You see that like in Tanguisson and Hila'an area throughout the coast and East and North, Northern Guam. But yeah, it is definitely looking at what the tree species are found in those cliff walls, and then even just making sure that, you know, it's downsizing or limiting just to protect those protected species that are found in those areas.

So it doesn't really stop it, but in some cases it does because some of these contractors do not want to meet with Fish and Wildlife Services. It's a long process to get permits through their office and their reviews. So that's why they would just like sometimes just rescind their permits. And we've had that in some occasions with some huge development plans that were coming through.

SENATOR SABINA PEREZ: Okay, thank you. So this question is for Edwin Reyes from the Bureau of Statistics and Plans. So I understand that you're revamping the, I guess, the land use plans or coming developing a comprehensive plan for. Do you see this as an opportunity to maybe add enforcement measures onto making sure that land use is compatible with adjacent neighbors or just in general you know, farmland, like you mentioned, you know, you think that you were stating earlier that, you know, any kind of mineral extraction isn't compatible with agriculture because it's, it's removing that substrate altogether. Do you see or maybe can you recommend any kind of enforcement, any kind of recommendations regarding enforcement on that?

EDWIN REYES, ADMINISTRATOR, GUAM COASTAL MANAGEMENT PROGRAM, BSP: Yeah, so certainly going forward with the Guam sustainability plan and providing that document will provide a reference point to be able to address the different development challenges of our time.

And what we hope to achieve is to be able to have an inclusive process with the community of Guam, which is required by law, in which we develop a plan that is not only enforced by regulatory agencies, but understood by people. And so this would be a document that I think should live up to the bureau's statutory authority and should

live up to the requirement that this is a decision document that needs to be referenced in order for agencies to be able to make decisions.

So if you look at, you know, conflicting uses, there are entire chapters in the north and central land use plan that says why quarrying would not be a good thing for the environment. Quarrying in our mind is only allowed in the M-2 zone. So anytime that there's a quarrying activity that's in any other zone other than M-2, our office would object to that use.

The challenge we have is getting other agencies to say, yeah, you know, at BSP we believe in your plan, and we think that we can base our position to object and join your objection based on that comprehensive development plan. And again, I brought up that statute because a comprehensive development plan is supposed to be applied to all agencies, instrumentalities of the government as a planning tool and a policy tool.

But when we do update the Guam sustainability plan, our mission and our objective is to ensure that that is fully enforceable.

SENATOR SABINA PEREZ: Okay. Thank you for that response. I guess the question is for Dr. Jenson from WERI. So in regards to quarrying, I guess this is this assumption or basically this thought that if the quarry happens in, you know, more of the coastal areas, there would not be an impact to the aquifer.

DR. JOHN JENSON, DIRECTOR, WERI: Yes. Well this has opened up a whole new perspective for me. I haven't been involved in this question of clearing and grading and trying to find a definition that distinguishes between that and quarrying. Quarrying to me, has been the kind of quarrying that Smithbridge or Hawaiian Rock does, which I can say, you know, with high confidence that, you know, that kind of quarrying is going to be restricted to the coastal zone because that's where the limestone for reasons related to the geologic history is, is hard and makes your useful aggregate for engineering construction purposes.

So, if quarrying is after industrial grade rock, yeah, it's going to be outside of the water producing zone of the aquifer. Now, I mentioned the DPW quarry is in an interesting location because it has a history of, you know, where it was opened up to obtain fill material and it's still useful for that.

It's useful to me because it's the best exposure of the rock that constitutes the aquifer. That's why for the aquifer field trips, we go to that quarry because that's the Barrigada

limestone, which is the core of the aquifer. And it's fortuitous that we have that, and like I say, it's, it's well maintained and well operated. So it's not a threat. And I want to make that clear that you know, when the time comes to close it, then we might want to think about what sort of actions are going to be necessary and that begs the broader question of what do you do with industrial quarries that are closed? And that's a question that every jurisdiction has to deal with. I'm sorry, Senator, I might be drifting. Is it addressing your question?

SENATOR SABINA PEREZ: Yeah, just you were confirming, but I just also wanted to ask, have there been studies on the impacts of those quarrying? Because I imagine there's studies about seeps, right? Discharges into the marine environment and has there been studies in regards to pouring on the coastal areas how it can impact our coral reefs? And does it, you know, potentially, is there an impact as we hear, I guess recently, with the CIS conference that there's an impact to sea level rise on, you know, the water lens, that it could be diminishing our water lens.

And so yeah. I'm just wondering if there's any studies, up to date studies, regarding quarrying in coastal regions in regards to both the marine life in addition to the water lens. You know, if you think about it, anything in the coastal regions can act as a buffer, you know, for inland activity.

You know, we see that with our coastal strands buffering, you know, buffering the winds to protect, providing these micro environments. So as you're removing these layers of things in the coast, basically we're creating, we're destroying an ecosystem and affecting the inner ecosystem.

So as we know, things are interconnected, right? And I think our aquifer is one of, you know, a natural wonder. It took millions of years for it to develop. And you know, I just want to exercise caution when we're talking about quarrying because to me it's a non-renewable resource because it was not created in our lifetime, right?

It's going to take another, you know, millennia to develop, you know, beyond our lifetime. And you know, I think any kind of policies that we put forward, we really have to think about sustaining ourselves and quarrying is not sustainable in my view. Yeah. So I think that's what I guess the comment I would like to make regarding that. If there were to be any studies that we can produce, looking at the impacts of quarrying on the marine environment in addition to the water lens. I think that's something that I would like to recommend at this time.

DR. JOHN JENSON, DIRECTOR, WERI: There have been no systematic studies of local impacts. I guess my sort of off the cuff thought on that is that the quarrying that we have going on now is in the most appropriate location and the kind of location that I would suggest. Obviously we have to have some quarrying. The material that comes out of Smithbridge, the material that comes out of Hawaiian Rock, and it used to come out of Perez Brothers, and it comes out of the DPW quarry is essential to our economy.

And so, as long as it's properly conducted and properly regulated, I think it can be done in a way that's safe. And there's no, I guess I don't have any particular concerns about the quarrying that is taking place now. It's just a matter of defining some of these other activities. I guess that, to make sure that they're being done appropriately.

SENATOR SABINA PEREZ: Okay. Well, thank you Dr. Jenson. I know my colleagues would like to ask questions as well, so yeah, we do appreciate it. If you can provide any written testimony as well.

DR. JOHN JENSON, DIRECTOR, WERI: Sure.

SENATOR SABINA PEREZ: Again, I would like to put a plug for any kind of studies on the impacts.

DR. JOHN JENSON, DIRECTOR, WERI: Yeah. Okay. Well, I'll certainly think about that and we'll look into that.

SENATOR SABINA PEREZ: Okay. Great. Thank you so much. Thank you, Madame Chair. Thank you.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Thank you Senator Perez. Senator Taitague, you're recognized.

SENATOR TELO TAITAGUE: Thank you Madame Chair and good afternoon already. I think it's afternoon. Yes, or good evening, almost. Good afternoon everyone. Thank you so much for being here. Great information. I'd like to also commend Edwin for providing the information, but not only that, making recommendations in certain areas such as building permit, clearing and grading, Guam Land Use Commission, CLTC leases, and legislative spot zoning. These are areas that I think we really need to look into and clear up and clean up and ensure that our environment is also protected at the same time.

That brings me to the question. I don't know who, maybe Vince you can answer this question with regards to who holds the data as far as you know, how many mineral mining sites there are on Guam. How many have expired? How many are still active? Do you keep that data and information?

VINCENT ARRIOLA, DIRECTOR, DPW: Senator, I know DLM, Land Management, has some because they get licensed via the Guam Land Use Commission, right? We keep data based on some of the permits that have come through here for clearing and grading. And as I understand, some may have turned into some form of a quarry type operation, and we've NOD'ed those to stop their operations. So, you know, we keep data on that. We can, you know, as we were going through this clearly, I think more information needs to be gathered from all the different agencies. And so we'll put something together from what we have, from the information that we have and turn it, submitted into the committee to include that and inventory of what we believe our quarries or mineral extraction sites throughout the island.

SENATOR TELO TAITAGUE: Thank you Vince. And, and thank you Joe too for coordinating with DPW to provide that information. So then again, it's like the number of government owned sites that are leased for mineral mining and those that have been obtained by Guam Land Use Commission, how many of those sites are active but have not received Guam Land Use Commission approvals into the private sector. How many, you know, this data is very good information to have. I'm glad we had this public hearing so that we can get that put together.

VINCENT ARRIOLA, DIRECTOR, DPW: We'll give you a lay of the land, so to speak …on course.

SENATOR TELO TAITAGUE: Absolutely. And I'm hoping that with BSP's contribution into this data information to provide a land a map to actually oversee where these mining sites are. It would be very helpful.

And I don't know if it's inclusive to, but when Senator Perez was bringing about how one particular area where it's just like cut off, you know it looks like a quarry, but they're kind of doing it to expand the property and cutting into the cliff line. A good example is that Hotel Bayview in Tumon. You know, coming down the hill from Horizon and going down Tumon, Bayview, that side there, I mean, it's a humongous wall that's gone up or not gone up that been cut into, it's almost like a wall. It's kind of scary to park back there because rocks can fall down, right? You know, things like that. I mean, to me it's almost like someone was just utilizing this area to get more material,

you know or rock that's needed. But I'm hoping things like that too can also go into the data as well, even though it might not have been given a permit as a quarry site or mining site, that would be great to have. Also with DPW mentioned earlier as well, Vince, the Mining Safety Administration. Is that correct? Am I saying that right?

VINCENT ARRIOLA, DIRECTOR, DPW: Yes. Okay. Yes, ma'am.

SENATOR TELO TAITAGUE: So what bearing does it have with regards to OSHA's responsibility? Because as you know OSHA has, you know, rules and regulations and with regards to their, well, it requires, OSHA requirements covered Guam's, public and private sector employees and employees conducting their mineral mining operation. And these rules and regulations are stringent requiring a safety inspector to be present during operation. So is it, OSHA that oversees this or does DPW send someone to oversee the operations of such?

VINCENT ARRIOLA, DIRECTOR, DPW: Well, for of the quarry, our GovGuam quarry we, actually, OSHA and MSHA are kind of in intertwined in the operation of that, you know, they each have their respective areas of responsibility. But primarily at the quarry, we run under MSHA. And you know, we're required to have our employees, as I mentioned earlier, go through a specific training to operate and work within a quarry.

SENATOR TELO TAITAGUE: And how does OSHA play into this?

VINCENT ARRIOLA, DIRECTOR, DPW: I believe other health or safety factors that may arise within or outskirts of you know, within the confines of the quarry itself.

SENATOR TELO TAITAGUE: Mm-hmm. Okay. Are there any known interests of companies wanting to lease government property for mineral mining currently?

VINCENT ARRIOLA, DIRECTOR, DPW: That I would not know Senator. I don't have any information on that. At all.

SENATOR TELO TAITAGUE: I'm glad it was brought up regarding the selling of aggregate or the use of aggregate that was mentioned earlier. I'm not going to go into that because we already know. It's on the radar with regards to that. So the data, very interesting stuff and it's ironic because the other day I was taking my father to Andersen and we decided to go to the back road and it's been a while since we've gone in that direction, you know? And to see what's going on in that area, it's just amazing, you

know how much digging is going on, you know, for materials. And Smithbridge, I didn't even realize had such a huge presence in that area as well. One of my biggest concerns, and it was also brought up too, is the after effect. You know, what do we do? Because once, and I think ,I don't know which agency brought it up, maybe Chelsea, once you know, this mining is done and they're finished with using whatever they need, I mean it's unusable afterwards and what do we do then? So it's kind of like an exit plan that needs to be put into play. So I hope this will also be addressed. And thank you Madam Speaker. This is such good information and appreciate..Oops, sorry. Sorry about that. Appreciate the time. Thank you.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Thank you very much Senator Taitague. Senator Nelson, you have the floor.

SENATOR TELENA NELSON: Thank you, Madam Speaker. Where to begin? I think we just by hearing a lot of the input from the agency leads and those that are very familiar with the statute and the current laws, I think we need to create, it looks like we are heading down this path where we need to create a law addressing the definition of quarry and addressing the definition of aquifer, especially because of a lot of the things that are being built today and the most recent developments. But I do have a question for Mr. Borja. Mr. Borja from the Department of Land Management. Good afternoon, sir. The question I would have is what is the current system that Department of Land Management uses to take inventory of the properties of Guam? That's you, Mr. Joe from the Department of Land Management. Madam Speaker, can you please ask Mr. Joe if he could ask the answer the question? Okay. I think he left.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: We'll call him up. Yeah, we'll call him.

SENATOR TELENA NELSON: Okay. There he is.

JOE BORJA, DIRECTOR, DLM: Senator I missed that. We got disconnected.

SENATOR TELENA NELSON: Yes.

JOE BORJA, DIRECTOR, DLM: Right after your set. This is Joe Borja.

SENATOR TELENA NELSON: Yes. What is the current software or program that you utilize at the Department of Land Management utilizes for the inventory of the properties of Guam?

JOE BORJA, DIRECTOR, DLM: For the inventory of the properties in Guam, private properties, government properties, or properties in general? It's a software that developed by NextGen vendor. It's called the land…..I'm sorry?

SENATOR TELENA NELSON: Are you able to view the properties in real time?

JOE BORJA, DIRECTOR, DLM: Not necessarily. Are you looking at an aerial photograph or the status of the property? The record of the property, record of ownership, for example.

SENATOR TELENA NELSON: How far back does the recording of the property show? What is the lag time from real time to, if I wanted to look at a property and see if they are doing any type of quarry, how far back or how recent would I be able to view that property's activity?

JOE BORJA, DIRECTOR, DLM: On an aerial photograph or on the ownership document? Or the planning document, for example, the GLUC document.

SENATOR TELENA NELSON: What's the difference?

JOE BORJA, DIRECTOR, DLM: Well, the difference is when you say you want to view the property, I mean, are you actually looking for a photograph of the aerial photograph of the property, or are you looking at the application maybe for a quarry relative to that property?

SENATOR TELENA NELSON: What is the difference between the three options that you just asked? What is the difference?

JOE BORJA, DIRECTOR, DLM: One of them said aerial photograph. And I believe the most recent aerial photograph that we have is 2018 that we use with our tax. We also use Google for planning purposes. That's not necessarily linked in by government law. The other one if you're looking for the ownership of the property you know, we can go back to Spanish time, to the Spanish records order.

Now, if you're looking for the use of the property, for example, to see maybe when a quarry started, we do have records at planning division. But those you know are only specific to those properties and if an application is made. I would in terms of looking to see if the property was actually used for a quarry, I think the oldest photographs that we have, aerial photographs are 1970 and then in 1994.

Google has a function of historical images. So you can go back, I think, to 1993, you know, on the Google map and see the evolution of that site from 1993 to 2018. I believe there more recent like that. So there's different types of information you can get for them.

Like I said, if you wanted to see the history of a quarry site in terms of what applications or what permit for granted to them, yeah, DPW and land management should have those records. If you're looking for an aerial photograph to see whether the property was disturbed or no permit, just to see, you know, what activity you can use that 1994, that auto-graphic photos.

And you can also use Google back to 2003, I believe is the earliest photograph of one that.

SENATOR TELENA NELSON: Thank you. So you do not have any software...Department of Land Management does not have programs or software that can track real time development or build within the island of Guam? Satellite imagery, you know?

JOE BORJA – DIRECTOR DLM: Yeah, we do with the permanent applications, you know, but those are like a database. They're text files. They're not, you know, photographs.

SENATOR TELENA NELSON: Yeah. Satellite imagery.

JOE BORJA – DIRECTOR DLM: Yeah, we have that. Yeah, it's not necessarily specific software. We basically use Excel to track these applications.

SENATOR TELENA NELSON: Okay. Thank you, Mr. Borja. Director Arriola, how many underground quarries does Guam currently have operating right now?

VINCENT ARRIOLA, DIRECTOR DPW: I'd estimate maybe about a dozen. Maybe about a dozen. Yeah. And, as I mentioned to Senator Telo Taitague earlier we'll put an inventory together to include location. Hopefully we can get at least some size information as well. And we'll turn it into the committee.

SENATOR TELENA NELSON: So why haven't these quarries been shut down?

VINCENT ARRIOLA, DIRECTOR DPW: I know two have been. I don't know about the rest. Some might be operable, some might not be operable. I'd have to look into that.

SENATOR TELENA NELSON: Yeah. Okay. Do you agree that Guam needs to establish a statute to regulate what quarrying is?

VINCENT ARRIOLA, DIRECTOR DPW: I think at the very least, is to define quarry, the operations of a quarry, the standards of a quarry. And I think we should base it on a lot of the OSHA and MSHA requirements.

SENATOR TELENA NELSON: Okay. And how does DPW justify a permit that was approved for excavated materials to be used for back fill to other construction projects? How do they justify that as not being a quarry?

VINCENT ARRIOLA, DIRECTOR DPW: Repeat that again, Senator.

SENATOR TELENA NELSON: How does DPW allow the scope of work for excavated materials to be used for back fill projects to other construction projects as not a quarry activity?

VINCENT ARRIOLA, DIRECTOR, DPW: Yeah. So without having that specific project in mind, it could really depend on the design. You know, the design could be as deep as five feet. I don't know how large the project is and what the volume is of excavated material. You know, you could excavate as low as two to three feet and you could excavate as, as far down as 60, 70 feet. Just depending. So it would really depend on the design and what it calls for.

SENATOR TELENA NELSON: So the estimated quantity on this specific permit is 26,000 cubic yards. That's to be excavated.

Zenon Ballinger, Chief Engineer, DPW - That's quite a bit.

VINCENT ARRIOLA, DIRECTOR DPW: Yeah. I've got our chief engineering, he's mentioning that's quite a bit. I'm going to have to look into that because I don't expect exactly what that is. What if in fact is a specific quarry or a clearing and grading permit or something that went over the bounds of perhaps a clearing and grading permit.

SENATOR TELENA NELSON: You're absolutely right. This was intended to be a clearing and grading permit that met all the requirements by statute for a clearing and grading permit. However, on the front cover of the permit, it gave it authorization to act as a quarry for moving back fill to other construction projects in the excavated cubic yard amounts, estimated quantity of 26,000 cubic yards.

VINCENT ARRIOLA, DIRECTOR DPW: That's a lot. That's a lot, Senator.

SENATOR TELENA NELSON: It's a quarry.

VINCENT ARRIOLA, DIRECTOR DPW: Yeah. Yeah.

SENATOR TELENA NELSON: This is my concern is that we're issuing these erroneous permits for specific corporations and everyone seems to be okay with it because it's still continuing.

VINCENT ARRIOLA, DIRECTOR DPW: Yeah. I don't know if...you know, I'd have to really take a look at that specific one. Like I mentioned, I know we've stopped a couple quarries and I believe some of them might be for that same reason. They came in asking for X and they went out there and did X, Y, Z. And so you know that's one of the reasons why we….We do have inspectors out there. We can't catch everybody. But, you know I think the good, maybe part of the good part is that I think we've got I'd say about 11, maybe 12 quarries or some, you know, that might fall under the definition of a quarry. So you know, we're going to have to go out there and see what….

SENATOR TELENA NELSON: And were not properly permitted or passed through the GLUC?

VINCENT ARRIOLA, DIRECTOR DPW: Right. Yes, ma'am.

SENATOR TELENA NELSON: So what kind of consequence do these corporations received?

VINCENT ARRIOLA, DIRECTOR DPW: Well, I…,

SENATOR TELENA NELSON: When government gives them the authority to blindly perform this type of scope of work.

VINCENT ARRIOLA, DIRECTOR DPW: Well there's two things that I see immediately. I'd have to look more into it, but certainly one is we could issue them a stop work order. We could issue them a notice of violation. And then the third one actually is we could take, depending who the contractor is, we could take them to a hearing before the contractor's license board.

SENATOR TELENA NELSON: Okay. I look forward to that. I'll come visit.

VINCENT ARRIOLA, DIRECTOR DPW: Yeah. But, but I understand where you're coming from. They come in for X and they go out there and then they do the XYZ. They do much more than what was really intended on the application and or the design. I agree with you, Senator.

SENATOR TELENA NELSON: Thank you very much Director.

VINCENT ARRIOLA, DIRECTOR DPW: Yeah.

SENATOR TELENA NELSON: Madame Speaker. I just have a question for EPA if they're available.

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: So this Captain Brian Bearden here.

SENATOR TELENA NELSON: Hafa Adai Cap. How are you doing? I have this constituent's email and it was sent to the Environmental Protection Agency, and the concern was that this quarry or this property there's a corporation that is supposedly clearing and grading. But however, there is evidence of this corporation removing, transporting and selling processed material on a daily basis.

They did not view any protective measures that prevent dust and noise pollution, pollutants affecting adjacent landowners. And you spoke of this earlier. And there was no form of watering or wetting access roads to and from their project that drastically affects adjacent landowners with extreme hazardous dust going on their properties.

And so, you know, when you start to process material like limestone, you get this dust and you can inhale this type of dust and it becomes also a health hazard for the neighboring areas. There is no meter to ensure that there is water that is utilized to prevent this dust spreading into other adjacent areas.

There is no federally certified safety officer that is operating at times to ensure that they are compiling. And this is required by federal mining laws that are now applicable to mining operations in Guam. How is this, how is this kind of corporation still able to operate as per the EPA requirements?

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: Yeah. Well, there's two parts of that, so I'll let Roland get to his part, which is going to be the dust control and such. As far as the permits go, as I mentioned, beginning in FY 2020, we began to enforce the application requirements for these activities that are conducting what appears to be quarrying where they have, we are requiring them to give us a copy of their GLUC conditional use letter.

SENATOR TELENA NELSON: And if we don't have one?

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: If they don't have one, we don't issue them a renewed permit. I think one of the issues that we have right now though, is that we don't have a really solid grip on how many of these are out there. And when their permits expire. I think I probably know the property you're talking about, and they are coming in for renewal now and so that's going to be something that we address with them. And if they continue to operate without a permit, then they're in violation of our earth moving or our soil erosion control regulations.

SENATOR TELENA NELSON: But how are they continuing to operate now if the situation was brought up?

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: Yeah, if it's the one I'm thinking about, that's the last permit that we let through when we were still under the impression that we were letting DLM make that determination for us. And so now they're up for renewal and we will treat them in accordance with our new procedures.

SENATOR TELENA NELSON: So..

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: But like I said, we don't have the best procedures right now, which is something I'm working on to track these existing operations to make sure they have a current permit. We have a, you know, we've had a

couple of very large enforcement actions against some of these big companies for failing to renew. And then, you know, we're hoping that it serves as deterrence. But we're still trying to find other ones and go after them with our limited resources, I'll throw that out there too. I write most of these myself, and it's tough to do that in addition to everything else.

SENATOR TELENA NELSON: So what is the consequence or fine that EPA can issue to these corporations for performing this illegal function?

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: Well, the last one that we did, and I just for the sake of not trying to cause any controversy, I won't say against which company, but it was, we charged them, I believe it was a certain amount per day. I forget what it was, but they hadn't renewed their license in well over a year. So it ended up being a very large fine. It was above the cap that we had at the time of 125,000. We settled with this company and they paid us 5,000 and then they diverted 120,000 to the Guam Trades Academy to fund the Erosion Control Contractor Certification Course that was put together by Guam EPA and NOA many years ago. And that's now a permit condition of all the permits we're issuing is that every contractor that gets a current permit from DPW, has six months to get that certification and by the end of this year, we're going to start requiring that as a permit application requirement. So we're trying to get people trained so that they, that's what we did in that case. So in that case, it ended up being a $125,000 fine. As you guys know the legislature lifted the cap a while back, so that fine could be much larger for any future corporation that we find doing the same thing.

SENATOR TELENA NELSON: And how, how can we at the legislature help you with resources to provide support for this enforcement piece?

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: Well, I don't know if I'm allowed to say it, but from my point of view, resources exactly what we need. We need more people, we need more vehicles. We basically need funding. We get some federal funding on my end. I try to get more federal funding, but that has tags, you know strings attached to it. We can only do certain things with that federal funding when it comes to enforcing these local Guam laws. We really need local funding to do that.

SENATOR TELENA NELSON: Okay. Is there a lot of there somewhere for, or like a force structure that you have developed or that EPA has developed to request for additional personnel?

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: I'm sorry, could you repeat that?

SENATOR TELENA NELSON: Is there a plan or any type of force structure that you have requested to acquire additional personnel to help with the enforcement piece?

BRIAN BEARDEN, US PUBLIC HEALTH SERVICE CHIEF ENGINEER, WATER DIVISION DIRECTOR, GUAM EPA: Yeah, I can't answer that. That would be at our administrator's level, and both he and our deputy administrator were unable to make it today. So I just can't answer that. I can tell you from our end, we continually request more resources to them to ask more.

SENATOR TELENA NELSON: Okay. All right. Thank you. Thank you Madame Speaker. I don't have any questions. You know, I'm just a little bit concerned. Well, not a little bit. I'm very, very concerned because we're aware that there are underground quarries. And this has been a common practice and I really applaud your efforts in, in moving forward. And I hope that we can come up with some type of bill that accommodates this illegal activity in protecting our resources, in protecting our aquifer as well. I mean my concern also is Dr. John Jenson. I don't know if I heard incorrectly, but you weren't too concerned about the quarry activities impact on the aquifer, is that correct?

JOE BORJA – DIRECTOR DLM: Well, the big quarry activity, say it's Smithbridge or Hawaiian Rock, is on the coast where the aquifer is discharging. So it's not any threat to the production of water for GWA, for instance.

SENATOR TELENA NELSON: It's just hard rock.

JOE BORJA – DIRECTOR DLM: Yeah.

SENATOR TELENA NELSON: Concerned about hard rock. So the other quarries that are in operation, there is a concern.

JOE BORJA – DIRECTOR DLM: Yeah. See, I don't know. This has been a real education for me today. I didn't know about this world that you all deal with of clearing and grading and people defining stuff as quarrying in order to do something that is different than what they're about.

So, you know when I think of quarries, I think of the legitimate operations that are going on and have been well managed for a long time and I'm familiar with, what's going on and comfortable with the way they're, manage things. Hawaiian Rock and, and Smithbridge and DPW's quarries is, is well managed.

But this is a whole other world that you're and yes, I think one of the key steps that you'd want to take would be to develop a definition that addresses the concerns that you have because you've absolutely got to have a clear definition. And we can certainly help you with that.

SENATOR TELENA NELSON: Thank you. So now that you as a representative of WERI is aware of these issues, can you, do you plan on taking any forward plan on taking, seeing this impact on an aquifer?

JOE BORJA – DIRECTOR DLM: Well, we fund. I guess. I don't have any source of…. I guess I need to think about exactly what the problem, I need to understand the problem better in order to know just what to address. I mean, I certainly agree that those kinds of problems are worthy of studying, but since I'm just now finding out about this, I have to have to know a little bit more about what the problem would be.

You know, we study problems one at a time as they come before us and we have to find a principal investigator who knows something about that subject and puts together a proposal. But if this is… first we have to define exactly what the question is. And, and I don't, I'll just have to confess, I don't know enough about the clearing and grading kind of problem to frame a research project out of it yet. But, but we certainly could.

SENATOR TELENA NELSON: Will you be able to make that effort to create the hypothesis and all those things with your current staffing pattern?

JOE BORJA – DIRECTOR DLM: Well we can put it on the list of things to study. Our problem is, I mean yeah, we have to work with the resources we have. I have a faculty of five researchers and dozen graduate students at any particular time.

And we have a process for identifying projects and we can certainly put that into the process. But I'd certainly be interested in following up with you and talking to your staff about what we might pursue.

SENATOR TELENA NELSON: Okay. I have, you know, I just have another question and this might be a little bit off topic Madame Speaker, but it does involve the aquifer. Are you, I'm pretty sure you're aware of the situation that Hawaii is facing.

JOE BORJA – DIRECTOR DLM: The Red Hill, the Red Hill problem?

SENATOR TELENA NELSON: Yes. Do you foresee us having to...do you foresee Guam eventually having this type of impact as we move forward in this towards the development of accommodating additional military forces on island?

JOE BORJA – DIRECTOR DLM: You mean a problem of a large scale fuel release of some kind?

SENATOR TELENA NELSON: Yes. And I mean the problem also of the contamination on our aquifer where we're not able to consume our own water.

JOE BORJA – DIRECTOR DLM: Well,….

SENATOR TELENA NELSON: Is there any studies being done? Are we examining the impact now that we're seeing? Are we tracking data? Are we pulling water out of the aquifer?

JOE BORJA – DIRECTOR DLM: Well, GWA and Guam EPA monitors the water that comes out of the aquifer for standard sorts of contaminants and, we don't ah…

SENATOR TELENA NELSON: But don't you do research on water quality?

JOE BORJA – DIRECTOR DLM: We do research, but we don't do regulatory monitoring. We have a close relationship with those who do. So we're aware of those. But I can't speak for what's monitored, but you know, to my knowledge, we don't have a problem such as they have at Red Hill. That was a substantial failure of a system. I mean, every community has the potential for failure like that.

SENATOR TELENA NELSON: Do you see Guam getting there with that potential? Do you see Guam with that type of potential in another 15 years?

DR. JOHN JENSON, DIRECTOR, WERI: Well, the risk is there by virtue of having fuel lines and fuel tanks and whatnot, like any community. The way that we cope with

their risk is by good management and good regulations and enforcement of those regulations. And as long as we do that, you know, I don't think we're not mismanaged. I think.

SENATOR TELENA NELSON: Okay, so what if we reboot the fuel threat and we include the septic tank issue in the northern aquifer. We include the unregulated quarries, the underground quarries on the northern aquifer. We include development on the northern aquifer without any proper, what is it? Runoff path? Do you see Guam.. Have you done an assessment on all of those things and had any way to do an assessment? 10, 15 years? What, what our water system would look like, what levels of contamination, like predictions and levels of contamination that our water will have because of all of these different types of impacts. Oh, and then we have the rounds, the lead from the rounds that will be shot in the northern aquifer. So there's all of these activities that are going to happen within the next two years. Have we done an assessment and that are occurring now? And then just layering on top of additional activities that could impact the aquifer.

Have we done like a thorough assessment of what can impact us in the next 10 to 15 years as far as our water system, our water availability, the contamination of a water? Have we done anything like that?

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: Senator, Senator Nelson. Hi, I may. I'm Mauryn McDonald, Acting Chief Engineer, and I can speak to some of these.

SENATOR TELENA NELSON: Coming in broken.

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: Okay, let's see. I'll go here. Can you hear me better?

SENATOR TELENA NELSON: No, there's, there's something wrong with the mic.

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: Okay. Well, I try to closer to the mic. To the microphone. Does that help any?

SENATOR TELENA NELSON: No. Do you have another, another mic you can use?

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: I don't have another mic. I can try to get on my phone. Let's see, it takes me a moment. What I can do is

provide something in writing to you. We do have some studies that have been done some activities. We've also are working with the One Guam Team with the military to establish new monitoring wells in northern Guam. Dr. Jenson is part of that working group and those wells and the drilling of those wells to monitor the aquifer are being funded by military grants as part of the building activity.

SENATOR TELENA NELSON: Is this going to be in the fence or outside the fence?

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: Some are in, I believe there are a couple, there are a couple that are within the fence line. I'm not very familiar exactly with the property boundaries, but we do have maps of those wells and we are basically undertaking that to monitor impacts on the lens as we extract more and more water.

DR. JOHN JENSON, DIRECTOR, WERI: I can speak to that.

SENATOR TELENA NELSON: Okay. Thank you. Dr. Jenson.

DR. JOHN JENSON, DIRECTOR, WERI: The One Guam Initiative is..

SENATOR TELENA NELSON: I'm familiar with it.

DR. JOHN JENSON, DIRECTOR, WERI: I'm sorry.

SENATOR TELENA NELSON: I'm familiar with the One Guam initiative.

DR. JOHN JENSON, DIRECTOR, WERI: Yeah. Okay. That includes the monitoring system, expansion and rehabilitation program, which is going to install seven additional wells on military installations, which will augment the seven wells that we have outside the fence that are the legacy of the 1982 Northern Guam Lens Study. That'll give us the capability for monitoring the response of the lens to pumping and changes in natural recharge in every one of the developed areas, the well fields in all but one of the six basins in the aquifer. And pumping and over pumping and the salinity of our aquifer is by far and away the primary threat to the thing that needs to be vigilantly monitored and it is being vigilantly monitored. And we have as Mo was just mentioning the putting the system in place, it's going to give us probably, you know, I'll have to say, of all the communities anywhere we've probably got the best system for monitoring the effects of pumping on the aquifer of any jurisdiction, community I know of anywhere.

When I mention this to the other directors in the other 54 states and territories, at the directors meetings, they're amazed at the level of cooperation we have with GWA and now with the military to monitor the aquifer. So we have a good system and it's well managed.

SENATOR TELENA NELSON: Okay. So will we be able to get data on what is found?

DR. JOHN JENSON, DIRECTOR, WERI: Those data are..

SENATOR TELENA NELSON: The findings from these initiatives that you're implementing?

DR. JOHN JENSON, DIRECTOR, WERI: Sure.

SENATOR TELENA NELSON: Okay. Yeah. All right. So these wells that are being installed in the military facilities, is it just specifically to monitor the aquifer or is it also to provide additional water within the base itself?

DR. JOHN JENSON, DIRECTOR, WERI: No, it's strictly to monitor the aquifer. These are wells that go all the way through the lens, down into the salt water. And, so we can see how the lens thickens and thins over time. And we have a record now of going back to 1982 for some of those wells. And now we're yeah, I'd be happy to show you some of the findings that have come out of that. It's really, really interesting.

SENATOR TELENA NELSON: I look forward to it. Okay. Thank you Dr. Jenson. And thank you Ms. McDonald. Yes, we do look forward to seeing the impacts that you've projected, that you spoke of earlier on the current activities and future activities on the aquifer. If it wouldn't be too much to ask, if you could send it to the speaker's office, so that…

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: Certainly.

SENATOR TELENA NELSON: Thank you so much.

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: Sure.

SENATOR TELENA NELSON: Thank you ma'am.

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: I have to apologize. I have to go to a meeting. My daughter is waiting for me to pick her up, but I'd be happy to provide any other information that you'd like to have and the Speaker's office does have my email address and contact information.

SENATOR TELENA NELSON: Thank you. Thank you so much.

MAURYN MCDONALD – ACTING CHIEF ENGINEER, GWA: Okay. Thank you.

SENATOR TELENA NELSON: Have a good day. Thank you Madam Speaker. I appreciate the time. I don't have any questions.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Thank you, Senator Nelson for the very good questions. I think you really hit it on the nail. So yeah. As we demand for the aggregate goes up at this stage of the military buildup, where the construction phase is very, right in the middle of the construction phase, so too, does the value of that aggregate go up, and I believe the pressure on our agencies to approve the permitting of the removal of this aggregate.

This is supported by at least two known proposals for public lands, which seek to extract minerals from these properties under the CLTC and the Guam Ancestral Lands Commission. I'm sure there are other efforts to secure land in the northern parts of Guam for additional aggregate removal. There's still some unsettled business with the current lease of the Guam Raceway Federation, who also is conducting mineral extraction, despite the prohibition of that on CHamoru Land Trust properties. The Guam Natural Resources Board consisting of the Guam Land Use Commission has jurisdiction over the proposals for the use, lease or purchase of government land for the purpose of commercial mining or removing any minerals, rocks, or sand for processing it.

It appears from this law that the Guam Natural Resources Board has the authority to adopt rules that will regulate mining on public lands and engage the people through public notice and public hearings on these projects. But as we've heard from the agencies, and I am so very grateful to each of you for sticking it out with us and for doing a lot of work in preparation of this hearing, to give us the concrete recommendations that you have. You know, it's clear that the threshold between what is considered grading and what's considered quarry needs to be more adequately defined. And in order to be more adequately enforced, and the enforcement gaps, of course, need to be closed. I think the definition of quarries limiting the exemptions of the

grading limits as Captain Brian discussed. And the other recommendations from the Department of Public Works and the other agencies. I'm going to take all of them into consideration. Yes. Director Borja, you had your hand up?

JOE BORJA – DIRECTOR DLM: Yes. I'm sorry to interrupt. If you can go ahead if.. I just want to say a couple of points maybe before you adjourn the informational briefing or like I can do now, but I really apologize for interrupting you Speaker.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: Okay. Please proceed.

JOE BORJA – DIRECTOR DLM: I have only six points, you know, and I think maybe your staff might be really good to take this concerning the aquifer. I'll start actually with the most serious thing. In that you know, quarrying, mining extraction and all that, really in the law, it's kind of like almost two separate commissions or boards that are looking at it.

One, of course, is the Natural Resources Board, which was established in about 1998, 1999. But even up to 2008, the Land Management had not created the, you know, the rules and regulations for that board. And in 2015 there was a request made of the legislature to what is the status of the Natural Resources Board, because I believe Speaker Forbes at one time had introduced a bill that I believe may have become public law, that those boards and commission that hadn't met in two years are, you know, wiped off.

And the Natural Resources Board is only for government land. And if you read the statue a little bit deeper, its function is actually just to study and evaluate, but it says, may recommend to the Governor. Meaning to say, I think that maybe the governor has some input into approving these applications to lease, sell or buy these lands on it.

And of course, the private lands or private quarries, if you might say, is actually handled under the TLUC. So right now, this group that presented all this information is a very esteem group. We've got all sorts of information from them, but we're looking at it from the tail end. You know, what happens if a quarry doesn't operate right?

But I think we have to go back to the foundation of the law and take a look at the GLUC and the Natural Resources Board. Now they're both one and the same, but why should the, you know, the government, the public lands have a different set of rules. And approval of mining specifically states mining in that, you know, is up to the board, and it seems up to the Governor. Number two. So we need to look at both of those laws and

to see if we can combine them and make one standard, you know, for mining, quarry or mineral extraction. So you're going to have to take a look again also at the zoning code because while it's allowed in M-2, and it's permitted in agriculture extraction in the agriculture zone there is that thing, you know, what do you do with agriculture?

You plant right in the soil, and if you can extract it and take it out, then you know, at the point that Edwin made is that you know, it's no longer really agricultural land. If you continue on that.

Thirdly, there needs to be some legal definition of aquifer versus the groundwater protection zone. Are they one and the same? Like that when we have to receive these applications for things like that. And then two, lastly number one, you know, there is a good monitoring well, embedded monitoring wells to kind of take a look at the effect of quarrying, the effect of fertilizer in a golf course and the effect of a metallic recycling center.

Now under the lease for the golf course, the CHamoru Land Trust golf course now, they were required to put in monitoring wells. And that monitoring well is right on the radius of the DPW quarry, the metallic recycling over there near the Bartolu Road, and of course, the golf course. It might be interesting just to the data.

And second to the last is GWA can actually generate a map that shows people in a certain area that have only a water bill. So what's the significance of that? If the bill from GWA is only a water bill, obviously they don't have sewer service, they may have a septic tank, but it's still over the aquifer.

And it might be interesting to plot that out and see how many people are over the aquifer without a sewer bill. Meaning they're not connected to public sewer, they're operating under a septic bank. And then lastly, it'd be interesting to see this closure issue, closure of quarries. Take a look at our, these most famous quarries, the one right behind GWA and GPA Mangilao, known as the Fadian Quarry.

When that was made available to GovGuam we promptly filled it up with abandoned vehicles. Like Dr. Jenson said, there's a hole in the ground to throw something in it. In this case, the Fadian Quarry was abandoned vehicles.

Also take a look at the closure issue on the quarry next to Guam Greyhound. Several years ago, you know, people start dumping trash. There was an underground fire there may be a decade ago. You know, what happened to the closure of that one. And then of

course, we have another one in Tamuning, almost right smack dab in the Tumon District, which is right behind the LBJ Elementary School.

Really deep quarry in there. And so, you know, so we have these, and then the next one is right next to Revenue and Tax in Barrigada. There was a quarry there at one time, and I think it got filled up with tires. So that's the closure of those quarries. So we've got, got to take a look at it. And again, the people that we have on this Speaker, it's now almost six o'clock, but these are people that really provide some good information and we should definitely you know, pay attention to their resources.

And I appreciate also, I want to thank the Senators that stuck it out here past five to get some information and hopefully develop legislation that will clarify this stuff. So thank you very much Speaker and I apologize for interrupting.

SPEAKER THERESE M. TERLAJE, CHAIRPERSON: No, I'm glad that you finally decided to give us some testimony. Mr. Director, you're the first one we called on today. The first one we wrote to, because we realized that the Department of Land Management, Guam Land Use Commission plays an instrumental role in all this, the Natural Resources Board as you described. And I do see under the rules and regs that they are empowered to formulate rules and regulations that no government land shall be leased or sold for the purpose of commercial mining until the rules have been adopted and promulgated pursuant to the Triple A and that they shall, in the rules shall include, and then it gives out some stuff.

So, no, and all your recommendations of course, I agree with you and the other agencies have made it very clear as to the gap and I'm very appreciative of that. And we if you could send us that last part, especially about the closure of some of these quarrying bits as you've described we can at least keep that in our inventory together with the DPW's list of the current ones.

Those closed supposedly. And you know, we will incorporate that into, you know, our findings.

But again, I thank you. I thank the Chief Planner. I thank Director Arriola and, and representatives from DPW. Thank you for being very frank and pointing out to us those gaps immediately and your recommendations.

I think they're very good. Captain Bearden and I can't thank you enough for being again, very obviously concerned with the impacts that are potential from this type of

activity and for your work right now in, without it being crystal clear in trying to enforce what you can. I very much appreciate that.

And to all the other agencies that are still on here, I'm trying to see. We've got BSP, Si Yu'os Ma'ase and to all of you, Doc, Dr. Jenson, of course, thank you very much for, for your input as well. We are going to take all the recommendations that have been made, we look forward, we are going to need your help a little bit more. And so I would appreciate your continued cooperation and again,

Si Yu'os Ma'ase to my colleagues, and I'm hoping that we can, you know, based on what we've learned today, follow through with closing those gaps, sharing what the resources are needed between the agencies so that they can do enforcement as necessary. And review.

I agree with you Director Borja, you know, let's not just look at them after the fact. Let's, let's see what we can do up front. I absolutely agree with that. And set parameters, and it shouldn't matter public or private land, what is good for the aquifer, right? We should enforce throughout. I agree with that as well.

So again, there being no additional testimony, this informational hearing is now adjourned and the time is 5:55 PM. Si Yu'os Ma'ase Todo.

Confirmation Public Hearing adjourned at 5:55 p.m.

III. FINDINGS

The Committee on Health, Land, Justice and Culture finds:

- Government agencies were asked to provide information on the types of permits applicable to mineral extraction, the processing of permits, the regulatory and enforcement responsibilities of the agencies under federal and local law, and whether through grading, excavating, quarrying, or any other means to extract minerals on Guam. The hearing was held to assist the committee in gaining a better understanding of the guidelines currently in place to discover any possible gaps in law or rule and if the existing laws and rules are adequate to protect Guam's health, welfare, and environment. The goal will eventually be to ensure best practices for private industry and appropriate government processes to

mitigate any potential negative impacts from mineral extraction on Guam, especially over Guam's aquifer.

- There have been several unsolicited offers to government agencies such as the CHamoru Land Trust and the Ancestral Lands Commission for additional mineral extraction on those properties, including the Guam Raceway, Lajuna, and adjacent properties on the northern side of Guam.
- In Guam law, mineral extraction is allowed in M2 zones in accordance with 21 GCA 61310(a)(3). Additionally, "extractive industry" is interpreted by Department of Land Management to mean mineral extraction, which is allowed as a conditional use in agricultural zones.
- Chapter 60 under Title 21 details that all proposals for the use, lease or purchase of government land for the purpose of commercial mining or removing therefrom any minerals, rocks or sand for processing shall be presented to the Guam Natural Resources Board. The Board shall determine if the proposal is consonant with the public interests and in keeping with proper conservation practices. The Board may recommend any such use, lease or sale of government land to the Governor including any such conditions that may be necessary such as bonds for compliance with the proposals presented.
- The Guam Land Use Commission shall serve ex-officio as the Guam Natural Resources Board. It shall be the function of the board to study and evaluate any plans or proposals for the utilization of government land, for natural resource development or exploitation however, no rules and regulations were promulgate pursuant to 21 GCA Chapter 60 § 60411 which states: It shall be the duty of the Guam Natural Resources Board to formulate such rules, regulations and procedures as are necessary to effectuate the aims and intents of this Act and no government land shall be leased or sold for the purpose of commercial mining or removing therefrom any minerals, rocks or sand for processing until the rules, regulations and procedures herewith authorized shall have been adopted and promulgated pursuant to the provisions of the Administrative Adjudication Act.
- The Bureau of Statistics and Plans has a Guam Flood Plain Management Ordinance from 2007, where mining or mineral extraction is included in the definition of development under that flood plain management ordinance. The CLTC also has rules regarding mineral extraction under the definition of

commercial use, which explicitly authorizes mineral extraction only with the approval of the Guam Legislature.

- The Bureau of Statistics and Plans (BSP) Guam Guidebook to Development cites some guidelines for mineral extraction to include guidelines for the Application Review Committee which cites specifically that they must determine if housing is located in or near a manmade hazard area such as an oil refinery or quarry.
- BSP notes in the Guidebook that Mineral Extraction is cited as an area of concern for development as outlined in the 1978 Guam Comprehensive Development Plan or "Kabalis Na Planu Para Guahan." The Comprehensive Plan notes that "mineral extraction is essential for construction, landfill and pavement purposes. However, operations must be monitored closely to ensure adherance to air, water quality and erosion standards, compatibility with landforms, adjacent uses and population density; and that land with historical, agricultural, or scenic value is not used for mineral extraction. Offshore coral and other dredging operations require further study. Beach sand mining is clearly an unacceptable use of the shoreline. In the future, an officially designated 200-mile off-shore economic zone may suggest the need for studies relating to deepwater mining, such as for manganese nodules."
- Through the standard application process for grading through the Department of Public Works (DPW), all applicants must clear the following agencies before the issuance of a grading permit by DPW: Department of Land Management (DLM), Department of Parks & Recreation State Historic Preservation Office (DPW, SHPO), Guam Power Authority (GPA), Guam Environmental Protection Agency (Guam EPA), Department of Agriculture (DOAg), Guam Geodetic Network (GGN) Survey Division at DLM, and the Guam Contractor's License Board. More clarity is needed on the guidelines for review of grading permits and how quarries are regulated.
- A study done in Alberta, Canada ("Aggregate Resource Extraction: Examining Environmental Impacts on Optimal Extraction and Reclamation Strategies") found that major concerns with mineral extraction include air pollution, noise and water pollution and the long terms effects of contamination of aquifers and poisoning of surface water bodies that present the largest issues.
- In 2002, USGS also had a report titled Managing and Protecting Aggregate Resources. There are potential environmental impacts associated with aggregate

extraction, including the conversion of land use, changes to the landscape, loss of habitat, noise, dust blasting effects, erosion and sedimentation.

- Extracting aggregate from some areas may alter the geologic conditions, which in turn may alter the dynamic equilibrium of the area, resulting in cascading environmental impacts. By employing best management practices, most environmental impacts can be controlled, mitigated, or kept at tolerable levels, and can be restricted to the immediate vicinity of the one aggregate operation.
- Despite 'extractive industry' being an allowable use in the past in an A-zone as a conditional use approved by the Guam Land Use Commission (GLUC) and acknowledged by DLM, the Bureau of Statistics and Plans (BSP) would not concur with mineral extraction as a conditional use or with a zone change which is not consistent with land use. Additionally, BSP stated that under conditional use in an A zone, they interpret it as biological extraction, not for minerals stating that it is "grossly misinterpreted" and that extracting geological resources from agricultural land will permanently damage the land so that it does not produce agriculture. BSP testified that they do not believe there should be any approval for geological extraction within A zoned properties. BSP would not concur with any proposed conditional uses or zone changes that would be non-consistent with other land use types other than what they recognize as M2 zones in their district maps. BSP also suggests to update the comprehensive development plan to be applied to all agencies as an instrument of the government as a policy tool.
- DLM also testified that in 1989, Guam Rock Products was approved a conditional use permit for "extractive industry" on Lot 7092-3, Yigo and received three additional extensions under Hawaiian Rock Products Company. In 1993, Western Pacific Rock Inc. received a conditional use permit for the "extractive industry" operation of a quarry construction operation, barracks, and cement batching facility with accessory activities in an A zone Lot on 7030-New-2-2. They received three additional extensions for the quarrying activities. In 2011, Smithbridge Guam received a conditional use for quarry operations to continue on Lot 7027-5, in Yigo as accessories to permit uses in an M1 zone.
- DLM's Chief Planner testified that their role in providing clearances for clearing and grading permits is mainly to identify and ensure that the applicant's proposed operation activity complies and conforms with the standards and requirements of the respective zone, and that proper ownership or authorization

is secured. If a permit is for quarrying, DLM testified it will not sign off unless there is a conditional use permit from the GLUC.

- Additionally, DPW does not move on a permit for mining or quarrying for mineral extraction unless approved by GLUC. However, DLM testified that in M2 zones, quarrying is allowed outright.
- DPW also testified that recently a notice of violation was issued and the ordering the stoppage of the activity for minor quarrying, however the law is silent on any penalties that can be imposed for violations. Additionally, DPW stated the law is absent on anything relative to grading materials being sold as part of clearing and grading. DPW committed to putting together some data regarding inventory of what they believe are quarries or mineral extraction sites throughout the island.
- Guam EPA testified that one of the gaps in the regulatory system is how operations are identified and in the permitting process wherein "applicants are clearly engaged in quarrying but claim that they are not, and the land use permitting body has stated to us that they do not know how to respond or to make that determination themselves." Additionally, Guam EPA noted that DLM is uncertain as to what a quarry is and who decides what a quarry is. Guam EPA further added that the definition of quarrying and surface mining would help resolve this issue and place it back into the realm of land-use determinations. Guam EPA also notes that it is obvious that there are lot of contractors using clearing and grading with very large cuts on the property with no reuse of the fill onsite. Because of the lack of a definition, Guam EPA now flags 20-50 acre projects with really large cuts as quarries.
- Current regulatory guidelines for the Department of Agriculture are relative only to whether activity impacts endangered species including under the Federal Endangered Species Act, Migratory Bird Treaty, The Sikes Act, the US Fish and Wildlife Services Cooperative Agreement, the Guam Endangered Species Act, the Protection of Wild Animals and the Marine Mammal Protection Act. Department of Agriculture testified that they do not have a measurement relative to the footprint impact of any extraction that takes place above or below ground to the forest surrounding that parcel. Additionally, DOAg added that biologists should be on site to monitor impacts on the site as well as surrounding areas, with considerations given to who will be paying for that biologist. DOAg

committed to drafting a narrative for any recommendations for mineral extraction regulations or law.

- GWA testified that a GWA well located near a quarry had to be shut down because it produced cloudy water, but since the quarry closed down, the well cleared up and they were able to bring the well back in operation. GWA could not point the issue directly to the quarrying activities. GWA does not have regulations in place that govern the depths of quarries.
- EPA would like to clarify wellhead protections as the language is confusing. In addition, Guam EPA regulates slope recommendations within their guidance however, DPW testified that IBC 2009 Section J108 Setbacks spells out specific recommendations and that a determination will need to be made if there is any conflict. Note: 22 GAR §10104(c)(10)(C) Conditional use approvals from Territorial Land Use Commission, when the area to be graded or excavated will be used as quarry, and extracted materials used to fill a different area or sold as a fill material by the owner.
- Guam State Historic Preservation Office recommended a separate mining or quarrying permit since that would give a focused review of those requests. A 35-acre mining or quarry site in Yigo was issued a notice of violation for significant loss of an historic site is is still working on mitigation efforts.
- WERI suggests that standards for closing quarries should be looked at to include what measures would be appropriate for filling it to mitigate environmental threats. WERI has also acknowledged that there have been no systematic studies on the local impacts of quarrying.
- DLM recommends harmonizing the Natural Resources Board and GLUC so that there is one standard for mineral extractions, whether on public or private land. DLM also recommends definitions of aquifer and groundwater protection zone. DLM also suggest to look at the closure of quarries and cited multiple examples. Action: follow up on inventory of closures.

The Committee on Health, Land, Justice and Culture concludes that:

- As the demand for the aggregate goes up at this stage of the military buildup, where the construction phase is very around the middle of the construction phase, so too, does the value of that aggregate and the pressure on government agencies to approve the permitting of the removal of this aggregate. This is

supported by at least two known proposals for public lands, which seek to extract minerals from these properties under the ClTC and the Guam Ancestral Lands Commission. There are undoubtedly other efforts to secure land in the northern parts of Guam for additional aggregate removal and there is still some unsettled business with the current lease of the Guam Raceway Federation, who also is conducting mineral extraction despite the prohibition of that on CHamoru Land Trust properties.

- The Guam Natural Resources Board consisting of the Guam Land Use Commission has jurisdiction over the proposals for the use and lease or purchase of government land for the purpose of commercial mining or removing therefrom any minerals, rocks, or sand for processing it. It appears from this law that the Guam Natural Resources Board has the authority to adopt rules that will regulate mining on public lands and engage the people through public notice and public hearings on these projects. Government agencies have made it clear that the threshold between what is considered grading and what is considered quarrying needs to be more adequately defined and in order to be more adequately enforced, and the enforcement gaps need to be closed.
- Definition of quarries and surface mining limiting the exemptions for grading must be taken into consideration, as recommended by Captain Brian Bearden from Guam EPA and other agencies.
- No government land shall be leased for mining without rules & regs from Natural Resources Board.