Road To Zero

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Chapter 1

Hierarchical Index

1.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Chapter 2

Class Index

2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 3

File Index

3.1 File List

Here is a list of all files with brief descriptions:

Chapter 4

Class Documentation

4.1 AssetsManager Class Reference

A class which manages visual and sound assets.

`#include <AssetsManager.h>`

Public Member Functions

- AssetsManager (void)

  Constructor for the AssetsManager class.
- void loadFont (std::string, std::string)

  Method to load a font and insert it into the font map.
- void loadTexture (std::string, std::string)

  Method to load a texture and insert it into the texture map.
- void loadSound (std::string, std::string)

  Method to load a sound and insert it into the sound map. Automatically creates a corresponding sf::SoundBuffer.
- void loadTrack (std::string, std::string)

  Method to load a track (sf::Music) and insert it into the track map.
- sf::Font * getFont (std::string)

  Method to get font associated with given font key.
- sf::Texture * getTexture (std::string)

  Method to get texture associated with given texture key.
- sf::SoundBuffer * getSoundBuffer (std::string)

  Method to get soundbuffer associated with given sound key.
- sf::Sound * getSound (std::string)

  Method to get sound associated with given sound key.
- void playTrack (void)

  Method to play the current track.
- void pauseTrack (void)

  Method to pause the current track.
- void stopTrack (void)

  Method to stop the current track.
- void nextTrack (void)

  Method to advance to the next track. Wraps around if the end of the track map is reached.

- void previousTrack (void)

  Method to return to the previous track. Wraps around if the beginning of the track map is reached.
- std::string getCurrentTrackKey (void)

  Method to get track key for current track.
- sf::SoundSource::Status getTrackStatus (void)

  Method to get the status of the current track.
- void clear (void)

  Method to clear all loaded assets.
- ~AssetsManager (void)

  Destructor for the AssetsManager class.

Public Attributes

- std::map< std::string, sf::Font * > font_map

  A map of pointers to loaded fonts.
- std::map< std::string, sf::Texture * > texture_map

  A map of pointers to loaded textures.
- std::map< std::string, sf::SoundBuffer * > soundbuffer_map

  A map of pointers to sound buffers.
- std::map< std::string, sf::Sound * > sound_map

  A map of pointers to loaded sounds.
- std::map< std::string, sf::Music * >::iterator current_track

  A map iterator which corresponds to the current track (i.e., the track currently being played).
- std::map< std::string, sf::Music * > track_map

  A map of pointers to opened tracks (i.e. sf::Music).

Private Member Functions

- void __loadSoundBuffer (std::string, std::string)

  Helper method to load a soundbuffer and insert it into the soundbuffer map. Should only be called by loadSound(), to create an sf::SoundBuffer corresponding to the loaded sf::Sound.

4.1.1 Detailed Description

A class which manages visual and sound assets.

4.1.2 Constructor & Destructor Documentation

4.1.2.1 AssetsManager()

```
AssetsManager::AssetsManager (
            void  )
```

Constructor for the AssetsManager class.

```
144 {
145     //...
146 
147     std::cout << "AssetsManager constructed at " << this << std::endl;
148 
149     return;
150 }   /* AssetsManager() */
```

4.1.2.2 ~AssetsManager()

```
AssetsManager::~AssetsManager (
            void  )
```

Destructor for the AssetsManager class.

```
773 {
774     this->clear();
775
776     std::cout « "AssetsManager at " « this « " destroyed" « std::endl;
777
778     return;
779 }   /* ~AssetsManager() */
```

4.1.3 Member Function Documentation

4.1.3.1 __loadSoundBuffer()

```
void AssetsManager::__loadSoundBuffer (
            std::string path_2_sound,
            std::string sound_key )  [private]
```

Helper method to load a soundbuffer and insert it into the soundbuffer map. Should only be called by loadSound(), to create an sf::SoundBuffer corresponding to the loaded sf::Sound.

Parameters

path_2_sound	A path (either relative or absolute) to the sound file.
sound_key	A key associated with the sound (for indexing into the soundbuffer map).

```
81 {
82     //  1. check key, throw error if already in use
83     if (this->soundbuffer_map.count(sound_key) > 0) {
84         std::string error_str = "ERROR  AssetsManager::__loadSoundBuffer()  sound key ";
85         error_str += sound_key;
86         error_str += " is already in use";
87
88         this->clear();
89
90         #ifdef _WIN32
91             std::cout « error_str « std::endl;
92         #endif  /* _WIN32 */
93
94         throw std::runtime_error(error_str);
95     }
96
97
98     //  2. load from file, throw error on fail
99     sf::SoundBuffer* soundbuffer_ptr = new sf::SoundBuffer();
100
101     if (not soundbuffer_ptr->loadFromFile(path_2_sound)) {
102         std::string error_str = "ERROR  AssetsManager::__loadSoundBuffer()  could not load ";
103         error_str += "soundbuffer at ";
104         error_str += path_2_sound;
105
106         this->clear();
107
108         #ifdef _WIN32
109             std::cout « error_str « std::endl;
110         #endif  /* _WIN32 */
111
112         throw std::runtime_error(error_str);
113     }
114
115
```

```
116     //  3. insert into soundbuffer map
117     this->soundbuffer_map.insert(
118         std::pair<std::string, sf::SoundBuffer*>(sound_key, soundbuffer_ptr)
119     );
120
121     std::cout « "SoundBuffer " « sound_key « " inserted into soundbuffer map" «
122         std::endl;
123
124     return;
125 }   /* __loadSoundBuffer() */
```

4.1.3.2 clear()

```
void AssetsManager::clear (
            void  )
```

Method to clear all loaded assets.

```
680 {
681     //  1. clear fonts
682     std::map<std::string, sf::Font*>::iterator font_iter;
683     for (
684         font_iter = this->font_map.begin();
685         font_iter != this->font_map.end();
686         font_iter++
687     ) {
688         delete font_iter->second;
689
690         std::cout « "Font " « font_iter->first « " deleted from font map" «
691             std::endl;
692     }
693     this->font_map.clear();
694
695
696     //  2. clear textures
697     std::map<std::string, sf::Texture*>::iterator texture_iter;
698     for (
699         texture_iter = this->texture_map.begin();
700         texture_iter != this->texture_map.end();
701         texture_iter++
702     ) {
703         delete texture_iter->second;
704
705         std::cout « "Texture " « texture_iter->first « " deleted from texture map" «
706             std::endl;
707     }
708     this->texture_map.clear();
709
710
711     //  3. clear sound buffers
712     std::map<std::string, sf::SoundBuffer*>::iterator soundbuffer_iter;
713     for (
714         soundbuffer_iter = this->soundbuffer_map.begin();
715         soundbuffer_iter != this->soundbuffer_map.end();
716         soundbuffer_iter++
717     ) {
718         delete soundbuffer_iter->second;
719
720         std::cout « "SoundBuffer " « soundbuffer_iter->first «
721             " deleted from soundbuffer map" « std::endl;
722     }
723     this->soundbuffer_map.clear();
724
725
726     //  4. clear sounds
727     std::map<std::string, sf::Sound*>::iterator sound_iter;
728     for (
729         sound_iter = this->sound_map.begin();
730         sound_iter != this->sound_map.end();
731         sound_iter++
732     ) {
733         sound_iter->second->stop();
734         delete sound_iter->second;
735
736         std::cout « "Sound " « sound_iter->first « " deleted from sound map" «
737             std::endl;
738     }
739     this->sound_map.clear();
740
```

```
741
742     //  5. clear tracks
743     std::map<std::string, sf::Music*>::iterator track_iter;
744     for (
745         track_iter = this->track_map.begin();
746         track_iter != this->track_map.end();
747         track_iter++
748     ) {
749         track_iter->second->stop();
750         delete track_iter->second;
751
752         std::cout « "Track " « track_iter->first « " deleted from track map" «
753             std::endl;
754     }
755     this->track_map.clear();
756
757     return;
758 }   /* clear() */
```

4.1.3.3 getCurrentTrackKey()

```
std::string AssetsManager::getCurrentTrackKey (
             void  )
```

Method to get track key for current track.

Returns

The track key for the current track.

```
644 {
645     return this->current_track->first;
646 }   /* getCurrentTrackKey() */
```

4.1.3.4 getFont()

```
sf::Font * AssetsManager::getFont (
             std::string font_key )
```

Method to get font associated with given font key.

Parameters

font_key	A key associated with the font (for indexing into the font map).

Returns

A pointer to the corresponding font.

```
385 {
386     //  1. check key, throw error if not found
387     if (this->font_map.count(font_key) <= 0) {
388         std::string error_str = "ERROR  AssetsManager::getFont()  font key ";
389         error_str += font_key;
390         error_str += " is not contained in font map";
391
392         this->clear();
393
394         #ifdef _WIN32
```

```
395             std::cout « error_str « std::endl;
396         #endif  /* _WIN32 */
397
398         throw std::runtime_error(error_str);
399     }
400
401     return this->font_map[font_key];
402 }   /* getFont() */
```

4.1.3.5 getSound()

```
sf::Sound * AssetsManager::getSound (
              std::string sound_key )
```

Method to get sound associated with given sound key.

Parameters

sound_key	A key associated with the sound (for indexing into the sound map).

Returns

A pointer to the corresponding sound.

```
495 {
496     //  1. check key, throw error if not found
497     if (this->sound_map.count(sound_key) <= 0) {
498         std::string error_str = "ERROR  AssetsManager::getSound()  sound key ";
499         error_str += sound_key;
500         error_str += " is not contained in sound map";
501
502         this->clear();
503
504         #ifdef _WIN32
505             std::cout « error_str « std::endl;
506         #endif  /* _WIN32 */
507
508         throw std::runtime_error(error_str);
509     }
510
511     return this->sound_map[sound_key];
512 }   /* getSound() */
```

4.1.3.6 getSoundBuffer()

```
sf::SoundBuffer * AssetsManager::getSoundBuffer (
              std::string sound_key )
```

Method to get soundbuffer associated with given sound key.

Parameters

sound_key	A key associated with the soundbuffer (for indexing into the soundbuffer map).

Returns

A pointer to the corresponding soundbuffer.

```
459 {
460     //  1. check key, throw error if not found
461     if (this->soundbuffer_map.count(sound_key) <= 0) {
462         std::string error_str = "ERROR  AssetsManager::getSoundBuffer()  sound key ";
463         error_str += sound_key;
464         error_str += " is not contained in soundbuffer map";
465 
466         this->clear();
467 
468         #ifdef _WIN32
469             std::cout << error_str << std::endl;
470         #endif  /* _WIN32 */
471 
472         throw std::runtime_error(error_str);
473     }
474 
475     return this->soundbuffer_map[sound_key];
476 }   /* getSoundBuffer() */
```

4.1.3.7 getTexture()

```
sf::Texture * AssetsManager::getTexture (
            std::string texture_key )
```

Method to get texture associated with given texture key.

Parameters

texture_key	A key associated with the texture (for indexing into the texture map).

Returns

A pointer to the corresponding texture.

```
422 {
423     //  1. check key, throw error if not found
424     if (this->texture_map.count(texture_key) <= 0) {
425         std::string error_str = "ERROR  AssetsManager::getTexture()  texture key ";
426         error_str += texture_key;
427         error_str += " is not contained in texture map";
428 
429         this->clear();
430 
431         #ifdef _WIN32
432             std::cout << error_str << std::endl;
433         #endif  /* _WIN32 */
434 
435         throw std::runtime_error(error_str);
436     }
437 
438     return this->texture_map[texture_key];
439 }   /* getTexture() */
```

4.1.3.8 getTrackStatus()

```
sf::SoundSource::Status AssetsManager::getTrackStatus (
            void  )
```

Method to get the status of the current track.

Returns

The status of the current track.

```
663 {
664     return this->current_track->second->getStatus();
665 }   /* getTrackStatus */
```

4.1.3.9 loadFont()

```
void AssetsManager::loadFont (
            std::string path_2_font,
            std::string font_key )
```

Method to load a font and insert it into the font map.

Parameters

path_2_font	A path (either relative or absolute) to the font file.
font_key	A key associated with the font (for indexing into the font map).

```
169 {
170     //  1. check key, throw error if already in use
171     if (this->font_map.count(font_key) > 0) {
172         std::string error_str = "ERROR  AssetsManager::loadFont()  font key ";
173         error_str += font_key;
174         error_str += " is already in use";
175 
176         this->clear();
177 
178         #ifdef _WIN32
179             std::cout << error_str << std::endl;
180         #endif  /* _WIN32 */
181 
182         throw std::runtime_error(error_str);
183     }
184 
185 
186     //  2. load from file, throw error on fail
187     sf::Font* font_ptr = new sf::Font();
188 
189     if (not font_ptr->loadFromFile(path_2_font)) {
190         std::string error_str = "ERROR  AssetsManager::loadFont()  could not load ";
191         error_str += "font at ";
192         error_str += path_2_font;
193 
194         this->clear();
195 
196         #ifdef _WIN32
197             std::cout << error_str << std::endl;
198         #endif  /* _WIN32 */
199 
200         throw std::runtime_error(error_str);
201     }
202 
203 
204     //  3. insert into font map
205     this->font_map.insert(std::pair<std::string, sf::Font*>(font_key, font_ptr));
206 
207     std::cout << "Font " << font_key << " inserted into font map" << std::endl;
208 
209     return;
210 }   /* loadFont() */
```

4.1.3.10 loadSound()

```
void AssetsManager::loadSound (
```

```
            std::string path_2_sound,
            std::string sound_key )
```

Method to load a sound and insert it into the sound map. Automatically creates a corresponding sf::SoundBuffer.

Parameters

path_2_sound	A path (either relative or absolute) to the sound file.
sound_key	A key associated with the sound (for indexing into the sound map).

```
293 {
294     //  1. create an associated sf::SoundBuffer
295     this->__loadSoundBuffer(path_2_sound, sound_key);
296 
297     //  2. associate sf::Sound with sf::SoundBuffer
298     sf::Sound* sound_ptr = new sf::Sound();
299     sound_ptr->setBuffer(*(this->soundbuffer_map[sound_key]));
300 
301     //  3. insert into sound map
302     this->sound_map.insert(std::pair<std::string, sf::Sound*>(sound_key, sound_ptr));
303 
304     std::cout « "Sound " « sound_key « " inserted into sound map" « std::endl;
305 
306     return;
307 }   /* loadSound() */
```

4.1.3.11 loadTexture()

```
void AssetsManager::loadTexture (
            std::string path_2_texture,
            std::string texture_key )
```

Method to load a texture and insert it into the texture map.

Parameters

path_2_texture	A path (either relative or absolute) to the texture file.
texture_key	A key associated with the texture (for indexing into the texture map).

```
230 {
231     //  1. check key, throw error if already in use
232     if (this->texture_map.count(texture_key) > 0) {
233         std::string error_str = "ERROR  AssetsManager::loadTexture()  texture key ";
234         error_str += texture_key;
235         error_str += " is already in use";
236 
237         this->clear();
238 
239         #ifdef _WIN32
240             std::cout « error_str « std::endl;
241         #endif  /* _WIN32 */
242 
243         throw std::runtime_error(error_str);
244     }
245 
246 
247     //  2. load from file, throw error on fail
248     sf::Texture* texture_ptr = new sf::Texture();
249 
250     if (not texture_ptr->loadFromFile(path_2_texture)) {
251         std::string error_str = "ERROR  AssetsManager::loadTexture()  could not load ";
252         error_str += "texture at ";
253         error_str += path_2_texture;
254 
255         this->clear();
256 
257         #ifdef _WIN32
258             std::cout « error_str « std::endl;
```

```
259         #endif  /* _WIN32 */
260
261         throw std::runtime_error(error_str);
262     }
263
264
265     //  3. insert into texture map
266     this->texture_map.insert(
267         std::pair<std::string, sf::Texture*>(texture_key, texture_ptr)
268     );
269
270     std::cout « "Texture " « texture_key « " inserted into texture map" « std::endl;
271
272     return;
273 }   /* loadTexture() */
```

4.1.3.12 loadTrack()

```
void AssetsManager::loadTrack (
              std::string path_2_track,
              std::string track_key )
```

Method to load a track (sf::Music) and insert it into the track map.

Parameters

path_2_track	A path (either relative or absolute) to the track file.
track_key	A key associated with the track (for indexing into the track map).

```
326 {
327     //  1. check key, throw error if already in use
328     if (this->track_map.count(track_key) > 0) {
329         std::string error_str = "ERROR  AssetsManager::loadTrack()  track key ";
330         error_str += track_key;
331         error_str += " is already in use";
332
333         this->clear();
334
335         #ifdef _WIN32
336             std::cout « error_str « std::endl;
337         #endif  /* _WIN32 */
338
339         throw std::runtime_error(error_str);
340     }
341
342     //  2. open from file, throw error on fail
343     sf::Music* track_ptr = new sf::Music();
344
345     if (not track_ptr->openFromFile(path_2_track)) {
346         std::string error_str = "ERROR  AssetsManager::loadTrack()  could not open ";
347         error_str += "track at ";
348         error_str += path_2_track;
349
350         this->clear();
351
352         #ifdef _WIN32
353             std::cout « error_str « std::endl;
354         #endif  /* _WIN32 */
355
356         throw std::runtime_error(error_str);
357     }
358
359     //  3. insert into track map
360     this->track_map.insert(std::pair<std::string, sf::Music*>(track_key, track_ptr));
361     this->current_track = this->track_map.begin();
362
363     std::cout « "Track " « track_key « " inserted into track map" « std::endl;
364
365     return;
366 }   /* loadTrack() */
```

4.1.3.13 nextTrack()

```
void AssetsManager::nextTrack (
            void  )
```

Method to advance to the next track. Wraps around if the end of the track map is reached.

```
585 {
586     //  1. stop current track
587     this->stopTrack();
588 
589     //  2. increment current track
590     this->current_track++;
591 
592     //  3. handle wrap around
593     if (this->current_track == this->track_map.end()) {
594         this->current_track = this->track_map.begin();
595     }
596 
597     return;
598 }   /* nextTrack() */
```

4.1.3.14 pauseTrack()

```
void AssetsManager::pauseTrack (
            void  )
```

Method to pause the current track.

```
546 {
547     this->current_track->second->pause();
548 
549     return;
550 }   /* pauseTrack() */
```

4.1.3.15 playTrack()

```
void AssetsManager::playTrack (
            void  )
```

Method to play the current track.

```
527 {
528     this->current_track->second->play();
529 
530     return;
531 }   /* playTrack() */
```

4.1.3.16 previousTrack()

```
void AssetsManager::previousTrack (
            void  )
```

Method to return to the previous track. Wraps around if the beginning of the track map is reached.

```
614 {
615     //  1. stop current track
616     this->stopTrack();
617 
618     //  2. handle wrap around
619     if (this->current_track == this->track_map.begin()) {
620         this->current_track = this->track_map.end();
621     }
622 
623     //  3. decrement current track
624     this->current_track--;
625 
626     return;
627 }   /* previousTrack() */
```

4.1.3.17 stopTrack()

```
void AssetsManager::stopTrack (
            void  )
```

Method to stop the current track.

```
565 {
566     this->current_track->second->stop();
567
568     return;
569 }   /* stopTrack() */
```

4.1.4 Member Data Documentation

4.1.4.1 current_track

```
std::map<std::string, sf::Music*>::iterator AssetsManager::current_track
```

A map iterator which corresponds to the current track (i.e., the track currently being played).

4.1.4.2 font_map

```
std::map<std::string, sf::Font*> AssetsManager::font_map
```

A map of pointers to loaded fonts.

4.1.4.3 sound_map

```
std::map<std::string, sf::Sound*> AssetsManager::sound_map
```

A map of pointers to loaded sounds.

4.1.4.4 soundbuffer_map

```
std::map<std::string, sf::SoundBuffer*> AssetsManager::soundbuffer_map
```

A map of pointers to sound buffers.

4.1.4.5 texture_map

```
std::map<std::string, sf::Texture*> AssetsManager::texture_map
```

A map of pointers to loaded textures.

4.1.4.6 track_map

```
std::map<std::string, sf::Music*> AssetsManager::track_map
```

A map of pointers to opened tracks (i.e. sf::Music).

The documentation for this class was generated from the following files:

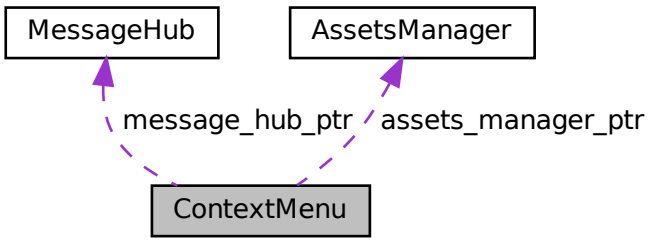
- header/ESC_core/AssetsManager.h
- source/ESC_core/AssetsManager.cpp

4.2 ContextMenu Class Reference

A class which defines a context menu for the game.

```
#include <ContextMenu.h>
```

Collaboration diagram for ContextMenu:



Public Member Functions

- ContextMenu (sf::Event *, sf::RenderWindow *, AssetsManager *, MessageHub *)

  Constructor for the ContextMenu class.
- void processEvent (void)

  Method to processEvent ContextMenu. To be called once per event.
- void processMessage (void)

  Method to processMessage ContextMenu. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- ~ContextMenu (void)

  Destructor for the ContextMenu class.

Public Attributes

- ConsoleState console_state

  The current state of the console screen.
- bool console_string_changed

  Boolean which indicates if console string just changed.
- bool game_menu_up

  Indicates whether or not the game menu is up.
- size_t console_substring_idx

  The current final index of the console string draw.
- unsigned long long int frame

  The current frame of this object.
- double position_x

  The position of the object.
- double position_y

  The position of the object.
- std::string console_string

  The string to be printed to the console screen.
- sf::RectangleShape menu_frame

  The frame of the context menu.
- sf::RectangleShape visual_screen

  The context menu screen for visuals.
- sf::ConvexShape visual_screen_frame_top

  The top framing of the visual screen.
- sf::ConvexShape visual_screen_frame_left

  The left framing of the visual screen.
- sf::ConvexShape visual_screen_frame_bottom

  The bottom framing of the visual screen.
- sf::ConvexShape visual_screen_frame_right

  The right framing of the visual screen.
- sf::RectangleShape console_screen

  The context menu console screen (for animated text output).
- sf::ConvexShape console_screen_frame_top

  The top framing of the console screen.
- sf::ConvexShape console_screen_frame_left

  The left framing of the console screen.
- sf::ConvexShape console_screen_frame_bottom

  The bottom framing of the console screen.
- sf::ConvexShape console_screen_frame_right

  The right framing of the console screen.

Private Member Functions

- void __setUpMenuFrame (void)

  Helper method to set up context menu frame (drawable).
- void __setUpVisualScreen (void)

  Helper method to set up context menu visual screen (drawable).
- void __setUpVisualScreenFrame (void)

  Helper method to set up framing for context menu visual screen (drawable).
- void __drawVisualScreenFrame (void)

Helper method to draw visual screen frame.

- void __setUpConsoleScreen (void)

  Helper method to set up context menu console screen (drawable).
- void __setUpConsoleScreenFrame (void)

  Helper method to set up framing for context menu console screen (drawable).
- void __drawConsoleScreenFrame (void)

  Helper method to draw console screen frame.
- void __setConsoleState (ConsoleState)

  Helper method to set state of console screen and update string if necessary.
- void __setConsoleString (void)

  Helper method to set console string depending on console state.
- void __drawConsoleText (void)

  Helper method to draw animated text to context menu console screen.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.
- void __sendQuitGameMessage (void)

  Helper method to format and send a quit game message.
- void __sendRestartGameMessage (void)

  Helper method to format and send a restart game message.

Private Attributes

- sf::Event * event_ptr

  A pointer to the event class.
- sf::RenderWindow * render_window_ptr

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.
- MessageHub * message_hub_ptr

  A pointer to the message hub.

4.2.1 Detailed Description

A class which defines a context menu for the game.

4.2.2 Constructor & Destructor Documentation

4.2.2.1 ContextMenu()

```
ContextMenu::ContextMenu (
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the ContextMenu class.

Parameters

event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
849 {
850     //  1. set attributes
851 
852     //  1.1. private
853     this->event_ptr = event_ptr;
854     this->render_window_ptr = render_window_ptr;
855 
856     this->assets_manager_ptr = assets_manager_ptr;
857     this->message_hub_ptr = message_hub_ptr;
858 
859     //  1.2. public
860     this->console_state = ConsoleState :: NONE_STATE;
861     this->__setConsoleState(ConsoleState :: READY);
862 
863     this->console_string_changed = true;
864     this->game_menu_up = false;
865 
866     this->frame = 0;
867 
868     this->position_x = GAME_WIDTH;
869     this->position_y = 0;
870 
871     //  2. set up and position drawable attributes
872     this->__setUpMenuFrame();
873     this->__setUpVisualScreen();
874     this->__setUpVisualScreenFrame();
875     this->__setUpConsoleScreen();
876     this->__setUpConsoleScreenFrame();
877 
878     std::cout « "ContextMenu constructed at " « this « std::endl;
879 
880     return;
881 }   /* ContextMenu() */
```

4.2.2.2 ~ContextMenu()

```
ContextMenu::~ContextMenu (
            void  )
```

Destructor for the ContextMenu class.

```
1031 {
1032     std::cout « "ContextMenu at " « this « " destroyed" « std::endl;
1033 
1034     return;
1035 }   /* ~ContextMenu() */
```

4.2.3 Member Function Documentation

4.2.3.1 __drawConsoleScreenFrame()

```
void ContextMenu::__drawConsoleScreenFrame (
            void  )  [private]
```

Helper method to draw console screen frame.

```
467 {
468     this->render_window_ptr->draw(this->console_screen_frame_top);
469     this->render_window_ptr->draw(this->console_screen_frame_left);
470     this->render_window_ptr->draw(this->console_screen_frame_bottom);
471     this->render_window_ptr->draw(this->console_screen_frame_right);
472 
473     return;
474 }   /* __drawContextScreenFrame() */
```

4.2.3.2 __drawConsoleText()

```
void ContextMenu::__drawConsoleText (
            void  )  [private]
```

Helper method to draw animated text to context menu console screen.

```
590 {
591     //  1. set up console text (drawable)
592     sf::Text console_text;
593 
594     if (this->console_string_changed) {
595         this->assets_manager_ptr->getSound("console string print")->play();
596 
597         console_text.setString(this->console_string.substr(0, this->console_substring_idx));
598 
599         this->console_substring_idx++;
600 
601         while (
602             (this->console_string.substr(0, this->console_substring_idx).back() == ' ') or
603             (this->console_string.substr(0, this->console_substring_idx).back() == '\n')
604         ) {
605             this->console_substring_idx++;
606 
607             if (this->console_substring_idx >= this->console_string.size()) {
608                 break;
609             }
610         }
611 
612         if (this->console_substring_idx >= this->console_string.size()) {
613             this->console_string_changed = false;
614         }
615     }
616 
617     else {
618         console_text.setString(this->console_string);
619     }
620 
621     console_text.setFont(*(this->assets_manager_ptr->getFont("Glass_TTY_VT220")));
622     console_text.setCharacterSize(16);
623     console_text.setFillColor(MONOCHROME_TEXT_GREEN);
624 
625     console_text.setPosition(
626         this->position_x - 50 - 300 + 16,
627         this->position_y + GAME_HEIGHT - 50 - 340 + 16
628     );
629 
630 
631     //  2. draw console text
632     this->render_window_ptr->draw(console_text);
633 
634 
635     //  3. assemble and draw blinking console cursor
636     if ((this->frame % FRAMES_PER_SECOND) > FRAMES_PER_SECOND / 2) {
637         sf::RectangleShape console_cursor(sf::Vector2f(10, 16));
638 
639         console_cursor.setFillColor(MONOCHROME_TEXT_GREEN);
640 
641         console_cursor.setPosition(
642             console_text.getPosition().x,
643             console_text.getPosition().y + console_text.getLocalBounds().height + 10
644         );
645 
646         this->render_window_ptr->draw(console_cursor);
647     }
648 
649     //  4. updating frame count if console is in menu state
650     if (this->console_state == ConsoleState :: MENU) {
651         std::string frame_count_string = "FRAME: ";
652         frame_count_string += std::to_string(this->frame);
```

```
653
654         sf::Text frame_count_text(
655             frame_count_string,
656             *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
657             16
658         );
659
660         frame_count_text.setFillColor(MONOCHROME_TEXT_GREEN);
661
662         frame_count_text.setPosition(
663             console_text.getPosition().x,
664             console_text.getPosition().y + console_text.getLocalBounds().height - 10
665         );
666
667         this->render_window_ptr->draw(frame_count_text);
668     }
669
670     return;
671 }   /* __drawConsoleText() */
```

4.2.3.3 __drawVisualScreenFrame()

```
void ContextMenu::__drawVisualScreenFrame (
            void  )  [private]
```

Helper method to draw visual screen frame.

```
242 {
243     this->render_window_ptr->draw(this->visual_screen_frame_top);
244     this->render_window_ptr->draw(this->visual_screen_frame_left);
245     this->render_window_ptr->draw(this->visual_screen_frame_bottom);
246     this->render_window_ptr->draw(this->visual_screen_frame_right);
247
248     return;
249 }   /* __drawVisualScreenFrame() */
```

4.2.3.4 __handleKeyPressEvents()

```
void ContextMenu::__handleKeyPressEvents (
            void  )  [private]
```

Helper method to handle key press events.

```
686 {
687     switch (this->event_ptr->key.code) {
688         case (sf::Keyboard::Escape): {
689             if (this->console_state == ConsoleState :: MENU) {
690                 this->__setConsoleState(ConsoleState :: READY);
691             }
692
693             else {
694                 this->__setConsoleState(ConsoleState :: MENU);
695             }
696
697             break;
698         }
699
700
701         case (sf::Keyboard::Q): {
702             if (this->console_state == ConsoleState :: MENU) {
703                 this->__sendQuitGameMessage();
704             }
705         }
706
707
708         case (sf::Keyboard::R): {
709             if (this->console_state == ConsoleState :: MENU) {
710                 this->__sendRestartGameMessage();
711             }
712         }
713
```

```
714
715         default: {
716             // do nothing!
717
718             break;
719         }
720     }
721
722     return;
723 }   /* __handleKeyPressEvents() */
```

4.2.3.5 __handleMouseButtonEvents()

```
void ContextMenu::__handleMouseButtonEvents (
             void  )  [private]
```

Helper method to handle mouse button events.

```
738 {
739     switch (this->event_ptr->mouseButton.button) {
740         case (sf::Mouse::Left): {
741             //...
742
743             break;
744         }
745
746
747         case (sf::Mouse::Right): {
748             //...
749
750             break;
751         }
752
753
754         default: {
755             // do nothing!
756
757             break;
758         }
759     }
760
761     return;
762 }   /* __handleMouseButtonEvents() */
```

4.2.3.6 __sendQuitGameMessage()

```
void ContextMenu::__sendQuitGameMessage (
             void  )  [private]
```

Helper method to format and send a quit game message.

```
777 {
778     Message quit_game_message;
779
780     quit_game_message.channel = GAME_CHANNEL;
781     quit_game_message.subject = "quit game";
782
783     this->message_hub_ptr->sendMessage(quit_game_message);
784
785     std::cout « "Quit game message sent by " « this « std::endl;
786     return;
787 }   /* __sendQuitGameMessage() */
```

4.2.3.7 __sendRestartGameMessage()

```
void ContextMenu::__sendRestartGameMessage (
            void  )  [private]
```

Helper method to format and send a restart game message.

```
802 {
803     Message restart_game_message;
804 
805     restart_game_message.channel = GAME_CHANNEL;
806     restart_game_message.subject = "restart game";
807 
808     this->message_hub_ptr->sendMessage(restart_game_message);
809 
810     std::cout « "Restart game message sent by " « this « std::endl;
811     return;
812 }   /* __sendRestartGameMessage() */
```

4.2.3.8 __setConsoleState()

```
void ContextMenu::__setConsoleState (
            ConsoleState console_state )  [private]
```

Helper method to set state of console screen and update string if necessary.

Parameters

console_state	The state (ConsoleState) to set the console to.

```
491 {
492     //  1. if no change, do nothing
493     if (this->console_state == console_state) {
494         return;
495     }
496 
497     //  2. update console state, set console string accordingly
498     this->console_state = console_state;
499     this->__setConsoleString();
500 
501     return;
502 }   /* __setConsoleState() */
```

4.2.3.9 __setConsoleString()

```
void ContextMenu::__setConsoleString (
            void  )  [private]
```

Helper method to set console string depending on console state.

```
517 {
518     this->console_string_changed = true;
519     this->console_substring_idx = 0;
520 
521     this->console_string.clear();
522 
523     switch (this->console_state) {
524         case (ConsoleState :: MENU): {
525             //           32 char x 17 line console "--------------------------------\n";
526             this->console_string                = "          **** MENU ****          \n";
527             this->console_string               += "                                  \n";
528             this->console_string               += "[R]:  RESTART                      \n";
529             this->console_string               += "                                  \n";
530             this->console_string               += "[TAB]:  TOGGLE RESOURCE OVERLAY \n";
```

```
531             this->console_string                += "[T]:  TUTORIAL                  \n";
532             this->console_string                += "                               \n";
533             this->console_string                += "                               \n";
534             this->console_string                += "                               \n";
535             this->console_string                += "                               \n";
536             this->console_string                += "                               \n";
537             this->console_string                += "                               \n";
538             this->console_string                += "                               \n";
539             this->console_string                += "[Q]:    QUIT                    \n";
540             this->console_string                += "[ESC]:  CLOSE MENU              \n";
541             this->console_string                += "                               \n";
542 
543             break;
544         }
545 
546 
547         case (ConsoleState :: TILE): {
548             // take console string from tile state message
549 
550             break;
551         }
552 
553 
554         default: {
555             //           32 char x 17 line console "--------------------------------\n";
556             this->console_string                 = "  **** RTZ 64 CONTEXT V12 ****  \n";
557             this->console_string                += "                                \n";
558             this->console_string                += "64K RAM SYSTEM  38911 BYTES FREE\n";
559             this->console_string                += "                                \n";
560             this->console_string                += "[TAB]:  TOGGLE RESOURCE OVERLAY \n";
561             this->console_string                += "                                \n";
562             this->console_string                += "[ESC]:          MENU            \n";
563             this->console_string                += "[LEFT CLICK]:  TILE INFO/OPTIONS\n";
564             this->console_string                += "[RIGHT CLICK]: CLEAR SELECTION  \n";
565             this->console_string                += "                               \n";
566             this->console_string                += "[ENTER]:  END TURN              \n";
567             this->console_string                += "                               \n";
568             this->console_string                += "READY.                          ";
569 
570             break;
571         }
572     }
573 
574     return;
575 }   /* __setConsoleString() */
```

4.2.3.10 __setUpConsoleScreen()

```
void ContextMenu::__setUpConsoleScreen (
            void  )  [private]
```

Helper method to set up context menu console screen (drawable).

```
264 {
265     this->console_screen.setSize(sf::Vector2f(300, 340));
266     this->console_screen.setOrigin(300, 340);
267     this->console_screen.setPosition(
268         this->position_x - 50,
269         this->position_y + GAME_HEIGHT - 50
270     );
271     this->console_screen.setFillColor(MONOCHROME_SCREEN_BACKGROUND);
272 
273     return;
274 }   /* __setUpConsoleScreen() */
```

4.2.3.11 __setUpConsoleScreenFrame()

```
void ContextMenu::__setUpConsoleScreenFrame (
            void  )  [private]
```

Helper method to set up framing for context menu console screen (drawable).

```
289 {
290     int n_points = 4;
291 
292     //  1. top framing
293     this->console_screen_frame_top.setPointCount(n_points);
294 
295     this->console_screen_frame_top.setPoint(
296         0,
297         sf::Vector2f(
298             this->position_x - 50,
299             this->position_y + GAME_HEIGHT - 50 - 340
300         )
301     );
302     this->console_screen_frame_top.setPoint(
303         1,
304         sf::Vector2f(
305             this->position_x - 50 + 16,
306             this->position_y + GAME_HEIGHT - 50 - 340 - 16
307         )
308     );
309     this->console_screen_frame_top.setPoint(
310         2,
311         sf::Vector2f(
312             this->position_x - 350 - 16,
313             this->position_y + GAME_HEIGHT - 50 - 340 - 16
314         )
315     );
316     this->console_screen_frame_top.setPoint(
317         3,
318         sf::Vector2f(
319             this->position_x - 350,
320             this->position_y + GAME_HEIGHT - 50 - 340
321         )
322     );
323 
324     this->console_screen_frame_top.setFillColor(VISUAL_SCREEN_FRAME_GREY);
325 
326     this->console_screen_frame_top.setOutlineThickness(2);
327     this->console_screen_frame_top.setOutlineColor(sf::Color(0, 0, 0, 255));
328 
329     this->console_screen_frame_top.move(0, -2);
330 
331 
332     //  2. left framing
333     this->console_screen_frame_left.setPointCount(n_points);
334 
335     this->console_screen_frame_left.setPoint(
336         0,
337         sf::Vector2f(
338             this->position_x - 350,
339             this->position_y + GAME_HEIGHT - 50 - 340
340         )
341     );
342     this->console_screen_frame_left.setPoint(
343         1,
344         sf::Vector2f(
345             this->position_x - 350 - 16,
346             this->position_y + GAME_HEIGHT - 50 - 340 - 16
347         )
348     );
349     this->console_screen_frame_left.setPoint(
350         2,
351         sf::Vector2f(
352             this->position_x - 350 - 16,
353             this->position_y + GAME_HEIGHT - 50 + 16
354         )
355     );
356     this->console_screen_frame_left.setPoint(
357         3,
358         sf::Vector2f(
359             this->position_x - 350,
360             this->position_y + GAME_HEIGHT - 50
361         )
362     );
363 
364     this->console_screen_frame_left.setFillColor(VISUAL_SCREEN_FRAME_GREY);
365 
366     this->console_screen_frame_left.setOutlineThickness(2);
367     this->console_screen_frame_left.setOutlineColor(sf::Color(0, 0, 0, 255));
368 
369     this->console_screen_frame_left.move(-2, 0);
370 
371 
372     //  3. bottom framing
373     this->console_screen_frame_bottom.setPointCount(n_points);
374 
```

```
375     this->console_screen_frame_bottom.setPoint(
376         0,
377         sf::Vector2f(
378             this->position_x - 350,
379             this->position_y + GAME_HEIGHT - 50
380         )
381     );
382     this->console_screen_frame_bottom.setPoint(
383         1,
384         sf::Vector2f(
385             this->position_x - 350 - 16,
386             this->position_y + GAME_HEIGHT - 50 + 16
387         )
388     );
389     this->console_screen_frame_bottom.setPoint(
390         2,
391         sf::Vector2f(
392             this->position_x - 50 + 16,
393             this->position_y + GAME_HEIGHT - 50 + 16
394         )
395     );
396     this->console_screen_frame_bottom.setPoint(
397         3,
398         sf::Vector2f(
399             this->position_x - 50,
400             this->position_y + GAME_HEIGHT - 50
401         )
402     );
403 
404     this->console_screen_frame_bottom.setFillColor(VISUAL_SCREEN_FRAME_GREY);
405 
406     this->console_screen_frame_bottom.setOutlineThickness(2);
407     this->console_screen_frame_bottom.setOutlineColor(sf::Color(0, 0, 0, 255));
408 
409     this->console_screen_frame_bottom.move(0, 2);
410 
411 
412     //  4. right framing
413     this->console_screen_frame_right.setPointCount(n_points);
414 
415     this->console_screen_frame_right.setPoint(
416         0,
417         sf::Vector2f(
418             this->position_x - 50,
419             this->position_y + GAME_HEIGHT - 50
420         )
421     );
422     this->console_screen_frame_right.setPoint(
423         1,
424         sf::Vector2f(
425             this->position_x - 50 + 16,
426             this->position_y + GAME_HEIGHT - 50 + 16
427         )
428     );
429     this->console_screen_frame_right.setPoint(
430         2,
431         sf::Vector2f(
432             this->position_x - 50 + 16,
433             this->position_y + GAME_HEIGHT - 50 - 340 - 16
434         )
435     );
436     this->console_screen_frame_right.setPoint(
437         3,
438         sf::Vector2f(
439             this->position_x - 50,
440             this->position_y + GAME_HEIGHT - 50 - 340
441         )
442     );
443 
444     this->console_screen_frame_right.setFillColor(VISUAL_SCREEN_FRAME_GREY);
445 
446     this->console_screen_frame_right.setOutlineThickness(2);
447     this->console_screen_frame_right.setOutlineColor(sf::Color(0, 0, 0, 255));
448 
449     this->console_screen_frame_right.move(2, 0);
450 
451     return;
452 }   /* __setUpConsoleScreenFrame() */
```

4.2.3.12 __setUpMenuFrame()

```
void ContextMenu::__setUpMenuFrame (
```

```
            void  )  [private]
```

Helper method to set up context menu frame (drawable).

```
68 {
69     this->menu_frame.setSize(sf::Vector2f(400, GAME_HEIGHT));
70     this->menu_frame.setOrigin(400, 0);
71     this->menu_frame.setPosition(this->position_x, this->position_y);
72     this->menu_frame.setFillColor(MENU_FRAME_GREY);
73 
74     return;
75 }   /* __setUpMenuFrame() */
```

4.2.3.13 __setUpVisualScreen()

```
void ContextMenu::__setUpVisualScreen (
            void  )  [private]
```

Helper method to set up context menu visual screen (drawable).

```
90 {
91     this->visual_screen.setSize(sf::Vector2f(300, 300));
92     this->visual_screen.setOrigin(300, 0);
93     this->visual_screen.setPosition(this->position_x - 50, this->position_y + 50);
94     this->visual_screen.setFillColor(MONOCHROME_SCREEN_BACKGROUND);
95 
96     return;
97 }   /* __setUpVisualScreen() */
```

4.2.3.14 __setUpVisualScreenFrame()

```
void ContextMenu::__setUpVisualScreenFrame (
            void  )  [private]
```

Helper method to set up framing for context menu visual screen (drawable).

```
112 {
113     int n_points = 4;
114 
115     //  1. top framing
116     this->visual_screen_frame_top.setPointCount(n_points);
117 
118     this->visual_screen_frame_top.setPoint(
119         0,
120         sf::Vector2f(this->position_x - 50, this->position_y + 50)
121     );
122     this->visual_screen_frame_top.setPoint(
123         1,
124         sf::Vector2f(this->position_x - 50 + 16, this->position_y + 50 - 16)
125     );
126     this->visual_screen_frame_top.setPoint(
127         2,
128         sf::Vector2f(this->position_x - 350 - 16, this->position_y + 50 - 16)
129     );
130     this->visual_screen_frame_top.setPoint(
131         3,
132         sf::Vector2f(this->position_x - 350, this->position_y + 50)
133     );
134 
135     this->visual_screen_frame_top.setFillColor(VISUAL_SCREEN_FRAME_GREY);
136 
137     this->visual_screen_frame_top.setOutlineThickness(2);
138     this->visual_screen_frame_top.setOutlineColor(sf::Color(0, 0, 0, 255));
139 
140     this->visual_screen_frame_top.move(0, -2);
141 
142 
143     //  2. left framing
144     this->visual_screen_frame_left.setPointCount(n_points);
145 
146     this->visual_screen_frame_left.setPoint(
```

```
147         0,
148         sf::Vector2f(this->position_x - 350, this->position_y + 50)
149     );
150     this->visual_screen_frame_left.setPoint(
151         1,
152         sf::Vector2f(this->position_x - 350 - 16, this->position_y + 50 - 16)
153     );
154     this->visual_screen_frame_left.setPoint(
155         2,
156         sf::Vector2f(this->position_x - 350 - 16, this->position_y + 350 + 16)
157     );
158     this->visual_screen_frame_left.setPoint(
159         3,
160         sf::Vector2f(this->position_x - 350, this->position_y + 350)
161     );
162 
163     this->visual_screen_frame_left.setFillColor(VISUAL_SCREEN_FRAME_GREY);
164 
165     this->visual_screen_frame_left.setOutlineThickness(2);
166     this->visual_screen_frame_left.setOutlineColor(sf::Color(0, 0, 0, 255));
167 
168     this->visual_screen_frame_left.move(-2, 0);
169 
170 
171     //  3. bottom framing
172     this->visual_screen_frame_bottom.setPointCount(n_points);
173 
174     this->visual_screen_frame_bottom.setPoint(
175         0,
176         sf::Vector2f(this->position_x - 350, this->position_y + 350)
177     );
178     this->visual_screen_frame_bottom.setPoint(
179         1,
180         sf::Vector2f(this->position_x - 350 - 16, this->position_y + 350 + 16)
181     );
182     this->visual_screen_frame_bottom.setPoint(
183         2,
184         sf::Vector2f(this->position_x - 50 + 16, this->position_y + 350 + 16)
185     );
186     this->visual_screen_frame_bottom.setPoint(
187         3,
188         sf::Vector2f(this->position_x - 50, this->position_y + 350)
189     );
190 
191     this->visual_screen_frame_bottom.setFillColor(VISUAL_SCREEN_FRAME_GREY);
192 
193     this->visual_screen_frame_bottom.setOutlineThickness(2);
194     this->visual_screen_frame_bottom.setOutlineColor(sf::Color(0, 0, 0, 255));
195 
196     this->visual_screen_frame_bottom.move(0, 2);
197 
198 
199     //  4. right framing
200     this->visual_screen_frame_right.setPointCount(n_points);
201 
202     this->visual_screen_frame_right.setPoint(
203         0,
204         sf::Vector2f(this->position_x - 50, this->position_y + 350)
205     );
206     this->visual_screen_frame_right.setPoint(
207         1,
208         sf::Vector2f(this->position_x - 50 + 16, this->position_y + 350 + 16)
209     );
210     this->visual_screen_frame_right.setPoint(
211         2,
212         sf::Vector2f(this->position_x - 50 + 16, this->position_y + 50 - 16)
213     );
214     this->visual_screen_frame_right.setPoint(
215         3,
216         sf::Vector2f(this->position_x - 50, this->position_y + 50)
217     );
218 
219     this->visual_screen_frame_right.setFillColor(VISUAL_SCREEN_FRAME_GREY);
220 
221     this->visual_screen_frame_right.setOutlineThickness(2);
222     this->visual_screen_frame_right.setOutlineColor(sf::Color(0, 0, 0, 255));
223 
224     this->visual_screen_frame_right.move(2, 0);
225 
226     return;
227 }   /* __setUpVisualScreenFrame() */
```

4.2.3.15 draw()

```
void ContextMenu::draw (
            void  )
```

Method to draw the hex tile to the render window. To be called once per frame.

```
1001 {
1002     //  1. menu frame
1003     this->render_window_ptr->draw(this->menu_frame);
1004 
1005     //  2. visual screen
1006     this->render_window_ptr->draw(this->visual_screen);
1007     this->__drawVisualScreenFrame();
1008 
1009     //  3. console screen
1010     this->render_window_ptr->draw(this->console_screen);
1011     this->__drawConsoleScreenFrame();
1012     this->__drawConsoleText();
1013 
1014     this->frame++;
1015     return;
1016 }   /* draw() */
```

4.2.3.16 processEvent()

```
void ContextMenu::processEvent (
            void  )
```

Method to processEvent ContextMenu. To be called once per event.

```
896 {
897     if (this->event_ptr->type == sf::Event::KeyPressed) {
898         this->__handleKeyPressEvents();
899     }
900 
901     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
902         this->__handleMouseButtonEvents();
903     }
904 
905     return;
906 }   /* processEvent() */
```

4.2.3.17 processMessage()

```
void ContextMenu::processMessage (
            void  )
```

Method to processMessage ContextMenu. To be called once per message.

```
921 {
922     switch (this->console_state) {
923         case (ConsoleState :: TILE): {
924             //  process no tile selected
925             if (not this->message_hub_ptr->isEmpty(NO_TILE_SELECTED_CHANNEL)) {
926                 Message no_tile_selected_message = this->message_hub_ptr->receiveMessage(
927                     NO_TILE_SELECTED_CHANNEL
928                 );
929 
930                 if (no_tile_selected_message.subject == "no tile selected") {
931                     this->__setConsoleState(ConsoleState :: READY);
932 
933                     std::cout << "No tile selected message received by " << this <<
934                         std::endl;
935                     this->message_hub_ptr->popMessage(NO_TILE_SELECTED_CHANNEL);
936                 }
937             }
938 
939             //  process tile state
```

```
940             if (not this->message_hub_ptr->isEmpty(TILE_STATE_CHANNEL)) {
941                 Message tile_state_message = this->message_hub_ptr->receiveMessage(
942                     TILE_STATE_CHANNEL
943                 );
944 
945                 if (tile_state_message.subject == "tile state") {
946                     this->console_string = tile_state_message.string_payload["console string"];
947 
948                     this->console_string_changed = true;
949                     this->console_substring_idx = 0;
950 
951                     std::cout « "Tile state message received by " « this « std::endl;
952                     this->message_hub_ptr->popMessage(TILE_STATE_CHANNEL);
953                 }
954             }
955 
956             //  process tile selected (subsequent left clicks causing program to hang)
957             if (not this->message_hub_ptr->isEmpty(TILE_SELECTED_CHANNEL)) {
958                 this->message_hub_ptr->popMessage(TILE_SELECTED_CHANNEL);
959             }
960 
961             break;
962         }
963 
964         default: {
965             //  process tile selected
966             if (not this->message_hub_ptr->isEmpty(TILE_SELECTED_CHANNEL)) {
967                 Message tile_selected_message = this->message_hub_ptr->receiveMessage(
968                     TILE_SELECTED_CHANNEL
969                 );
970 
971                 if (tile_selected_message.subject == "tile selected") {
972                     this->__setConsoleState(ConsoleState :: TILE);
973 
974                     std::cout « "Tile selected message received by " « this «
975                         std::endl;
976                     this->message_hub_ptr->popMessage(TILE_SELECTED_CHANNEL);
977                 }
978             }
979 
980             break;
981         }
982     }
983 
984     return;
985 }   /* processMessage() */
```

4.2.4 Member Data Documentation

4.2.4.1 assets_manager_ptr

```
AssetsManager* ContextMenu::assets_manager_ptr  [private]
```

A pointer to the assets manager.

4.2.4.2 console_screen

```
sf::RectangleShape ContextMenu::console_screen
```

The context menu console screen (for animated text output).

4.2.4.3 console_screen_frame_bottom

```
sf::ConvexShape ContextMenu::console_screen_frame_bottom
```

The bottom framing of the console screen.

4.2.4.4 console_screen_frame_left

```
sf::ConvexShape ContextMenu::console_screen_frame_left
```

The left framing of the console screen.

4.2.4.5 console_screen_frame_right

```
sf::ConvexShape ContextMenu::console_screen_frame_right
```

The right framing of the console screen.

4.2.4.6 console_screen_frame_top

```
sf::ConvexShape ContextMenu::console_screen_frame_top
```

The top framing of the console screen.

4.2.4.7 console_state

```
ConsoleState ContextMenu::console_state
```

The current state of the console screen.

4.2.4.8 console_string

```
std::string ContextMenu::console_string
```

The string to be printed to the console screen.

4.2.4.9 console_string_changed

```
bool ContextMenu::console_string_changed
```

Boolean which indicates if console string just changed.

4.2.4.10 console_substring_idx

```
size_t ContextMenu::console_substring_idx
```

The current final index of the console string draw.

4.2.4.11 event_ptr

```
sf::Event* ContextMenu::event_ptr  [private]
```

A pointer to the event class.

4.2.4.12 frame

```
unsigned long long int ContextMenu::frame
```

The current frame of this object.

4.2.4.13 game_menu_up

```
bool ContextMenu::game_menu_up
```

Indicates whether or not the game menu is up.

4.2.4.14 menu_frame

```
sf::RectangleShape ContextMenu::menu_frame
```

The frame of the context menu.

4.2.4.15 message_hub_ptr

```
MessageHub* ContextMenu::message_hub_ptr  [private]
```

A pointer to the message hub.

4.2.4.16 position_x

```
double ContextMenu::position_x
```

The position of the object.

4.2.4.17 position_y

```
double ContextMenu::position_y
```

The position of the object.

4.2.4.18 render_window_ptr

```
sf::RenderWindow* ContextMenu::render_window_ptr  [private]
```

A pointer to the render window.

4.2.4.19 visual_screen

```
sf::RectangleShape ContextMenu::visual_screen
```

The context menu screen for visuals.

4.2.4.20 visual_screen_frame_bottom

```
sf::ConvexShape ContextMenu::visual_screen_frame_bottom
```

The bottom framing of the visual screen.

4.2.4.21 visual_screen_frame_left

```
sf::ConvexShape ContextMenu::visual_screen_frame_left
```

The left framing of the visual screen.

4.2.4.22 visual_screen_frame_right

```
sf::ConvexShape ContextMenu::visual_screen_frame_right
```

The right framing of the visual screen.

4.2.4.23 visual_screen_frame_top

```
sf::ConvexShape ContextMenu::visual_screen_frame_top
```

The top framing of the visual screen.

The documentation for this class was generated from the following files:

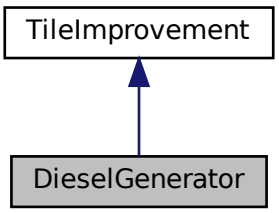
- header/ContextMenu.h
- source/ContextMenu.cpp

4.3 DieselGenerator Class Reference

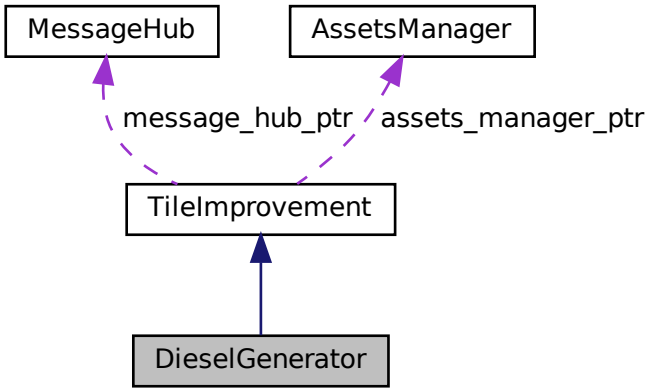
A settlement class (child class of TileImprovement).

```
#include <DieselGenerator.h>
```

Inheritance diagram for DieselGenerator:



Collaboration diagram for DieselGenerator:



Public Member Functions

- DieselGenerator (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)

  Constructor for the DieselGenerator class.
- void processEvent (void)

  Method to process DieselGenerator. To be called once per event.
- void processMessage (void)

  Method to process DieselGenerator. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ∼DieselGenerator (void)

  Destructor for the DieselGenerator class.

Public Attributes

- bool skip_smoke_processing

  A boolean which indicates whether or not to skip smoke processing.
- double smoke_da

  The per frame delta in smoke particle alpha value.
- double smoke_dx

  The per frame delta in smoke particle x position.
- double smoke_dy

  The per frame delta in smoke particle y position.
- double smoke_prob

  The probability of spawning a new smoke prob in any given frame.
- std::list< sf::Sprite > smoke_sprite_list

  A list of smoke sprite (for chimney animation).

Private Member Functions

- void __setUpTileImprovementSpriteAnimated (void)

  Helper method to set up tile improvement sprite (static).
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.3.1 Detailed Description

A settlement class (child class of TileImprovement).

4.3.2 Constructor & Destructor Documentation

4.3.2.1 DieselGenerator()

```
DieselGenerator::DieselGenerator (
            double position_x,
            double position_y,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the DieselGenerator class.

Ref: Wikipedia [2023]

Parameters

position_x	The x position of the tile.
position_y	The y position of the tile.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
212   :
213 TileImprovement(
214     position_x,
215     position_y,
216     event_ptr,
217     render_window_ptr,
218     assets_manager_ptr,
219     message_hub_ptr
220 )
```

```
221 {
222     //  1. set attributes
223 
224     //  1.1. private
225     //...
226 
227     //  1.2. public
228     this->tile_improvement_type = TileImprovementType :: DIESEL_GENERATOR;
229 
230     this->is_running = false;
231     this->skip_smoke_processing = true;
232 
233     this->smoke_da = 1e-8 * SECONDS_PER_FRAME;
234     this->smoke_dx = 5 * SECONDS_PER_FRAME;
235     this->smoke_dy = -10 * SECONDS_PER_FRAME;
236     this->smoke_prob = 8 * SECONDS_PER_FRAME;
237 
238     this->smoke_sprite_list = {};
239 
240     this->tile_improvement_string = "DIESEL GEN";
241 
242     this->__setUpTileImprovementSpriteAnimated();
243 
244     std::cout « "DieselGenerator constructed at " « this « std::endl;
245 
246     return;
247 }   /* DieselGenerator() */
```

4.3.2.2 ~DieselGenerator()

```
DieselGenerator::~DieselGenerator (
             void  )  [virtual]
```

Destructor for the DieselGenerator class.

```
356 {
357     std::cout « "DieselGenerator at " « this « " destroyed" « std::endl;
358 
359     return;
360 }   /* ~DieselGenerator() */
```

4.3.3 Member Function Documentation

4.3.3.1 __handleKeyPressEvents()

```
void DieselGenerator::__handleKeyPressEvents (
             void  )  [private], [virtual]
```

Helper method to handle key press events.

Reimplemented from TileImprovement.

```
114 {
115     switch (this->event_ptr->key.code) {
116         //...
117 
118 
119         default: {
120             // do nothing!
121 
122             break;
123         }
124     }
125 
126     return;
127 }   /* __handleKeyPressEvents() */
```

4.3.3.2 __handleMouseButtonEvents()

```
void DieselGenerator::__handleMouseButtonEvents (
            void  )  [private], [virtual]
```

Helper method to handle mouse button events.

Reimplemented from TileImprovement.

```
142 {
143     switch (this->event_ptr->mouseButton.button) {
144         case (sf::Mouse::Left): {
145             //...
146 
147             break;
148         }
149 
150 
151         case (sf::Mouse::Right): {
152             //...
153 
154             break;
155         }
156 
157 
158         default: {
159             // do nothing!
160 
161             break;
162         }
163     }
164 
165     return;
166 }   /* __handleMouseButtonEvents() */
```

4.3.3.3 __setUpTileImprovementSpriteAnimated()

```
void DieselGenerator::__setUpTileImprovementSpriteAnimated (
            void  )  [private]
```

Helper method to set up tile improvement sprite (static).

```
68 {
69     sf::Sprite diesel_generator_sheet(
70         *(this->assets_manager_ptr->getTexture("diesel generator"))
71     );
72 
73     int n_elements = diesel_generator_sheet.getLocalBounds().height / 64;
74 
75     for (int i = 0; i < n_elements; i++) {
76         this->tile_improvement_sprite_animated.push_back(
77             sf::Sprite(
78                 *(this->assets_manager_ptr->getTexture("diesel generator")),
79                 sf::IntRect(0, i * 64, 64, 64)
80             )
81         );
82 
83         this->tile_improvement_sprite_animated.back().setOrigin(
84             this->tile_improvement_sprite_animated.back().getLocalBounds().width / 2,
85             this->tile_improvement_sprite_animated.back().getLocalBounds().height
86         );
87 
88         this->tile_improvement_sprite_animated.back().setPosition(
89             this->position_x,
90             this->position_y - 32
91         );
92 
93         this->tile_improvement_sprite_animated.back().setColor(
94             sf::Color(255, 255, 255, 0)
95         );
96     }
97 
98     return;
99 }   /* __setUpTileImprovementSpriteAnimated() */
```

4.3.3.4 draw()

```
void DieselGenerator::draw (
            void  )  [virtual]
```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from TileImprovement.

```
307 {
308     //  1. if just built, call base method and return
309     if (this->just_built) {
310         TileImprovement :: draw();
311 
312         return;
313     }
314 
315 
316     //  1. draw first element of animated sprite
317     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
318 
319 
320     //  2. draw second element of animated sprite
321     if (this->is_running) {
322         //...
323     }
324 
325     else {
326         //...
327     }
328 
329     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
330 
331 
332     //  3. draw smoke effects
333     if (this->is_running) {
334         //...
335     }
336 
337     //...
338 
339     this->frame++;
340     return;
341 }   /* draw() */
```

4.3.3.5 processEvent()

```
void DieselGenerator::processEvent (
            void  )  [virtual]
```

Method to process DieselGenerator. To be called once per event.

Reimplemented from TileImprovement.

```
262 {
263     if (this->event_ptr->type == sf::Event::KeyPressed) {
264         this->__handleKeyPressEvents();
265     }
266 
267     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
268         this->__handleMouseButtonEvents();
269     }
270 
271     return;
272 }   /* processEvent() */
```

4.3.3.6 processMessage()

```
void DieselGenerator::processMessage (
            void  )  [virtual]
```

Method to process DieselGenerator. To be called once per message.

Reimplemented from TileImprovement.

```
287 {
288     //...
289
290     return;
291 }   /* processMessage() */
```

4.3.4 Member Data Documentation

4.3.4.1 skip_smoke_processing

```
bool DieselGenerator::skip_smoke_processing
```

A boolean which indicates whether or not to skip smoke processing.

4.3.4.2 smoke_da

```
double DieselGenerator::smoke_da
```

The per frame delta in smoke particle alpha value.

4.3.4.3 smoke_dx

```
double DieselGenerator::smoke_dx
```

The per frame delta in smoke particle x position.

4.3.4.4 smoke_dy

```
double DieselGenerator::smoke_dy
```

The per frame delta in smoke particle y position.

4.3.4.5 smoke_prob

```
double DieselGenerator::smoke_prob
```

The probability of spawning a new smoke prob in any given frame.

4.3.4.6 smoke_sprite_list

```
std::list<sf::Sprite> DieselGenerator::smoke_sprite_list
```

A list of smoke sprite (for chimney animation).

The documentation for this class was generated from the following files:

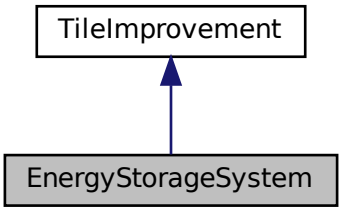
- header/DieselGenerator.h
- source/DieselGenerator.cpp

4.4 EnergyStorageSystem Class Reference

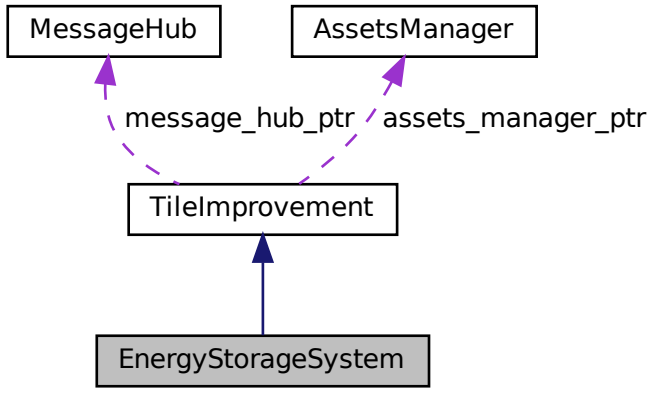
A settlement class (child class of TileImprovement).

```
#include <EnergyStorageSystem.h>
```

Inheritance diagram for EnergyStorageSystem:



Collaboration diagram for EnergyStorageSystem:



Public Member Functions

- EnergyStorageSystem (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)

  Constructor for the EnergyStorageSystem class.
- void processEvent (void)

  Method to process EnergyStorageSystem. To be called once per event.
- void processMessage (void)

  Method to process EnergyStorageSystem. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ∼EnergyStorageSystem (void)

  Destructor for the EnergyStorageSystem class.

Private Member Functions

- void __setUpTileImprovementSpriteStatic (void)

  Helper method to set up tile improvement sprite (static).
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.4.1 Detailed Description

A settlement class (child class of TileImprovement).

4.4.2 Constructor & Destructor Documentation

4.4.2.1 EnergyStorageSystem()

```
EnergyStorageSystem::EnergyStorageSystem (
            double position_x,
            double position_y,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the EnergyStorageSystem class.

Ref: Wikipedia [2023]

Parameters

position_x	The x position of the tile.
position_y	The y position of the tile.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
201   :
202 TileImprovement(
203     position_x,
204     position_y,
205     event_ptr,
206     render_window_ptr,
207     assets_manager_ptr,
208     message_hub_ptr
209 )
210 {
211     //  1. set attributes
212
213     //  1.1. private
214     //...
215
216     //  1.2. public
217     this->tile_improvement_type = TileImprovementType :: ENERGY_STORAGE_SYSTEM;
218
219     this->is_running = false;
220
221     this->tile_improvement_string = "ENERGY STORAGE";
222
223     this->__setUpTileImprovementSpriteStatic();
224
225     std::cout « "EnergyStorageSystem constructed at " « this « std::endl;
226
227     return;
228 }   /* EnergyStorageSystem() */
```

4.4.2.2 ~EnergyStorageSystem()

```
EnergyStorageSystem::~EnergyStorageSystem (
            void  )  [virtual]
```

Destructor for the EnergyStorageSystem class.

```
317 {
318     std::cout « "EnergyStorageSystem at " « this « " destroyed" « std::endl;
319 
320     return;
321 }   /* ~EnergyStorageSystem() */
```

4.4.3 Member Function Documentation

4.4.3.1 __handleKeyPressEvents()

```
void EnergyStorageSystem::__handleKeyPressEvents (
            void  )  [private], [virtual]
```

Helper method to handle key press events.

Reimplemented from TileImprovement.

```
103 {
104     switch (this->event_ptr->key.code) {
105         //...
106 
107 
108         default: {
109             // do nothing!
110 
111             break;
112         }
113     }
114 
115     return;
116 }   /* __handleKeyPressEvents() */
```

4.4.3.2 __handleMouseButtonEvents()

```
void EnergyStorageSystem::__handleMouseButtonEvents (
            void  )  [private], [virtual]
```

Helper method to handle mouse button events.

Reimplemented from TileImprovement.

```
131 {
132     switch (this->event_ptr->mouseButton.button) {
133         case (sf::Mouse::Left): {
134             //...
135 
136             break;
137         }
138 
139 
140         case (sf::Mouse::Right): {
141             //...
142 
143             break;
144         }
145 
146 
147         default: {
148             // do nothing!
149 
150             break;
151         }
152     }
153 
154     return;
155 }   /* __handleMouseButtonEvents() */
```

4.4.3.3 __setUpTileImprovementSpriteStatic()

```
void EnergyStorageSystem::__setUpTileImprovementSpriteStatic (
            void  )  [private]
```

Helper method to set up tile improvement sprite (static).

```
68 {
69     this->tile_improvement_sprite_static.setTexture(
70         *(this->assets_manager_ptr->getTexture("energy storage system"))
71     );
72
73     this->tile_improvement_sprite_static.setOrigin(
74         this->tile_improvement_sprite_static.getLocalBounds().width / 2,
75         this->tile_improvement_sprite_static.getLocalBounds().height
76     );
77
78     this->tile_improvement_sprite_static.setPosition(
79         this->position_x,
80         this->position_y - 32
81     );
82
83     this->tile_improvement_sprite_static.setColor(
84         sf::Color(255, 255, 255, 0)
85     );
86
87     return;
88 }   /* __setUpTileImprovementSpriteStatic() */
```

4.4.3.4 draw()

```
void EnergyStorageSystem::draw (
            void  )  [virtual]
```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from TileImprovement.

```
288 {
289     //  1. if just built, call base method and return
290     if (this->just_built) {
291         TileImprovement :: draw();
292
293         return;
294     }
295
296
297     //  1. draw static sprite
298     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
299
300     this->frame++;
301     return;
302 }   /* draw() */
```

4.4.3.5 processEvent()

```
void EnergyStorageSystem::processEvent (
            void  )  [virtual]
```

Method to process EnergyStorageSystem. To be called once per event.

Reimplemented from TileImprovement.

```
243 {
244     if (this->event_ptr->type == sf::Event::KeyPressed) {
245         this->__handleKeyPressEvents();
246     }
247
248     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
249         this->__handleMouseButtonEvents();
250     }
251
252     return;
253 }   /* processEvent() */
```

4.4.3.6 processMessage()

```
void EnergyStorageSystem::processMessage (
            void  )  [virtual]
```

Method to process EnergyStorageSystem. To be called once per message.

Reimplemented from TileImprovement.

```
268 {
269     //...
270
271     return;
272 }   /* processMessage() */
```

The documentation for this class was generated from the following files:

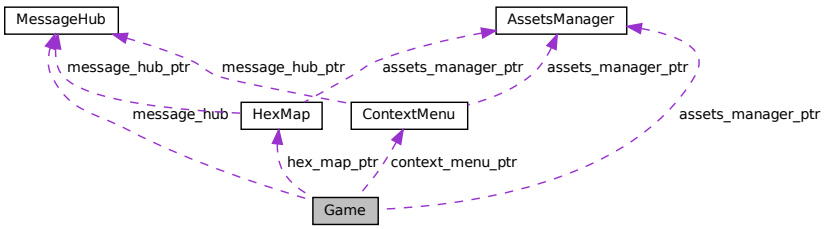
- header/EnergyStorageSystem.h
- source/EnergyStorageSystem.cpp

4.5 Game Class Reference

A class which acts as the central class for the game, by containing all other classes and implementing the game loop.

```
#include <Game.h>
```

Collaboration diagram for Game:



Public Member Functions

- Game (sf::RenderWindow *, AssetsManager *)

  Constructor for the Game class.
- bool run (void)

  Method to run game (defines game loop).
- ~Game (void)

  Destructor for the Game class.

Public Attributes

- GamePhase game_phase

  The current phase of the game.
- bool quit_game

  Boolean indicating whether to quit (true) or create a new Game instance (false).
- bool game_loop_broken

  Boolean indicating whether or not the game loop is broken.
- bool show_frame_clock_overlay

  Boolean indicating whether or not to show frame and clock overlay.
- unsigned long long int frame

  The current frame of the game.
- double time_since_start_s

  The time elapsed [s] since the start of the game.
- int year

  Current game year.
- int month

  Current game month.
- int population

  Current population.
- int credits

  Current balance of credits.
- int demand_MWh

  Current energy demand [MWh].
- int cumulative_emissions_tonnes

  Cumulative emissions [tonnes] (1 tonne = 1000 kg).
- int turn = 0

  The current game turn.
- sf::Clock clock

  The game clock.
- sf::Event event

  The game events class.
- MessageHub message_hub

  The message hub (for inter-object message traffic).
- HexMap * hex_map_ptr

  Pointer to the hex map (defines game world).
- ContextMenu * context_menu_ptr

  Pointer to the context menu.

Private Member Functions

- void __toggleFrameClockOverlay (void)

  Helper method to toggle frame clock overlay.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.
- void __processEvent (void)

  Helper method to process Game. To be called once per event.
- void __processMessage (void)

Helper method to process Game. To be called once per message.

- void __sendGameStateMessage (void)

  Helper method to format and send a game state message.

- void __insufficientCreditsAlarm (void)

  Helper method to sound and display and insufficient credits alarm.

- void __drawFrameClockOverlay (void)

  Helper method to draw frame clock overlay.

- void __drawHUD (void)

  Helper method to heads-up display (HUD).

- void __draw (void)

  Helper method to draw game to the render window. To be called once per frame.

Private Attributes

- sf::RenderWindow * render_window_ptr

  A pointer to the render window.

- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.

4.5.1 Detailed Description

A class which acts as the central class for the game, by containing all other classes and implementing the game loop.

4.5.2 Constructor & Destructor Documentation

4.5.2.1 Game()

```
Game::Game (
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr )
```

Constructor for the Game class.

```
702 {
703     //  1. set attributes
704
705     //  1.1. private
706     this->render_window_ptr = render_window_ptr;
707
708     this->assets_manager_ptr = assets_manager_ptr;
709
710     //  1.2. public
711     this->game_phase = GamePhase :: BUILD_SETTLEMENT;
712
713     this->quit_game = false;
714     this->game_loop_broken = false;
715     this->show_frame_clock_overlay = false;
716
717     this->frame = 0;
718     this->time_since_start_s = 0;
719
720     double seconds_since_epoch = time(NULL);
721     double years_since_epoch = seconds_since_epoch / SECONDS_PER_YEAR;
722
723     this->year = 1970 + (int)years_since_epoch;
```

```
724     this->month = (years_since_epoch - (int)years_since_epoch) * 12 + 1;
725
726     this->population = 0;
727     this->credits = STARTING_CREDITS;
728     this->demand_MWh = 0;
729     this->cumulative_emissions_tonnes = 0;
730
731     this->hex_map_ptr = new HexMap(
732         6,
733         &(this->event),
734         this->render_window_ptr,
735         this->assets_manager_ptr,
736         &(this->message_hub)
737     );
738
739     this->context_menu_ptr = new ContextMenu(
740         &(this->event),
741         this->render_window_ptr,
742         this->assets_manager_ptr,
743         &(this->message_hub)
744     );
745
746     //  2. add message channel(s)
747     this->message_hub.addChannel(GAME_CHANNEL);
748     this->message_hub.addChannel(GAME_STATE_CHANNEL);
749
750     std::cout << "Game constructed at " << this << std::endl;
751
752     return;
753 }   /* Game() */
```

4.5.2.2 ~Game()

```
Game::~Game (
            void  )
```

Destructor for the Game class.

```
837 {
838     //  1. clean up attributes
839     delete this->hex_map_ptr;
840     delete this->context_menu_ptr;
841
842     std::cout << "Game at " << this << " destroyed" << std::endl;
843
844     return;
845 }   /* ~Game() */
```

4.5.3 Member Function Documentation

4.5.3.1 __draw()

```
void Game::__draw (
            void  )  [private]
```

Helper method to draw game to the render window. To be called once per frame.

```
669 {
670     this->__drawHUD();
671
672     if (this->show_frame_clock_overlay) {
673         this->__drawFrameClockOverlay();
674     }
675
676     return;
677 }   /* draw() */
```

4.5.3.2 __drawFrameClockOverlay()

```
void Game::__drawFrameClockOverlay (
            void  )  [private]
```

Helper method to draw frame clock overlay.

```
495 {
496     std::string frame_clock_string = "FRAME: ";
497     frame_clock_string += std::to_string(this->frame);
498     frame_clock_string += "\nTIME SINCE START [s]: ";
499     frame_clock_string += std::to_string(this->time_since_start_s);
500 
501     sf::Text frame_clock_text(
502         frame_clock_string,
503         *(this->assets_manager_ptr->getFont("DroidSansMono")),
504         16
505     );
506 
507     sf::RectangleShape frame_clock_backing(
508         sf::Vector2f(
509             1.02 * frame_clock_text.getLocalBounds().width,
510             1.20 * frame_clock_text.getLocalBounds().height
511         )
512     );
513     frame_clock_backing.setFillColor(sf::Color(0, 0, 0, 255));
514 
515     this->render_window_ptr->draw(frame_clock_backing);
516     this->render_window_ptr->draw(frame_clock_text);
517 
518     return;
519 }   /* __drawFrameClockOverlay() */
```

4.5.3.3 __drawHUD()

```
void Game::__drawHUD (
            void  )  [private]
```

Helper method to heads-up display (HUD).

```
534 {
535     //  1. first line (top)
536     std::string HUD_string = "YEAR: ";
537     HUD_string += std::to_string(this->year);
538 
539     HUD_string += "    MONTH: ";
540     HUD_string += std::to_string(this->month);
541 
542     HUD_string += "    POPULATION: ";
543     HUD_string += std::to_string(this->population);
544 
545     HUD_string += "    CREDITS: ";
546     HUD_string += std::to_string(this->credits);
547     HUD_string += " K";
548 
549     HUD_string += "    CURRENT DEMAND: ";
550     HUD_string += std::to_string(this->demand_MWh);
551     HUD_string += " MWh";
552 
553     sf::Text HUD_text(
554         HUD_string,
555         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
556         16
557     );
558 
559     HUD_text.setPosition(
560         (800 - HUD_text.getLocalBounds().width) / 2,
561         8
562     );
563 
564     HUD_text.setFillColor(MONOCHROME_TEXT_GREEN);
565 
566     this->render_window_ptr->draw(HUD_text);
567 
568 
569     //  2. second line (top)
570     HUD_string = "CUMULATIVE EMISSIONS: ";
```

```
571     HUD_string += std::to_string(this->cumulative_emissions_tonnes);
572     HUD_string += " tonnes (CO2e)";
573 
574     HUD_string += "    LIFETIME LIMIT: ";
575     HUD_string += std::to_string(EMISSIONS_LIFETIME_LIMIT_TONNES);
576     HUD_string += " tonnes (CO2e)";
577 
578     HUD_text.setString(HUD_string);
579 
580     HUD_text.setPosition(
581         (800 - HUD_text.getLocalBounds().width) / 2,
582         35
583     );
584 
585     this->render_window_ptr->draw(HUD_text);
586 
587 
588     //  3. third line (bottom)
589     HUD_string = "GAME PHASE: ";
590 
591     switch (this->game_phase) {
592         case (GamePhase :: BUILD_SETTLEMENT): {
593             HUD_string += "BUILD SETTLEMENT";
594 
595             break;
596         }
597 
598 
599         case (GamePhase :: SYSTEM_MANAGEMENT): {
600             HUD_string += "SYSTEM MANAGEMENT";
601 
602             break;
603         }
604 
605 
606         case (GamePhase :: LOSS_EMISSIONS): {
607             HUD_string += "LOSS (EMISSIONS)";
608 
609             break;
610         }
611 
612 
613         case (GamePhase :: LOSS_DEMAND): {
614             HUD_string += "LOSS (DEMAND)";
615 
616             break;
617         }
618 
619 
620         case (GamePhase :: LOSS_CREDITS): {
621             HUD_string += "LOSS (CREDITS)";
622 
623             break;
624         }
625 
626 
627         case (GamePhase :: VICTORY): {
628             HUD_string += "VICTORY";
629 
630             break;
631         }
632 
633 
634         default: {
635             HUD_string += "???";
636 
637             break;
638         }
639     }
640 
641     HUD_string += "    TURN: ";
642     HUD_string += std::to_string(this->turn);
643 
644     HUD_text.setString(HUD_string);
645 
646     HUD_text.setPosition(
647         (800 - HUD_text.getLocalBounds().width) / 2,
648         GAME_HEIGHT - 35
649     );
650 
651     this->render_window_ptr->draw(HUD_text);
652 
653     return;
654 }   /* __drawHUD() */
```

4.5.3.4 __handleKeyPressEvents()

```
void Game::__handleKeyPressEvents (
            void  )  [private]
```

Helper method to handle key press events.

```
93 {
94     switch (this->event.key.code) {
95         case (sf::Keyboard::Tilde): {
96             this->__toggleFrameClockOverlay();
97 
98             break;
99         }
100 
101 
102         case (sf::Keyboard::Tab): {
103             this->hex_map_ptr->toggleResourceOverlay();
104 
105             break;
106         }
107 
108 
109         default: {
110             // do nothing!
111 
112             break;
113         }
114     }
115 
116     return;
117 }   /* __handleKeyPressEvents() */
```

4.5.3.5 __handleMouseButtonEvents()

```
void Game::__handleMouseButtonEvents (
            void  )  [private]
```

Helper method to handle mouse button events.

```
132 {
133     switch (this->event.mouseButton.button) {
134         case (sf::Mouse::Left): {
135             //...
136 
137             break;
138         }
139 
140 
141         case (sf::Mouse::Right): {
142             //...
143 
144             break;
145         }
146 
147 
148         default: {
149             // do nothing!
150 
151             break;
152         }
153     }
154 
155     return;
156 }   /* __handleMouseButtonEvents() */
```

4.5.3.6 __insufficientCreditsAlarm()

```
void Game::__insufficientCreditsAlarm (
            void  )  [private]
```

Helper method to sound and display and insufficient credits alarm.

```
388 {
389     //  1. sound buzzer
390     this->assets_manager_ptr->getSound("insufficient credits")->play();
391 
392     //  2. construct alarm text and backing rectangle
393     sf::Text insufficient_credits_text(
394         "INSUFFICIENT CREDITS",
395         (*(this->assets_manager_ptr->getFont("DroidSansMono"))),
396         32
397     );
398 
399     insufficient_credits_text.setOrigin(
400         insufficient_credits_text.getLocalBounds().width / 2,
401         insufficient_credits_text.getLocalBounds().height / 2
402     );
403 
404     insufficient_credits_text.setPosition(400, GAME_HEIGHT / 2);
405 
406     sf::RectangleShape backing_rectangle(
407         sf::Vector2f(
408             1.1 * insufficient_credits_text.getLocalBounds().width,
409             1.5 * insufficient_credits_text.getLocalBounds().height
410         )
411     );
412 
413     backing_rectangle.setFillColor(RESOURCE_CHIP_GREY);
414 
415     backing_rectangle.setOrigin(
416         backing_rectangle.getLocalBounds().width / 2,
417         backing_rectangle.getLocalBounds().height / 2
418     );
419 
420     backing_rectangle.setPosition(400, (GAME_HEIGHT / 2) + 8);
421 
422     //  3. display loop (blocking ~3 seconds)
423     bool red_flag = true;
424     int alarm_frame = 0;
425     double time_since_alarm_s = 0;
426 
427     sf::Clock alarm_clock;
428 
429     while (alarm_frame < 2.5 * FRAMES_PER_SECOND) {
430 
431 
432         time_since_alarm_s = alarm_clock.getElapsedTime().asSeconds();
433 
434         if (time_since_alarm_s >= (alarm_frame + 1) * SECONDS_PER_FRAME) {
435             while (this->render_window_ptr->pollEvent(this->event)) {
436                 // do nothing!
437             }
438 
439             this->render_window_ptr->clear();
440 
441             this->hex_map_ptr->draw();
442             this->context_menu_ptr->draw();
443             this->__draw();
444 
445             if (alarm_frame % (FRAMES_PER_SECOND / 3) == 0) {
446                 if (red_flag) {
447                     red_flag = false;
448                 }
449 
450                 else {
451                     red_flag = true;
452                 }
453             }
454 
455             if (red_flag) {
456                 insufficient_credits_text.setFillColor(MONOCHROME_TEXT_RED);
457             }
458 
459             else {
460                 insufficient_credits_text.setFillColor(sf::Color(255, 255, 255));
461             }
462 
463             this->render_window_ptr->draw(backing_rectangle);
464             this->render_window_ptr->draw(insufficient_credits_text);
465 
```

```
466             this->render_window_ptr->display();
467
468             alarm_frame++;
469             this->frame++;
470         }
471
472         // check track status, move to next if stopped
473         if (this->assets_manager_ptr->getTrackStatus() == sf::SoundSource::Stopped) {
474             this->assets_manager_ptr->nextTrack();
475             this->assets_manager_ptr->playTrack();
476         }
477     }
478
479     return;
480 }   /* __insufficientCreditsAlarm( */
```

4.5.3.7 __processEvent()

```
void Game::__processEvent (
              void  )  [private]
```

Helper method to process Game. To be called once per event.

```
172 {
173     if (this->event.type == sf::Event::Closed) {
174         this->quit_game = true;
175         this->game_loop_broken = true;
176     }
177
178     if (this->event.type == sf::Event::KeyPressed) {
179         this->__handleKeyPressEvents();
180     }
181
182     if (this->event.type == sf::Event::MouseButtonPressed) {
183         this->__handleMouseButtonEvents();
184     }
185
186     return;
187 }   /* __processEvent() */
```

4.5.3.8 __processMessage()

```
void Game::__processMessage (
              void  )  [private]
```

Helper method to process Game. To be called once per message.

```
285 {
286     if (not this->message_hub.isEmpty(GAME_CHANNEL)) {
287         Message game_channel_message = this->message_hub.receiveMessage(GAME_CHANNEL);
288
289         if (game_channel_message.subject == "quit game") {
290             this->quit_game = true;
291             this->game_loop_broken = true;
292
293             std::cout « "Quit game message received by " « this « std::endl;
294             this->message_hub.popMessage(GAME_CHANNEL);
295         }
296
297         if (game_channel_message.subject == "restart game") {
298             this->game_loop_broken = true;
299
300             std::cout « "Restart game message received by " « this « std::endl;
301             this->message_hub.popMessage(GAME_CHANNEL);
302         }
303
304         if (game_channel_message.subject == "state request") {
305             std::cout « "Game state request message received by " « this « std::endl;
306
307             this->__sendGameStateMessage();
308             this->message_hub.popMessage(GAME_CHANNEL);
```

```
309         }
310
311         if (game_channel_message.subject == "credits spent") {
312             this->credits -= game_channel_message.int_payload["credits spent"];
313
314             std::cout « "Credits spent message (" «
315                 game_channel_message.int_payload["credits spent"] « ") received by "
316                 « this « std::endl;
317
318             std::cout « "Current credits (Game): " « this->credits « " K" «
319                 std::endl;
320
321             this->message_hub.popMessage(GAME_CHANNEL);
322         }
323
324         if (game_channel_message.subject == "insufficient credits") {
325             std::cout « "Insufficient credits message received by " « this «
326                 std::endl;
327
328             this->__insufficientCreditsAlarm();
329
330             this->message_hub.popMessage(GAME_CHANNEL);
331         }
332
333         if (game_channel_message.subject == "update game phase") {
334             std::cout « "Update game phase message received by " « this « std::endl;
335
336             if (
337                 game_channel_message.string_payload["game phase"] == "system management"
338             ) {
339                 this->game_phase = GamePhase :: SYSTEM_MANAGEMENT;
340                 this->population = STARTING_POPULATION;
341                 this->turn++;
342             }
343
344             else if (
345                 game_channel_message.string_payload["game phase"] == "loss emissions"
346             ) {
347                 this->game_phase = GamePhase :: LOSS_EMISSIONS;
348             }
349
350             else if (
351                 game_channel_message.string_payload["game phase"] == "loss demand"
352             ) {
353                 this->game_phase = GamePhase :: LOSS_DEMAND;
354             }
355
356             else if (
357                 game_channel_message.string_payload["game phase"] == "loss credits"
358             ) {
359                 this->game_phase = GamePhase :: LOSS_CREDITS;
360             }
361
362             else if (
363                 game_channel_message.string_payload["game phase"] == "victory"
364             ) {
365                 this->game_phase = GamePhase :: VICTORY;
366             }
367
368             this->message_hub.popMessage(GAME_CHANNEL);
369         }
370     }
371
372     return;
373 }   /* __processMessage() */
```

4.5.3.9 __sendGameStateMessage()

```
void Game::__sendGameStateMessage (
            void  )  [private]
```

Helper method to format and send a game state message.

```
202 {
203     Message game_state_message;
204
205     game_state_message.channel = GAME_STATE_CHANNEL;
206     game_state_message.subject = "game state";
207
```

```
208     game_state_message.int_payload["year"] = this->year;
209     game_state_message.int_payload["month"] = this->month;
210     game_state_message.int_payload["population"] = this->population;
211     game_state_message.int_payload["credits"] = this->credits;
212     game_state_message.int_payload["demand_MWh"] = this->demand_MWh;
213     game_state_message.int_payload["cumulative_emissions_tonnes"] =
214         this->cumulative_emissions_tonnes;
215
216     switch (this->game_phase) {
217         case (GamePhase :: BUILD_SETTLEMENT): {
218             game_state_message.string_payload["game phase"] = "build settlement";
219
220             break;
221         }
222
223
224         case (GamePhase :: SYSTEM_MANAGEMENT): {
225             game_state_message.string_payload["game phase"] = "system management";
226
227             break;
228         }
229
230
231         case (GamePhase :: LOSS_EMISSIONS): {
232             game_state_message.string_payload["game phase"] = "loss emissions";
233
234             break;
235         }
236
237
238         case (GamePhase :: LOSS_DEMAND): {
239             game_state_message.string_payload["game phase"] = "loss demand";
240
241             break;
242         }
243
244
245         case (GamePhase :: LOSS_CREDITS): {
246             game_state_message.string_payload["game phase"] = "loss credits";
247
248             break;
249         }
250
251
252         case (GamePhase :: VICTORY): {
253             game_state_message.string_payload["game phase"] = "victory";
254
255             break;
256         }
257
258
259         default: {
260             // do nothing!
261
262             break;
263         }
264     }
265
266     this->message_hub.sendMessage(game_state_message);
267
268     std::cout « "Game state message sent by " « this « std::endl;
269     return;
270 }   /* __sendGameStateMessage() */
```

4.5.3.10 __toggleFrameClockOverlay()

```
void Game::__toggleFrameClockOverlay (
            void  )  [private]
```

Helper method to toggle frame clock overlay.

```
68 {
69     if (this->show_frame_clock_overlay) {
70         this->show_frame_clock_overlay = false;
71     }
72
73     else {
74         this->show_frame_clock_overlay = true;
75     }
```

```
76
77     return;
78 }   /* __toggleFrameClockOverlay() */
```

4.5.3.11 run()

```
bool Game::run (
              void  )
```

Method to run game (defines game loop).

Returns

Boolean indicating whether to quit (true) or create a new Game instance (false).

```
771 {
772     //  1. play brand animation
773     //...
774
775     //  2. show splash screen
776     //...
777
778     //  3. start game loop
779     while (not this->game_loop_broken) {
780         this->time_since_start_s = this->clock.getElapsedTime().asSeconds();
781
782         if (this->time_since_start_s >= (this->frame + 1) * SECONDS_PER_FRAME) {
783             //  6.1. process events
784             while (this->render_window_ptr->pollEvent(this->event)) {
785                 this->hex_map_ptr->processEvent();
786                 this->context_menu_ptr->processEvent();
787                 this->__processEvent();
788             }
789
790
791             //  6.2. process messages
792             while (this->message_hub.hasTraffic()) {
793                 this->hex_map_ptr->processMessage();
794                 this->context_menu_ptr->processMessage();
795                 this->__processMessage();
796             }
797
798
799             //  6.3. draw frame
800             this->render_window_ptr->clear();
801
802             this->hex_map_ptr->draw();
803             this->context_menu_ptr->draw();
804             this->__draw();
805
806             this->render_window_ptr->display();
807
808
809             //  6.4. increment frame
810             this->frame++;
811         }
812
813         // check track status, move to next if stopped
814         if (this->assets_manager_ptr->getTrackStatus() == sf::SoundSource::Stopped) {
815             this->assets_manager_ptr->nextTrack();
816             this->assets_manager_ptr->playTrack();
817         }
818
819     }
820
821     return this->quit_game;
822 }   /* run() */
```

4.5.4 Member Data Documentation

4.5.4.1 assets_manager_ptr

```
AssetsManager* Game::assets_manager_ptr  [private]
```

A pointer to the assets manager.

4.5.4.2 clock

```
sf::Clock Game::clock
```

The game clock.

4.5.4.3 context_menu_ptr

```
ContextMenu* Game::context_menu_ptr
```

Pointer to the context menu.

4.5.4.4 credits

```
int Game::credits
```

Current balance of credits.

4.5.4.5 cumulative_emissions_tonnes

```
int Game::cumulative_emissions_tonnes
```

Cumulative emissions [tonnes] (1 tonne = 1000 kg).

4.5.4.6 demand_MWh

```
int Game::demand_MWh
```

Current energy demand [MWh].

4.5.4.7 event

```
sf::Event Game::event
```

The game events class.

4.5.4.8 frame

```
unsigned long long int Game::frame
```

The current frame of the game.

4.5.4.9 game_loop_broken

```
bool Game::game_loop_broken
```

Boolean indicating whether or not the game loop is broken.

4.5.4.10 game_phase

```
GamePhase Game::game_phase
```

The current phase of the game.

4.5.4.11 hex_map_ptr

```
HexMap* Game::hex_map_ptr
```

Pointer to the hex map (defines game world).

4.5.4.12 message_hub

```
MessageHub Game::message_hub
```

The message hub (for inter-object message traffic).

4.5.4.13 month

```
int Game::month
```

Current game month.

4.5.4.14 population

```
int Game::population
```

Current population.

4.5.4.15 quit_game

```
bool Game::quit_game
```

Boolean indicating whether to quit (true) or create a new Game instance (false).

4.5.4.16 render_window_ptr

```
sf::RenderWindow* Game::render_window_ptr  [private]
```

A pointer to the render window.

4.5.4.17 show_frame_clock_overlay

```
bool Game::show_frame_clock_overlay
```

Boolean indicating whether or not to show frame and clock overlay.

4.5.4.18 time_since_start_s

```
double Game::time_since_start_s
```

The time elapsed [s] since the start of the game.

4.5.4.19 turn

```
int Game::turn = 0
```

The current game turn.

4.5.4.20 year

```
int Game::year
```

Current game year.

The documentation for this class was generated from the following files:

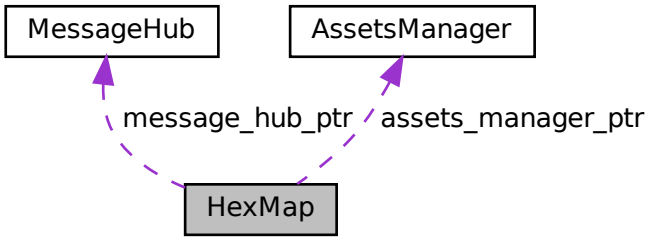
- header/Game.h
- source/Game.cpp

4.6 HexMap Class Reference

A class which defines a hex map of hex tiles.

```
#include <HexMap.h>
```

Collaboration diagram for HexMap:



Public Member Functions

- HexMap (int, sf::Event *, sf::RenderWindow *, AssetsManager *, MessageHub *)

  Constructor (intended) for the HexMap class.
- void assess (void)

  Method to assess the resource of the selected tile.
- void reroll (void)

  Method to re-roll the hex map.
- void toggleResourceOverlay (void)

  Method to toggle the hex map resource overlay.
- void processEvent (void)

  Method to process HexMap. To be called once per event.
- void processMessage (void)

  Method to process HexMap. To be called once per message.
- void draw (void)

  Method to draw the hex map to the render window. To be called once per frame.
- void clear (void)

  Method to clear the hex map.
- ~HexMap (void)

  Destructor for the HexMap class.

Public Attributes

- bool show_resource

  A boolean which indicates whether or not to show resource value.
- bool tile_selected

  A boolean which indicates if a tile is currently selected.
- int n_layers

  The number of layers in the hex map.
- int n_tiles

  The number of tiles in the hex map.
- unsigned long long int frame

  The current frame of this object.
- double position_x

  The x position of the hex map's origin (i.e. central) tile.
- double position_y

  The y position of the hex map's origin (i.e. central) tile.
- sf::RectangleShape glass_screen

  To give the effect of an old glass screen over the hex map.
- std::vector< double > tile_position_x_vec

  A vector of tile x positions.
- std::vector< double > tile_position_y_vec

  A vector of tile y position.
- std::vector< HexTile * > border_tiles_vec

  A vector of pointers to the border tiles.
- std::map< double, std::map< double, HexTile * > > hex_map

  A position-indexed, nested map of hex tiles.
- std::vector< HexTile * > hex_draw_order_vec

  A vector of hex tiles, in drawing order.

Private Member Functions

- void __setUpGlassScreen (void)

  Helper method to set up glass screen effect (drawable).
- void __layTiles (void)

  Helper method to lay the hex tiles down to generate the game world.
- void __buildDrawOrderVector (void)

  Helper method to build tile drawing order vector.
- std::vector< double > __getNoise (int, int=128)

  Helper method to generate a vector of noise, with values mapped to the closed interval [0, 1]. Applies a random cosine series approach.
- void __procedurallyGenerateTileTypes (void)

  Helper method to procedurally generate tile types and set tiles accordingly.
- std::vector< double > __getValidMapIndexPositions (double, double)

  Helper method to translate given position into valid index position for a.
- std::vector< HexTile * > __getNeighboursVector (HexTile *)

  Helper method to assemble a vector pointers to all neighbours of the given tile.
- TileType __getMajorityTileType (HexTile *)

  Function to return majority tile type of a tile and its neighbours. If no clear majority, simply returns the type of the given tile.
- void __smoothTileTypes (void)

  Helper method to smooth tile types using a majority rules approach.
- bool __isLakeTouchingOcean (HexTile *)
- void __enforceOceanContinuity (void)

  Helper method to scan tiles and enforce ocean continuity. That is to say, if a lake tile is found to be in contact with an ocean tile, then it becomes ocean.
- void __procedurallyGenerateTileResources (void)

  Helper method to procedurally generate tile resources and set tiles accordingly.
- void __assembleHexMap (void)

  Helper method to assemble the hex map.
- HexTile * __getSelectedTile (void)

  Helper method to get pointer to selected tile.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.
- void __sendNoTileSelectedMessage (void)

  Helper method to format and send message on no tile selected.
- void __assessNeighbours (HexTile *)

  Helper method to assess all neighbours of the given tile.

Private Attributes

- sf::Event * event_ptr

  A pointer to the event class.
- sf::RenderWindow * render_window_ptr

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.
- MessageHub * message_hub_ptr

  A pointer to the message hub.

4.6.1 Detailed Description

A class which defines a hex map of hex tiles.

4.6.2 Constructor & Destructor Documentation

4.6.2.1 HexMap()

```
HexMap::HexMap (
            int n_layers,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor (intended) for the HexMap class.

Parameters

n_layers	The number of layers in the HexMap.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
1116 {
1117     //  1. set attributes
1118 
1119     //  1.1. private
1120     this->event_ptr = event_ptr;
1121     this->render_window_ptr = render_window_ptr;
1122 
1123     this->assets_manager_ptr = assets_manager_ptr;
1124     this->message_hub_ptr = message_hub_ptr;
1125 
1126     //  1.2. public
1127     this->show_resource = false;
1128     this->tile_selected = false;
1129 
1130     this->frame = 0;
1131 
1132     this->n_layers = n_layers;
1133     if (this->n_layers < 0) {
1134         this->n_layers = 0;
1135     }
1136 
1137     this->position_x = 400;
1138     this->position_y = 400;
1139 
1140     //  2. assemble n layer hex map
1141     this->__assembleHexMap();
1142 
1143     //  3. set up and position drawable attributes
1144     this->__setUpGlassScreen();
1145 
1146     //  4. add message channel(s)
1147     this->message_hub_ptr->addChannel(TILE_SELECTED_CHANNEL);
1148     this->message_hub_ptr->addChannel(NO_TILE_SELECTED_CHANNEL);
1149     this->message_hub_ptr->addChannel(TILE_STATE_CHANNEL);
1150     this->message_hub_ptr->addChannel(HEX_MAP_CHANNEL);
1151 
1152     std::cout << "HexMap constructed at " << this << std::endl;
1153 
```

```
1154     return;
1155 }   /* HexMap(), intended */
```

4.6.2.2 ~HexMap()

```
HexMap::~HexMap (
            void  )
```

Destructor for the HexMap class.

```
1447 {
1448     this->clear();
1449
1450     std::cout << "HexMap at " << this << " destroyed" << std::endl;
1451
1452     return;
1453 }   /* ~HexMap() */
```

4.6.3 Member Function Documentation

4.6.3.1 __assembleHexMap()

```
void HexMap::__assembleHexMap (
            void  )  [private]
```

Helper method to assemble the hex map.

```
875 {
876     //  1. seed RNG (using milliseconds since 1 Jan 1970)
877     unsigned long long int milliseconds_since_epoch =
878         std::chrono::duration_cast<std::chrono::milliseconds>(
879             std::chrono::system_clock::now().time_since_epoch()
880         ).count();
881     srand(milliseconds_since_epoch);
882
883     //  2. lay tiles
884     this->__layTiles();
885     this->__buildDrawOrderVector();
886
887     //  3. procedurally generate types
888     this->__procedurallyGenerateTileTypes();
889
890     //  4. procedurally generate resources
891     this->__procedurallyGenerateTileResources();
892
893     return;
894 }   /* __assembleHexMap() */
```

4.6.3.2 __assessNeighbours()

```
void HexMap::__assessNeighbours (
            HexTile * hex_ptr )  [private]
```

Helper method to assess all neighbours of the given tile.

Parameters

Pointer	to the tile whose neighbours are to be assessed.

```
1067 {
1068     std::vector<HexTile*> neighbours_vec = this->__getNeighboursVector(hex_ptr);
1069 
1070     for (size_t i = 0; i < neighbours_vec.size(); i++) {
1071         neighbours_vec[i]->assess();
1072     }
1073 
1074     return;
1075 }   /* __assessNeighbours() */
```

4.6.3.3 __buildDrawOrderVector()

```
void HexMap::__buildDrawOrderVector (
            void  )  [private]
```

Helper method to build tile drawing order vector.

```
273 {
274     //  1. build temp list of tiles
275     std::list<HexTile*> temp_list;
276 
277     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
278     std::map<double, HexTile*>::iterator hex_map_iter_y;
279     for (
280         hex_map_iter_x = this->hex_map.begin();
281         hex_map_iter_x != this->hex_map.end();
282         hex_map_iter_x++
283     ) {
284         for (
285             hex_map_iter_y = hex_map_iter_x->second.begin();
286             hex_map_iter_y != hex_map_iter_x->second.end();
287             hex_map_iter_y++
288         ) {
289             temp_list.push_back(hex_map_iter_y->second);
290         }
291     }
292 
293     //  2. move elements from temp list to drawing order vector
294     double min_position_y = 0;
295     std::list<HexTile*>::iterator list_iter;
296 
297     while (not temp_list.empty()) {
298         //  2.1. determine min y position
299         min_position_y = std::numeric_limits<double>::infinity();
300 
301         for (
302             list_iter = temp_list.begin();
303             list_iter != temp_list.end();
304             list_iter++
305         ) {
306             if ((*list_iter)->position_y < min_position_y) {
307                 min_position_y = (*list_iter)->position_y;
308             }
309         }
310 
311         //  2.2 move min y list elements to drawing order vec
312         list_iter = temp_list.begin();
313         while (list_iter != temp_list.end()) {
314             if ((*list_iter)->position_y == min_position_y) {
315                 this->hex_draw_order_vec.push_back((*list_iter));
316                 list_iter = temp_list.erase(list_iter);
317             }
318 
319             else {
320                 list_iter++;
321             }
322         }
323     }
324 
325     return;
326 }   /* __buildDrawOrderVector() */
```

4.6.3.4 __enforceOceanContinuity()

```
void HexMap::__enforceOceanContinuity (
            void  )  [private]
```

Helper method to scan tiles and enforce ocean continuity. That is to say, if a lake tile is found to be in contact with an ocean tile, then it becomes ocean.

```
786 {
787     std::cout « "enforcing ocean continuity ..." « std::endl;
788 
789     bool tile_changed = false;
790 
791     //  1. scan tiles and enforce (where appropriate)
792     std::map<double, std::map<double, HexTile*»::iterator hex_map_iter_x;
793     std::map<double, HexTile*>::iterator hex_map_iter_y;
794     HexTile* hex_ptr;
795     for (
796         hex_map_iter_x = this->hex_map.begin();
797         hex_map_iter_x != this->hex_map.end();
798         hex_map_iter_x++
799     ) {
800         for (
801             hex_map_iter_y = hex_map_iter_x->second.begin();
802             hex_map_iter_y != hex_map_iter_x->second.end();
803             hex_map_iter_y++
804         ) {
805             hex_ptr = hex_map_iter_y->second;
806 
807             if (this->__isLakeTouchingOcean(hex_ptr)) {
808                 hex_ptr->setTileType(TileType :: OCEAN);
809                 tile_changed = true;
810             }
811         }
812     }
813 
814     if (tile_changed) {
815         this->__enforceOceanContinuity();
816     }
817     else {
818         return;
819     }
820 }   /* __enforceOceanContinuity() */
```

4.6.3.5 __getMajorityTileType()

```
TileType HexMap::__getMajorityTileType (
            HexTile * hex_ptr )  [private]
```

Function to return majority tile type of a tile and its neighbours. If no clear majority, simply returns the type of the given tile.

Parameters

hex_ptr	Pointer to the given tile.

Returns

The majority tile type of the tile and its neighbours. If no clear majority type, then the type of the given tile is simply returned.

```
642 {
643     //  1. init type count map
644     std::map<TileType, int> type_count_map;
645     type_count_map[hex_ptr->tile_type] = 1;
646 
647     //  2. survey neighbours, count type instances
```

```
648     std::vector<HexTile*> neighbours_vec = this->__getNeighboursVector(hex_ptr);
649
650     for (size_t i = 0; i < neighbours_vec.size(); i++) {
651         if (type_count_map.count(neighbours_vec[i]->tile_type) <= 0) {
652             type_count_map[neighbours_vec[i]->tile_type] = 1;
653         }
654         else {
655             type_count_map[neighbours_vec[i]->tile_type] += 1;
656         }
657     }
658
659     //  3. find majority tile type
660     int max_count = -1 * std::numeric_limits<int>::infinity();
661     TileType majority_tile_type = hex_ptr->tile_type;
662
663     std::map<TileType, int>::iterator map_iter;
664     for (
665         map_iter = type_count_map.begin();
666         map_iter != type_count_map.end();
667         map_iter++
668     ){
669         if (map_iter->second > max_count) {
670             max_count = map_iter->second;
671             majority_tile_type = map_iter->first;
672         }
673     }
674
675     //  4. detect ties
676     for (
677         map_iter = type_count_map.begin();
678         map_iter != type_count_map.end();
679         map_iter++
680     ){
681         if (
682             map_iter->second == max_count and
683             map_iter->first != majority_tile_type
684         ) {
685             majority_tile_type = hex_ptr->tile_type;
686             break;
687         }
688     }
689
690     return majority_tile_type;
691 }   /* __getMajorityTileType() */
```

4.6.3.6 __getNeighboursVector()

```
std::vector< HexTile * > HexMap::__getNeighboursVector (
            HexTile * hex_ptr )  [private]
```

Helper method to assemble a vector pointers to all neighbours of the given tile.

Parameters

hex_ptr	A pointer to the given tile.

Returns

A vector of pointers to all neighbours of the given tile.

```
584 {
585     std::vector<HexTile*> neighbours_vec;
586
587     //  1. build potential neighbour positions
588     std::vector<double> potential_neighbour_x_vec(6, 0);
589     std::vector<double> potential_neighbour_y_vec(6, 0);
590
591     for (int i = 0; i < 6; i++) {
592         potential_neighbour_x_vec[i] = hex_ptr->position_x +
593             2 * hex_ptr->minor_radius * cos((60 * i) * (M_PI / 180));
594
595         potential_neighbour_y_vec[i] = hex_ptr->position_y +
```

```
596             2 * hex_ptr->minor_radius * sin((60 * i) * (M_PI / 180));
597     }
598
599     //  2. populate neighbours vector
600     std::vector<double> map_index_positions;
601     double potential_x = 0;
602     double potential_y = 0;
603
604     for (int i = 0; i < 6; i++) {
605         potential_x = potential_neighbour_x_vec[i];
606         potential_y = potential_neighbour_y_vec[i];
607
608         map_index_positions = this->__getValidMapIndexPositions(
609             potential_x,
610             potential_y
611         );
612
613         if (not (map_index_positions[0] == -1)) {
614             neighbours_vec.push_back(
615                 this->hex_map[map_index_positions[0]][map_index_positions[1]]
616             );
617         }
618     }
619
620     return neighbours_vec;
621 }   /* __getNeighbourVector() */
```

4.6.3.7 __getNoise()

```
std::vector< double > HexMap::__getNoise (
            int n_elements,
            int n_components = 128 )  [private]
```

Helper method to generate a vector of noise, with values mapped to the closed interval [0, 1]. Applies a random cosine series approach.

Parameters

n_elements	The number of elements in the generated noise vector.
n_components	The number of components to use in the random cosine series. Defaults to 64.

Returns

A vector of noise, with values mapped to the closed interval [0, 1].

```
349 {
350     //  1. generate random amplitude, wave number, direction, and phase vectors
351     std::vector<double> random_amplitude_vec(n_components, 0);
352     std::vector<double> random_wave_number_vec(n_components, 0);
353     std::vector<double> random_frequency_vec(n_components, 0);
354     std::vector<double> random_direction_vec(n_components, 0);
355     std::vector<double> random_phase_vec(n_components, 0);
356
357     for (int i = 0; i < n_components; i++) {
358         random_amplitude_vec[i] = 10 * ((double)rand() / RAND_MAX);
359
360         random_wave_number_vec[i] = 2 * M_PI * ((double)rand() / RAND_MAX);
361
362         random_frequency_vec[i] = ((double)rand() / RAND_MAX);
363
364         random_direction_vec[i] = 2 * M_PI * ((double)rand() / RAND_MAX);
365
366         random_phase_vec[i] = 2 * M_PI * ((double)rand() / RAND_MAX);
367     }
368
369     //  2. generate noise vec
370     double amp = 0;
371     double wave_no = 0;
372     double freq = 0;
373     double dir = 0;
```

```
374     double phase = 0;
375
376     double x = 0;
377     double y = 0;
378     double t = time(NULL);
379
380     double max_noise = -1 * std::numeric_limits<double>::infinity();
381     double min_noise = std::numeric_limits<double>::infinity();
382
383     double noise = 0;
384     std::vector<double> noise_vec(n_elements, 0);
385
386     for (int i = 0; i < n_elements; i++) {
387         x = this->tile_position_x_vec[i] - this->position_x;
388         y = this->tile_position_y_vec[i] - this->position_y;
389
390         for (int j = 0; j < n_components; j++) {
391             amp = random_amplitude_vec[j];
392             wave_no = random_wave_number_vec[j];
393             freq = random_frequency_vec[j];
394             dir = random_direction_vec[j];
395             phase = random_phase_vec[j];
396
397             noise += (amp / (j + 1)) * cos(
398                 wave_no * (j + 1) * (x * sin(dir) + y * cos(dir)) +
399                 2 * M_PI * (j + 1) * freq * t +
400                 phase
401             );
402         }
403
404         noise_vec[i] = noise;
405
406         if (noise > max_noise) {
407             max_noise = noise;
408         }
409
410         else if (noise < min_noise) {
411             min_noise = noise;
412         }
413
414         noise = 0;
415     }
416
417     //  3. normalize noise vec
418     for (int i = 0; i < n_elements; i++) {
419         noise_vec[i] = (noise_vec[i] - min_noise) / (max_noise - min_noise);
420
421         if (noise_vec[i] < 0) {
422             noise_vec[i] = 0;
423         }
424         else if (noise_vec[i] > 1) {
425             noise_vec[i] = 1;
426         }
427     }
428
429     return noise_vec;
430 }   /* __getNoise() */
```

4.6.3.8 __getSelectedTile()

```
HexTile * HexMap::__getSelectedTile (
            void  )  [private]
```

Helper method to get pointer to selected tile.

Returns

Pointer to selected tile (or NULL if no tile selected).

```
911 {
912     HexTile* selected_tile_ptr = NULL;
913
914     bool break_flag = false;
915     std::map<double, std::map<double, HexTile*>>::iterator hex_map_iter_x;
916     std::map<double, HexTile*>::iterator hex_map_iter_y;
917
```

```
918     for (
919         hex_map_iter_x = this->hex_map.begin();
920         hex_map_iter_x != this->hex_map.end();
921         hex_map_iter_x++
922     ) {
923         for (
924             hex_map_iter_y = hex_map_iter_x->second.begin();
925             hex_map_iter_y != hex_map_iter_x->second.end();
926             hex_map_iter_y++
927         ) {
928             if (hex_map_iter_y->second->is_selected) {
929                 selected_tile_ptr = hex_map_iter_y->second;
930                 break_flag = true;
931             }
932
933             if (break_flag) {
934                 break;
935             }
936         }
937
938         if (break_flag) {
939             break;
940         }
941     }
942
943     return selected_tile_ptr;
944 }   /* __getSelectedTile() */
```

4.6.3.9 __getValidMapIndexPositions()

```
std::vector< double > HexMap::__getValidMapIndexPositions (
            double potential_x,
            double potential_y )  [private]
```

Helper method to translate given position into valid index position for a.

Parameters

potential_x	The potential x position of the tile.
potential_y	The potential y position of the tile.

Returns

A vector of positions, either valid for indexing into the hex map, or sentinel values (-1) if invalid.

```
530 {
531     std::vector<double> map_index_positions = {-1, -1};
532
533     std::map<double, std::map<double, HexTile*>>::iterator hex_map_iter_x;
534     std::map<double, HexTile*>::iterator hex_map_iter_y;
535     HexTile* hex_ptr;
536
537     double distance = 0;
538
539     for (
540         hex_map_iter_x = this->hex_map.begin();
541         hex_map_iter_x != this->hex_map.end();
542         hex_map_iter_x++
543     ) {
544         for (
545             hex_map_iter_y = hex_map_iter_x->second.begin();
546             hex_map_iter_y != hex_map_iter_x->second.end();
547             hex_map_iter_y++
548         ) {
549             hex_ptr = hex_map_iter_y->second;
550
551             distance = sqrt(
```

```
552                 pow(hex_ptr->position_x - potential_x, 2) +
553                 pow(hex_ptr->position_y - potential_y, 2)
554             );
555
556             if (distance <= hex_ptr->minor_radius / 4) {
557                 map_index_positions = {hex_ptr->position_x, hex_ptr->position_y};
558                 return map_index_positions;
559             }
560         }
561     }
562
563     return map_index_positions;
564 }   /* __isInHexMap() */
```

4.6.3.10 __handleKeyPressEvents()

```
void HexMap::__handleKeyPressEvents (
            void  )  [private]
```

Helper method to handle key press events.

```
959 {
960     switch (this->event_ptr->key.code) {
961         case (sf::Keyboard::Escape): {
962             this->tile_selected = false;
963         }
964
965
966         default: {
967             // do nothing!
968
969             break;
970         }
971     }
972
973     return;
974 }   /* __handleKeyPressEvents() */
```

4.6.3.11 __handleMouseButtonEvents()

```
void HexMap::__handleMouseButtonEvents (
            void  )  [private]
```

Helper method to handle mouse button events.

```
989 {
990     switch (this->event_ptr->mouseButton.button) {
991         case (sf::Mouse::Left): {
992             HexTile* hex_ptr = this->__getSelectedTile();
993
994             if (hex_ptr != NULL) {
995                 this->tile_selected = true;
996             }
997
998             else if (this->tile_selected) {
999                 this->tile_selected = false;
1000                 this->__sendNoTileSelectedMessage();
1001             }
1002
1003             break;
1004         }
1005
1006
1007         case (sf::Mouse::Right): {
1008             if (this->tile_selected) {
1009                 this->tile_selected = false;
1010                 this->__sendNoTileSelectedMessage();
1011             }
1012
1013             break;
1014         }
```

```
1015
1016
1017         default: {
1018             // do nothing!
1019
1020             break;
1021         }
1022     }
1023
1024     return;
1025 }   /* __handleMouseButtonEvents() */
```

4.6.3.12 __isLakeTouchingOcean()

```
bool HexMap::__isLakeTouchingOcean (
            HexTile * hex_ptr )  [private]
753 {
754     //  1. if not lake tile, return
755     if (not (hex_ptr->tile_type == TileType :: LAKE)) {
756         return false;
757     }
758
759     //  2. scan neighbours for ocean tiles
760     std::vector<HexTile*> neighbours_vec = this->__getNeighboursVector(hex_ptr);
761
762     for (size_t i = 0; i < neighbours_vec.size(); i++) {
763         if (neighbours_vec[i]->tile_type == TileType :: OCEAN) {
764             return true;
765         }
766     }
767
768     return false;
769 }   /* __isLakeTouchingOcean() */
```

4.6.3.13 __layTiles()

```
void HexMap::__layTiles (
            void  )  [private]
```

Helper method to lay the hex tiles down to generate the game world.

```
88 {
89     this->n_tiles = 0;
90
91     //  1. add origin tile
92     HexTile* hex_ptr = new HexTile(
93         this->position_x,
94         this->position_y,
95         this->event_ptr,
96         this->render_window_ptr,
97         this->assets_manager_ptr,
98         this->message_hub_ptr
99     );
100
101     this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
102     this->tile_position_x_vec.push_back(hex_ptr->position_x);
103     this->tile_position_y_vec.push_back(hex_ptr->position_y);
104     this->n_tiles++;
105
106
107     //  2. fill out first row (reflect across origin tile)
108     for (int i = 0; i < this->n_layers; i++) {
109         hex_ptr = new HexTile(
110             this->position_x + 2 * (i + 1) * hex_ptr->minor_radius,
111             this->position_y,
112             this->event_ptr,
113             this->render_window_ptr,
114             this->assets_manager_ptr,
115             this->message_hub_ptr
116         );
117
```

```
118         this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
119         this->tile_position_x_vec.push_back(hex_ptr->position_x);
120         this->tile_position_y_vec.push_back(hex_ptr->position_y);
121         this->n_tiles++;
122 
123         if (i == this->n_layers - 1) {
124             this->border_tiles_vec.push_back(hex_ptr);
125         }
126 
127         hex_ptr = new HexTile(
128             this->position_x - 2 * (i + 1) * hex_ptr->minor_radius,
129             this->position_y,
130             this->event_ptr,
131             this->render_window_ptr,
132             this->assets_manager_ptr,
133             this->message_hub_ptr
134         );
135 
136         this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
137         this->tile_position_x_vec.push_back(hex_ptr->position_x);
138         this->tile_position_y_vec.push_back(hex_ptr->position_y);
139         this->n_tiles++;
140 
141         if (i == this->n_layers - 1) {
142             this->border_tiles_vec.push_back(hex_ptr);
143         }
144     }
145 
146 
147     //  3. fill out subsequent rows (reflect across first row)
148     HexTile* first_row_left_tile = hex_ptr;
149 
150     int offset_count = 1;
151 
152     double x_offset = 0;
153     double y_offset = 0;
154 
155     for (
156         int row_width = 2 * this->n_layers;
157         row_width > this->n_layers;
158         row_width--
159     ) {
160         //  3.1. upper row
161         x_offset = first_row_left_tile->position_x +
162             2 * offset_count * first_row_left_tile->minor_radius *
163             cos(60 * (M_PI / 180));
164 
165         y_offset = first_row_left_tile->position_y -
166             2 * offset_count * first_row_left_tile->minor_radius *
167             sin(60 * (M_PI / 180));
168 
169         hex_ptr = new HexTile(
170             x_offset,
171             y_offset,
172             this->event_ptr,
173             this->render_window_ptr,
174             this->assets_manager_ptr,
175             this->message_hub_ptr
176         );
177 
178         this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
179         this->tile_position_x_vec.push_back(hex_ptr->position_x);
180         this->tile_position_y_vec.push_back(hex_ptr->position_y);
181         this->n_tiles++;
182 
183         this->border_tiles_vec.push_back(hex_ptr);
184 
185         for (int i = 1; i < row_width; i++) {
186             x_offset += 2 * first_row_left_tile->minor_radius;
187 
188             hex_ptr = new HexTile(
189                 x_offset,
190                 y_offset,
191                 this->event_ptr,
192                 this->render_window_ptr,
193                 this->assets_manager_ptr,
194                 this->message_hub_ptr
195             );
196 
197             this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
198             this->tile_position_x_vec.push_back(hex_ptr->position_x);
199             this->tile_position_y_vec.push_back(hex_ptr->position_y);
200             this->n_tiles++;
201 
202             if (row_width == this->n_layers + 1 or i == row_width - 1) {
203                 this->border_tiles_vec.push_back(hex_ptr);
204             }
```

```
205         }
206
207         //  3.2. lower row
208         x_offset = first_row_left_tile->position_x +
209             2 * offset_count * first_row_left_tile->minor_radius *
210             cos(60 * (M_PI / 180));
211
212         y_offset = first_row_left_tile->position_y +
213             2 * offset_count * first_row_left_tile->minor_radius *
214             sin(60 * (M_PI / 180));
215
216         hex_ptr = new HexTile(
217             x_offset,
218             y_offset,
219             this->event_ptr,
220             this->render_window_ptr,
221             this->assets_manager_ptr,
222             this->message_hub_ptr
223         );
224
225         this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
226         this->tile_position_x_vec.push_back(hex_ptr->position_x);
227         this->tile_position_y_vec.push_back(hex_ptr->position_y);
228         this->n_tiles++;
229
230         this->border_tiles_vec.push_back(hex_ptr);
231
232         for (int i = 1; i < row_width; i++) {
233             x_offset += 2 * first_row_left_tile->minor_radius;
234
235             hex_ptr = new HexTile(
236                 x_offset,
237                 y_offset,
238                 this->event_ptr,
239                 this->render_window_ptr,
240                 this->assets_manager_ptr,
241                 this->message_hub_ptr
242             );
243
244             this->hex_map[hex_ptr->position_x][hex_ptr->position_y] = hex_ptr;
245             this->tile_position_x_vec.push_back(hex_ptr->position_x);
246             this->tile_position_y_vec.push_back(hex_ptr->position_y);
247             this->n_tiles++;
248
249             if (row_width == this->n_layers + 1 or i == row_width - 1) {
250                 this->border_tiles_vec.push_back(hex_ptr);
251             }
252         }
253
254         offset_count++;
255     }
256
257     return;
258 }   /* __layTiles() */
```

4.6.3.14 __procedurallyGenerateTileResources()

```
void HexMap::__procedurallyGenerateTileResources (
            void  )  [private]
```

Helper method to procedurally generate tile resources and set tiles accordingly.

```
835 {
836     //  1. get random cosine series noise vec
837     std::vector<double> noise_vec = this->__getNoise(this->n_tiles);
838
839     //  2. set tile resources based on random cosine series noise
840     int noise_idx = 0;
841
842     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
843     std::map<double, HexTile*>::iterator hex_map_iter_y;
844     for (
845         hex_map_iter_x = this->hex_map.begin();
846         hex_map_iter_x != this->hex_map.end();
847         hex_map_iter_x++
848     ) {
849         for (
850             hex_map_iter_y = hex_map_iter_x->second.begin();
851             hex_map_iter_y != hex_map_iter_x->second.end();
```

```
852             hex_map_iter_y++
853         ) {
854             hex_map_iter_y->second->setTileResource(noise_vec[noise_idx]);
855             noise_idx++;
856         }
857     }
858 
859     return;
860 }   /* __procedurallyGenerateTileResources() */
```

4.6.3.15 __procedurallyGenerateTileTypes()

```
void HexMap::__procedurallyGenerateTileTypes (
            void  )  [private]
```

Helper method to procedurally generate tile types and set tiles accordingly.

```
445 {
446     //  1. get random cosine series noise vec
447     std::vector<double> noise_vec = this->__getNoise(this->n_tiles);
448 
449     //  2. set initial tile types based on either random cosine series noise or white
450     //     noise (decided by coin toss)
451     int noise_idx = 0;
452 
453     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
454     std::map<double, HexTile*>::iterator hex_map_iter_y;
455     for (
456         hex_map_iter_x = this->hex_map.begin();
457         hex_map_iter_x != this->hex_map.end();
458         hex_map_iter_x++
459     ) {
460         for (
461             hex_map_iter_y = hex_map_iter_x->second.begin();
462             hex_map_iter_y != hex_map_iter_x->second.end();
463             hex_map_iter_y++
464         ) {
465             if ((double)rand() / RAND_MAX > 0.5) {
466                 hex_map_iter_y->second->setTileType(noise_vec[noise_idx]);
467             }
468             else {
469                 hex_map_iter_y->second->setTileType((double)rand() / RAND_MAX);
470             }
471             noise_idx++;
472         }
473     }
474 
475     //  3. smooth tile types (majority rules)
476     this->__smoothTileTypes();
477 
478     //  4. set border tile type to ocean
479     for (size_t i = 0; i < this->border_tiles_vec.size(); i++) {
480         this->border_tiles_vec[i]->setTileType(TileType :: OCEAN);
481     }
482 
483     //  5. enforce ocean continuity (i.e. all lake tiles touching ocean become ocean)
484     this->__enforceOceanContinuity();
485 
486     //  6. decorate tiles
487     for (
488         hex_map_iter_x = this->hex_map.begin();
489         hex_map_iter_x != this->hex_map.end();
490         hex_map_iter_x++
491     ) {
492         for (
493             hex_map_iter_y = hex_map_iter_x->second.begin();
494             hex_map_iter_y != hex_map_iter_x->second.end();
495             hex_map_iter_y++
496         ) {
497             hex_map_iter_y->second->decorateTile();
498         }
499     }
500 
501     return;
502 }   /* __procedurallyGenerateTileTypes() */
```

4.6.3.16 __sendNoTileSelectedMessage()

```
void HexMap::__sendNoTileSelectedMessage (
            void  )  [private]
```

Helper method to format and send message on no tile selected.

```
1040 {
1041     Message no_tile_selected_message;
1042
1043     no_tile_selected_message.channel = NO_TILE_SELECTED_CHANNEL;
1044     no_tile_selected_message.subject = "no tile selected";
1045
1046     this->message_hub_ptr->sendMessage(no_tile_selected_message);
1047
1048     std::cout « "No tile selected message sent by " « this « std::endl;
1049     return;
1050 }   /* __sendNoTileSelectedMessage() */
```

4.6.3.17 __setUpGlassScreen()

```
void HexMap::__setUpGlassScreen (
            void  )  [private]
```

Helper method to set up glass screen effect (drawable).

```
68 {
69     this->glass_screen.setSize(sf::Vector2f(GAME_WIDTH, GAME_HEIGHT));
70     this->glass_screen.setFillColor(sf::Color(MONOCHROME_SCREEN_BACKGROUND));
71
72     return;
73 }   /* __setUpGlassScreen() */
```

4.6.3.18 __smoothTileTypes()

```
void HexMap::__smoothTileTypes (
            void  )  [private]
```

Helper method to smooth tile types using a majority rules approach.

```
706 {
707     std::cout « "smoothing ..." « std::endl;
708
709     std::map<double, std::map<double, HexTile*»::iterator hex_map_iter_x;
710     std::map<double, HexTile*>::iterator hex_map_iter_y;
711     HexTile* hex_ptr;
712     TileType majority_tile_type;
713
714     for (
715         hex_map_iter_x = this->hex_map.begin();
716         hex_map_iter_x != this->hex_map.end();
717         hex_map_iter_x++
718     ) {
719         for (
720             hex_map_iter_y = hex_map_iter_x->second.begin();
721             hex_map_iter_y != hex_map_iter_x->second.end();
722             hex_map_iter_y++
723         ) {
724             hex_ptr = hex_map_iter_y->second;
725             majority_tile_type = this->__getMajorityTileType(hex_ptr);
726
727             if (majority_tile_type != hex_ptr->tile_type) {
728                 hex_ptr->setTileType(majority_tile_type);
729             }
730         }
731     }
732
733     return;
734 }   /* __smoothTileTypes() */
```

4.6.3.19 assess()

```
void HexMap::assess (
            void  )
```

Method to assess the resource of the selected tile.

```
1170 {
1171     HexTile* selected_tile_ptr = this->__getSelectedTile();
1172     if (selected_tile_ptr != NULL) {
1173         selected_tile_ptr->assess();
1174     }
1175
1176     return;
1177 }   /* assess() */
```

4.6.3.20 clear()

```
void HexMap::clear (
            void  )
```

Method to clear the hex map.

```
1409 {
1410     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
1411     std::map<double, HexTile*>::iterator hex_map_iter_y;
1412     for (
1413         hex_map_iter_x = this->hex_map.begin();
1414         hex_map_iter_x != this->hex_map.end();
1415         hex_map_iter_x++
1416     ) {
1417         for (
1418             hex_map_iter_y = hex_map_iter_x->second.begin();
1419             hex_map_iter_y != hex_map_iter_x->second.end();
1420             hex_map_iter_y++
1421         ) {
1422             delete hex_map_iter_y->second;
1423         }
1424     }
1425     this->hex_map.clear();
1426
1427     this->tile_position_x_vec.clear();
1428     this->tile_position_y_vec.clear();
1429     this->border_tiles_vec.clear();
1430
1431     return;
1432 }   /* clear() */
```

4.6.3.21 draw()

```
void HexMap::draw (
            void  )
```

Method to draw the hex map to the render window. To be called once per frame.

```
1348 {
1349     //  1. draw background
1350     sf::Color glass_screen_colour = this->glass_screen.getFillColor();
1351     glass_screen_colour.a = 255;
1352     this->glass_screen.setFillColor(glass_screen_colour);
1353
1354     this->render_window_ptr->draw(this->glass_screen);
1355
1356     //  2. draw tiles in drawing order
1357     for (size_t i = 0; i < this->hex_draw_order_vec.size(); i++) {
1358         this->hex_draw_order_vec[i]->draw();
1359     }
1360
1361     //  3. redraw selected tile
```

```
1362     HexTile* selected_tile_ptr = this->__getSelectedTile();
1363     if (selected_tile_ptr != NULL) {
1364         selected_tile_ptr->draw();
1365     }
1366 
1367     //  4. draw resource overlay text indication
1368     if (this->show_resource) {
1369         sf::Text resource_overlay_text(
1370             "**** RENEWABLE RESOURCE OVERLAY ****",
1371             *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
1372             16
1373         );
1374 
1375         resource_overlay_text.setPosition(
1376             (800 - resource_overlay_text.getLocalBounds().width) / 2,
1377             GAME_HEIGHT - 70
1378         );
1379 
1380         resource_overlay_text.setFillColor(MONOCHROME_TEXT_GREEN);
1381 
1382         this->render_window_ptr->draw(resource_overlay_text);
1383     }
1384 
1385     //  5. draw glass screen
1386     glass_screen_colour = this->glass_screen.getFillColor();
1387     glass_screen_colour.a = 40;
1388     this->glass_screen.setFillColor(glass_screen_colour);
1389 
1390     this->render_window_ptr->draw(this->glass_screen);
1391 
1392     this->frame++;
1393     return;
1394 }   /* draw() */
```

4.6.3.22 processEvent()

```
void HexMap::processEvent (
             void  )
```

Method to process HexMap. To be called once per event.

```
1255 {
1256     //  1. process HexTile events
1257     std::map<double, std::map<double, HexTile*»::iterator hex_map_iter_x;
1258     std::map<double, HexTile*>::iterator hex_map_iter_y;
1259     for (
1260         hex_map_iter_x = this->hex_map.begin();
1261         hex_map_iter_x != this->hex_map.end();
1262         hex_map_iter_x++
1263     ) {
1264         for (
1265             hex_map_iter_y = hex_map_iter_x->second.begin();
1266             hex_map_iter_y != hex_map_iter_x->second.end();
1267             hex_map_iter_y++
1268         ) {
1269             hex_map_iter_y->second->processEvent();
1270         }
1271     }
1272 
1273     //  2. process HexMap events
1274     if (this->event_ptr->type == sf::Event::KeyPressed) {
1275         this->__handleKeyPressEvents();
1276     }
1277 
1278     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
1279         this->__handleMouseButtonEvents();
1280     }
1281 
1282     return;
1283 }   /* processEvent() */
```

4.6.3.23 processMessage()

```
void HexMap::processMessage (
            void  )
```

Method to process HexMap. To be called once per message.

```
1298 {
1299     //  1. process HexTile messages
1300     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
1301     std::map<double, HexTile*>::iterator hex_map_iter_y;
1302     for (
1303         hex_map_iter_x = this->hex_map.begin();
1304         hex_map_iter_x != this->hex_map.end();
1305         hex_map_iter_x++
1306     ) {
1307         for (
1308             hex_map_iter_y = hex_map_iter_x->second.begin();
1309             hex_map_iter_y != hex_map_iter_x->second.end();
1310             hex_map_iter_y++
1311         ) {
1312             hex_map_iter_y->second->processMessage();
1313         }
1314     }
1315
1316     //  2. process HexMap messages
1317     if (not this->message_hub_ptr->isEmpty(HEX_MAP_CHANNEL)) {
1318         Message hex_map_message = this->message_hub_ptr->receiveMessage(
1319             HEX_MAP_CHANNEL
1320         );
1321
1322         if (hex_map_message.subject == "assess neighbours") {
1323             HexTile* hex_ptr = this->__getSelectedTile();
1324             this->__assessNeighbours(hex_ptr);
1325
1326             std::cout « "Assess neighbours message received by " « this « std::endl;
1327             this->message_hub_ptr->popMessage(HEX_MAP_CHANNEL);
1328         }
1329     }
1330
1331     return;
1332 }   /* processMessage() */
```

4.6.3.24 reroll()

```
void HexMap::reroll (
            void  )
```

Method to re-roll the hex map.

```
1192 {
1193     this->clear();
1194     this->__assembleHexMap();
1195
1196     return;
1197 }   /* reroll() */
```

4.6.3.25 toggleResourceOverlay()

```
void HexMap::toggleResourceOverlay (
            void  )
```

Method to toggle the hex map resource overlay.

```
1212 {
1213     std::map<double, std::map<double, HexTile*>::iterator hex_map_iter_x;
1214     std::map<double, HexTile*>::iterator hex_map_iter_y;
1215     for (
1216         hex_map_iter_x = this->hex_map.begin();
```

```
1217         hex_map_iter_x != this->hex_map.end();
1218         hex_map_iter_x++
1219     ) {
1220         for (
1221             hex_map_iter_y = hex_map_iter_x->second.begin();
1222             hex_map_iter_y != hex_map_iter_x->second.end();
1223             hex_map_iter_y++
1224         ) {
1225             hex_map_iter_y->second->toggleResourceOverlay();
1226         }
1227     }
1228
1229     if (this->show_resource) {
1230         this->show_resource = false;
1231         this->assets_manager_ptr->getSound("resource overlay toggle off")->play();
1232     }
1233
1234     else {
1235         this->show_resource = true;
1236         this->assets_manager_ptr->getSound("resource overlay toggle on")->play();
1237     }
1238
1239     return;
1240 }   /* toggleResourceOverlay() */
```

4.6.4 Member Data Documentation

4.6.4.1 assets_manager_ptr

```
AssetsManager* HexMap::assets_manager_ptr  [private]
```

A pointer to the assets manager.

4.6.4.2 border_tiles_vec

```
std::vector<HexTile*> HexMap::border_tiles_vec
```

A vector of pointers to the border tiles.

4.6.4.3 event_ptr

```
sf::Event* HexMap::event_ptr  [private]
```

A pointer to the event class.

4.6.4.4 frame

```
unsigned long long int HexMap::frame
```

The current frame of this object.

4.6.4.5 glass_screen

```
sf::RectangleShape HexMap::glass_screen
```

To give the effect of an old glass screen over the hex map.

4.6.4.6 hex_draw_order_vec

```
std::vector<HexTile*> HexMap::hex_draw_order_vec
```

A vector of hex tiles, in drawing order.

4.6.4.7 hex_map

```
std::map<double, std::map<double, HexTile*> > HexMap::hex_map
```

A position-indexed, nested map of hex tiles.

4.6.4.8 message_hub_ptr

```
MessageHub* HexMap::message_hub_ptr  [private]
```

A pointer to the message hub.

4.6.4.9 n_layers

```
int HexMap::n_layers
```

The number of layers in the hex map.

4.6.4.10 n_tiles

```
int HexMap::n_tiles
```

The number of tiles in the hex map.

4.6.4.11 position_x

```
double HexMap::position_x
```

The x position of the hex map's origin (i.e. central) tile.

4.6.4.12 position_y

```
double HexMap::position_y
```

The y position of the hex map's origin (i.e. central) tile.

4.6.4.13 render_window_ptr

```
sf::RenderWindow* HexMap::render_window_ptr  [private]
```

A pointer to the render window.

4.6.4.14 show_resource

```
bool HexMap::show_resource
```

A boolean which indicates whether or not to show resource value.

4.6.4.15 tile_position_x_vec

```
std::vector<double> HexMap::tile_position_x_vec
```

A vector of tile x positions.

4.6.4.16 tile_position_y_vec

```
std::vector<double> HexMap::tile_position_y_vec
```

A vector of tile y position.

4.6.4.17 tile_selected

```
bool HexMap::tile_selected
```

A boolean which indicates if a tile is currently selected.

The documentation for this class was generated from the following files:

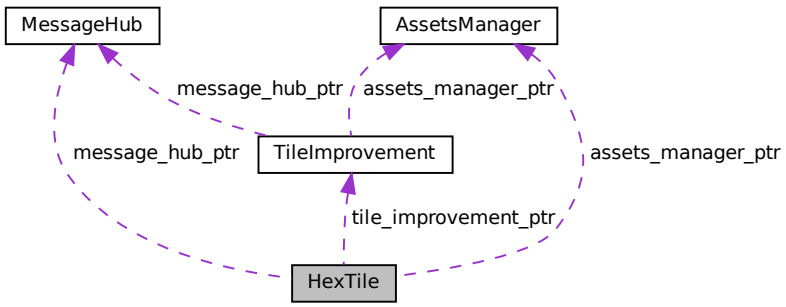
- header/HexMap.h
- source/HexMap.cpp

4.7 HexTile Class Reference

A class which defines a hex tile of the hex map.

```
#include <HexTile.h>
```

Collaboration diagram for HexTile:



Public Member Functions

- HexTile (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)

  Constructor for the HexTile class.
- void setTileType (TileType)

  Method to set the tile type (by enum value).
- void setTileType (double)

  Method to set the tile type (by numeric input).
- void setTileResource (TileResource)

  Method to set the tile resource (by enum value).
- void setTileResource (double)

  Method to set the tile resource (by numeric input).
- void decorateTile (void)

  Method to decorate tile.
- void toggleResourceOverlay (void)

  Method to toggle the tile resource overlay.

- void assess (void)

  Method to assess the tile's resource.
- void processEvent (void)

  Method to process HexTile. To be called once per event.
- void processMessage (void)

  Method to process HexTile. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- ~HexTile (void)

  Destructor for the HexTile class.

Public Attributes

- TileType tile_type
- TileResource tile_resource
- bool show_node

  A boolean which indicates whether or not to show the tile node.
- bool show_resource

  A boolean which indicates whether or not to show resource value.
- bool resource_assessed

  A boolean which indicates whether or not the resource has been assessed.
- bool resource_assessment

  A boolean which triggers a resource assessment notification.
- bool is_selected

  A boolean which indicates whether or not the tile is selected.
- bool draw_explosion

  A boolean which indicates whether or not to draw a tile explosion.
- bool decoration_cleared

  A boolean which indicates if the tile decoration has been cleared.
- bool has_improvement

  A boolean which indicates if tile has improvement or not.
- TileImprovement * tile_improvement_ptr

  A pointer to the improvement for this tile.
- bool build_menu_open

  A boolean which indicates if the tile build menu is open.
- size_t explosion_frame

  The current frame of the explosion animation.
- unsigned long long int frame

  The current frame of this object.
- int credits

  The current balance of credits.
- double position_x

  The x position of the tile.
- double position_y

  The y position of the tile.
- double major_radius

  The radius of the smallest bounding circle.
- double minor_radius

  The radius of the largest inscribed circle.
- std::string game_phase

The current phase of the game.

- sf::CircleShape node_sprite

  A circle shape to mark the tile node.
- sf::ConvexShape tile_sprite

  A convex shape which represents the tile.
- sf::ConvexShape select_outline_sprite

  A convex shape which outlines the tile when selected.
- sf::CircleShape resource_chip_sprite

  A circle shape which represents a resource chip.
- sf::Text resource_text

  A text representation of the resource.
- sf::Sprite tile_decoration_sprite

  A tile decoration sprite.
- sf::Sprite magnifying_glass_sprite

  A magnifying glass sprite.
- std::vector< sf::Sprite > explosion_sprite_reel

  A reel of sprites for a tile explosion animation.
- sf::RectangleShape build_menu_backing

  A backing for the tile build menu.
- sf::Text build_menu_backing_text

  A text label for the build menu.
- std::vector< std::vector< sf::Sprite > > build_menu_options_vec

  A vector of sprites for illustrating the tile build options.
- std::vector< sf::Text > build_menu_options_text_vec

  A vector of text for the tile build options.

Private Member Functions

- void __setUpNodeSprite (void)

  Helper method to set up node sprite.
- void __setUpTileSprite (void)

  Helper method to set up tile sprite.
- void __setUpSelectOutlineSprite (void)

  Helper method to set up select outline sprite.
- void __setUpResourceChipSprite (void)

  Helper method to set up resource chip sprite.
- void __setResourceText (void)

  Helper method to set up resource text.
- void __setUpMagnifyingGlassSprite (void)

  Helper method to set up and position magnifying glass sprite.
- void __setUpTileExplosionReel (void)

  Helper method to set up tile explosion sprite reel.
- void __setUpBuildOption (std::string, std::string)

  Helper method to set up and postion the sprite and text for a build option.
- void __setUpDieselGeneratorBuildOption (void)

  Helper method to set up and position the diesel generator build option.
- void __setUpWindTurbineBuildOption (bool=false, bool=false)

  Helper method to set up and position the wind turbine build option.
- void __setUpSolarPVBuildOption (bool=false)

  Helper method to set up and position the solar PV array build option.

- void __setUpTidalTurbineBuildOption (void)

  Helper method to set up and position the tidal turbine build option.
- void __setUpWaveEnergyConverterBuildOption (void)

  Helper method to set up and position the wave energy converter build option.
- void __setUpEnergyStorageSystemBuildOption (void)

  Helper method to set up and position the wave energy converter build option.
- void __setUpBuildMenu (void)

  Helper method to set up and place build menu assets (drawable).
- void __setIsSelected (bool)

  Helper method to set the is selected attribute (of tile and improvement).
- void __clearDecoration (void)

  Helper method to clear tile decoration.
- bool __isClicked (void)

  Helper method to determine if tile was clicked on.
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.
- void __openBuildMenu (void)

  Helper method to open the tile improvement build menu.
- void __closeBuildMenu (void)

  Helper method to close the tile improvement build menu.
- void __buildSettlement (void)

  Helper method to build a settlement on this tile.
- void __buildDieselGenerator (void)

  Helper method to build a diesel generator on this tile.
- void __buildSolarPV (void)

  Helper method to build a solar PV array on this tile.
- void __buildWindTurbine (void)

  Helper method to build a wind turbine on this tile.
- void __buildTidalTurbine (void)

  Helper method to build a tidal turbine on this tile.
- void __buildWaveEnergyConverter (void)

  Helper method to build a wave energy converter on this tile.
- void __buildEnergyStorage (void)

  Helper method to build an energy storage system on this tile.
- void __sendTileSelectedMessage (void)

  Helper method to format and send message on tile selection.
- std::string __getTileCoordsSubstring (void)

  Helper method to assemble and return tile coordinates substring.
- std::string __getTileTypeSubstring (void)

  Helper method to assemble and return tile type substring.
- std::string __getTileResourceSubstring (void)

  Helper method to assemble and return tile resource substring.
- std::string __getTileImprovementSubstring (void)

  Helper method to assemble and return the tile improvement substring.
- std::string __getTileOptionsSubstring (void)

  Helper method to assemble and return tile options substring.
- void __sendTileStateMessage (void)

  Helper method to format and send tile state message.
- void __sendAssessNeighboursMessage (void)

Helper method to format and send assess neighbours message.

- void __sendGameStateRequest (void)

  Helper method to format and send a game state request (message).
- void __sendUpdateGamePhaseMessage (std::string)

  Helper method to format and send update game phase message.
- void __sendCreditsSpentMessage (int)

  Helper method to format and send a credits spent message.
- void __sendInsufficientCreditsMessage (void)

  Helper method to format and send an insufficient credits message.

Private Attributes

- sf::Event * event_ptr

  A pointer to the event class.
- sf::RenderWindow * render_window_ptr

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.
- MessageHub * message_hub_ptr

  A pointer to the message hub.

4.7.1 Detailed Description

A class which defines a hex tile of the hex map.

4.7.2 Constructor & Destructor Documentation

4.7.2.1 HexTile()

```
HexTile::HexTile (
            double position_x,
            double position_y,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the HexTile class.

Ref: Wikipedia [2023]

Parameters

position_x	The x position of the tile.
position_y	The y position of the tile.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
2181 {
2182     //  1. set attributes
2183
2184     //  1.1. private
2185     this->event_ptr = event_ptr;
2186     this->render_window_ptr = render_window_ptr;
2187
2188     this->assets_manager_ptr = assets_manager_ptr;
2189     this->message_hub_ptr = message_hub_ptr;
2190
2191     //  1.2. public
2192     this->show_node = false;
2193     this->show_resource = false;
2194     this->resource_assessed = false;
2195     this->resource_assessment = false;
2196     this->is_selected = false;
2197     this->draw_explosion = false;
2198
2199     this->decoration_cleared = false;
2200     this->has_improvement = false;
2201     this->tile_improvement_ptr = NULL;
2202
2203     this->build_menu_open = false;
2204
2205     this->explosion_frame = 0;
2206
2207     this->frame = 0;
2208     this->credits = 0;
2209
2210     this->position_x = position_x;
2211     this->position_y = position_y;
2212
2213     this->major_radius = 32;
2214     this->minor_radius = (sqrt(3) / 2) * this->major_radius;
2215
2216     this->game_phase = "build settlement";
2217
2218     //  2. set up and position drawable attributes
2219     this->__setUpNodeSprite();
2220     this->__setUpTileSprite();
2221     this->__setUpSelectOutlineSprite();
2222     this->__setUpResourceChipSprite();
2223     this->__setResourceText();
2224     this->__setUpMagnifyingGlassSprite();
2225     this->__setUpTileExplosionReel();
2226
2227     //  3. set tile type and resource (default to none type and average)
2228     this->setTileType(TileType :: NONE_TYPE);
2229     this->setTileResource(TileResource :: AVERAGE);
2230
2231     std::cout « "HexTile constructed at " « this « std::endl;
2232
2233     return;
2234 }   /* HexTile() */
```

4.7.2.2 ~HexTile()

```
HexTile::~HexTile (
            void  )
```

Destructor for the HexTile class.

```
2765 {
2766     if (this->tile_improvement_ptr != NULL) {
2767         delete this->tile_improvement_ptr;
2768     }
2769
2770     std::cout « "HexTile at " « this « " destroyed" « std::endl;
2771
2772     return;
2773 }   /* ~HexTile() */
```

4.7.3 Member Function Documentation

4.7.3.1 __buildDieselGenerator()

```
void HexTile::__buildDieselGenerator (
            void  )  [private]
```

Helper method to build a diesel generator on this tile.

```
1361 {
1362     int build_cost = DIESEL_GENERATOR_BUILD_COST;
1363 
1364     if (this->credits < build_cost) {
1365         std::cout « "Cannot build diesel generator: insufficient credits (need "
1366             « build_cost « " K)" « std::endl;
1367 
1368         this->__sendInsufficientCreditsMessage();
1369         return;
1370     }
1371 
1372     this->tile_improvement_ptr = new DieselGenerator(
1373         this->position_x,
1374         this->position_y,
1375         this->event_ptr,
1376         this->render_window_ptr,
1377         this->assets_manager_ptr,
1378         this->message_hub_ptr
1379     );
1380 
1381     this->has_improvement = true;
1382     this->__closeBuildMenu();
1383 
1384     this->__sendCreditsSpentMessage(build_cost);
1385     this->__sendTileStateMessage();
1386     this->__sendGameStateRequest();
1387 
1388     return;
1389 }   /* __buildDieselGenerator() */
```

4.7.3.2 __buildEnergyStorage()

```
void HexTile::__buildEnergyStorage (
            void  )  [private]
```

Helper method to build an energy storage system on this tile.

```
1604 {
1605     int build_cost = ENERGY_STORAGE_SYSTEM_BUILD_COST;
1606 
1607     if (this->credits < build_cost) {
1608         std::cout « "Cannot build energy storage system: insufficient credits (need "
1609             « build_cost « " K)" « std::endl;
1610 
1611         this->__sendInsufficientCreditsMessage();
1612         return;
1613     }
1614 
1615     this->tile_improvement_ptr = new EnergyStorageSystem(
1616         this->position_x,
1617         this->position_y,
1618         this->event_ptr,
1619         this->render_window_ptr,
1620         this->assets_manager_ptr,
1621         this->message_hub_ptr
1622     );
1623 
1624     this->has_improvement = true;
1625     this->__closeBuildMenu();
1626 
1627     this->__sendCreditsSpentMessage(build_cost);
1628     this->__sendTileStateMessage();
1629     this->__sendGameStateRequest();
1630 
1631     return;
1632 }   /* __buildEnergyStorage() */
```

4.7.3.3 __buildSettlement()

```
void HexTile::__buildSettlement (
            void  )  [private]
```

Helper method to build a settlement on this tile.

```
1315 {
1316     if (this->credits < BUILD_SETTLEMENT_COST) {
1317         std::cout « "Cannot build settlement: insufficient credits (need "
1318             « BUILD_SETTLEMENT_COST « " K)" « std::endl;
1319 
1320         this->__sendInsufficientCreditsMessage();
1321         return;
1322     }
1323 
1324     this->__clearDecoration();
1325 
1326     this->tile_improvement_ptr = new Settlement(
1327         this->position_x,
1328         this->position_y,
1329         this->event_ptr,
1330         this->render_window_ptr,
1331         this->assets_manager_ptr,
1332         this->message_hub_ptr
1333     );
1334 
1335     this->has_improvement = true;
1336 
1337     this->assess();
1338     this->__sendAssessNeighboursMessage();
1339 
1340     this->__sendUpdateGamePhaseMessage("system management");
1341     this->__sendCreditsSpentMessage(BUILD_SETTLEMENT_COST);
1342     this->__sendTileStateMessage();
1343     this->__sendGameStateRequest();
1344 
1345     return;
1346 }   /* __buildSettlement() */
```

4.7.3.4 __buildSolarPV()

```
void HexTile::__buildSolarPV (
            void  )  [private]
```

Helper method to build a solar PV array on this tile.

```
1404 {
1405     int build_cost = SOLAR_PV_BUILD_COST;
1406 
1407     if (this->tile_type == TileType :: LAKE) {
1408         build_cost *= SOLAR_PV_WATER_BUILD_MULTIPLIER;
1409     }
1410 
1411     if (this->credits < build_cost) {
1412         std::cout « "Cannot build solar PV array: insufficient credits (need "
1413             « build_cost « " K)" « std::endl;
1414 
1415         this->__sendInsufficientCreditsMessage();
1416         return;
1417     }
1418 
1419     this->tile_improvement_ptr = new SolarPV(
1420         this->position_x,
1421         this->position_y,
1422         this->event_ptr,
1423         this->render_window_ptr,
1424         this->assets_manager_ptr,
1425         this->message_hub_ptr
1426     );
1427 
1428     this->has_improvement = true;
1429     this->__closeBuildMenu();
1430 
1431     if (this->tile_type == TileType :: LAKE) {
1432         this->decoration_cleared = true;
1433         this->assets_manager_ptr->getSound("splash")->play();
```

```
1434     }
1435
1436     this->__sendCreditsSpentMessage(build_cost);
1437     this->__sendTileStateMessage();
1438     this->__sendGameStateRequest();
1439
1440     return;
1441 }   /* __buildSolarPV() */
```

4.7.3.5 __buildTidalTurbine()

```
void HexTile::__buildTidalTurbine (
            void  )  [private]
```

Helper method to build a tidal turbine on this tile.

```
1514 {
1515     int build_cost = TIDAL_TURBINE_BUILD_COST;
1516
1517     if (this->credits < build_cost) {
1518         std::cout « "Cannot build tidal turbine: insufficient credits (need "
1519             « build_cost « " K)" « std::endl;
1520
1521         this->__sendInsufficientCreditsMessage();
1522         return;
1523     }
1524
1525     this->tile_improvement_ptr = new TidalTurbine(
1526         this->position_x,
1527         this->position_y,
1528         this->event_ptr,
1529         this->render_window_ptr,
1530         this->assets_manager_ptr,
1531         this->message_hub_ptr
1532     );
1533
1534     this->has_improvement = true;
1535     this->decoration_cleared = true;
1536     this->assets_manager_ptr->getSound("splash")->play();
1537     this->__closeBuildMenu();
1538
1539     this->__sendCreditsSpentMessage(build_cost);
1540     this->__sendTileStateMessage();
1541     this->__sendGameStateRequest();
1542
1543     return;
1544 }   /* __buildTidalTurbine() */
```

4.7.3.6 __buildWaveEnergyConverter()

```
void HexTile::__buildWaveEnergyConverter (
            void  )  [private]
```

Helper method to build a wave energy converter on this tile.

```
1559 {
1560     int build_cost = WAVE_ENERGY_CONVERTER_BUILD_COST;
1561
1562     if (this->credits < build_cost) {
1563         std::cout « "Cannot build wave energy converter: insufficient credits (need "
1564             « build_cost « " K)" « std::endl;
1565
1566         this->__sendInsufficientCreditsMessage();
1567         return;
1568     }
1569
1570     this->tile_improvement_ptr = new WaveEnergyConverter(
1571         this->position_x,
1572         this->position_y,
1573         this->event_ptr,
1574         this->render_window_ptr,
```

```
1575         this->assets_manager_ptr,
1576         this->message_hub_ptr
1577     );
1578
1579     this->has_improvement = true;
1580     this->decoration_cleared = true;
1581     this->assets_manager_ptr->getSound("splash")->play();
1582     this->__closeBuildMenu();
1583
1584     this->__sendCreditsSpentMessage(build_cost);
1585     this->__sendTileStateMessage();
1586     this->__sendGameStateRequest();
1587
1588     return;
1589 }   /* __buildWaveEnergyConverter() */
```

4.7.3.7 __buildWindTurbine()

```
void HexTile::__buildWindTurbine (
             void  )  [private]
```

Helper method to build a wind turbine on this tile.

```
1456 {
1457     int build_cost = WIND_TURBINE_BUILD_COST;
1458
1459     if (
1460         (this->tile_type == TileType :: LAKE) or
1461         (this->tile_type == TileType :: OCEAN)
1462     ) {
1463         build_cost *= WIND_TURBINE_WATER_BUILD_MULTIPLIER;
1464     }
1465
1466     if (this->credits < build_cost) {
1467         std::cout « "Cannot build wind turbine: insufficient credits (need "
1468             « build_cost « " K)" « std::endl;
1469
1470         this->__sendInsufficientCreditsMessage();
1471         return;
1472     }
1473
1474     this->tile_improvement_ptr = new WindTurbine(
1475         this->position_x,
1476         this->position_y,
1477         this->event_ptr,
1478         this->render_window_ptr,
1479         this->assets_manager_ptr,
1480         this->message_hub_ptr
1481     );
1482
1483     this->has_improvement = true;
1484     this->__closeBuildMenu();
1485
1486     if (
1487         (this->tile_type == TileType :: LAKE) or
1488         (this->tile_type == TileType :: OCEAN)
1489     ) {
1490         this->decoration_cleared = true;
1491         this->assets_manager_ptr->getSound("splash")->play();
1492     }
1493
1494     this->__sendCreditsSpentMessage(build_cost);
1495     this->__sendTileStateMessage();
1496     this->__sendGameStateRequest();
1497
1498     return;
1499 }   /* __buildWindTurbine() */
```

4.7.3.8 __clearDecoration()

```
void HexTile::__clearDecoration (
            void  )  [private]
```

Helper method to clear tile decoration.

```
807 {
808     this->decoration_cleared = true;
809     this->draw_explosion = true;
810 
811     switch (this->tile_type) {
812         case (TileType :: FOREST): {
813             this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
814 
815             break;
816         }
817 
818 
819         case (TileType :: MOUNTAINS): {
820             this->assets_manager_ptr->getSound("clear mountains tile")->play();
821 
822             break;
823         }
824 
825 
826         case (TileType :: PLAINS): {
827             this->assets_manager_ptr->getSound("clear non-mountains tile")->play();
828 
829             break;
830         }
831 
832 
833         default: {
834             // do nothing!
835 
836             break;
837         }
838     }
839 
840     return;
841 }   /* __clearDecoration() */
```

4.7.3.9 __closeBuildMenu()

```
void HexTile::__closeBuildMenu (
            void  )  [private]
```

Helper method to close the tile improvement build menu.

```
1290 {
1291     if (not this->build_menu_open) {
1292         return;
1293     }
1294 
1295     this->build_menu_open = false;
1296     this->assets_manager_ptr->getSound("build menu close")->play();
1297 
1298     return;
1299 }   /* __closeBuildMenu() */
```

4.7.3.10 __getTileCoordsSubstring()

```
std::string HexTile::__getTileCoordsSubstring (
            void  )  [private]
```

Helper method to assemble and return tile coordinates substring.

Returns

Tile coordinates substring.

```
1673 {
1674     std::string coords_substring = "TILE COORDS:  (";
1675     coords_substring += std::to_string(int(this->position_x - 400));
1676     coords_substring += ", ";
1677     coords_substring += std::to_string(int(this->position_y - 400));
1678     coords_substring += ")\n";
1679 
1680     return coords_substring;
1681 }   /* __getTileCoordsSubstring() */
```

4.7.3.11 __getTileImprovementSubstring()

```
std::string HexTile::__getTileImprovementSubstring (
            void  )  [private]
```

Helper method to assemble and return the tile improvement substring.

Returns

Tile improvement substring.

```
1832 {
1833     std::string improvement_substring = "TILE IMPROVEMENT:  ";
1834 
1835     if (this->has_improvement) {
1836         improvement_substring += this->tile_improvement_ptr->tile_improvement_string;
1837         improvement_substring += "\n";
1838     }
1839 
1840     else {
1841         improvement_substring += "NONE\n";
1842     }
1843 
1844     return improvement_substring;
1845 }   /* __getTileImprovementSubstring() */
```

4.7.3.12 __getTileOptionsSubstring()

```
std::string HexTile::__getTileOptionsSubstring (
            void  )  [private]
```

Helper method to assemble and return tile options substring.

Returns

Tile options substring.

```
1862 {
1863     //                  32 char x 17 line console "--------------------------------\n";
1864     std::string options_substring               = "     **** TILE OPTIONS ****     \n";
1865     options_substring                          += "                                \n";
1866 
1867     if (this->game_phase == "build settlement") {
1868         if (
1869             (this->tile_type != TileType :: OCEAN) and
1870             (this->tile_type != TileType :: LAKE)
1871         ) {
1872             options_substring += "[B]:  BUILD SETTLEMENT (";
1873             options_substring += std::to_string(BUILD_SETTLEMENT_COST);
1874             options_substring += " K)";
1875         }
```

```
1876     }
1877
1878
1879     else if (this->game_phase == "system management") {
1880         if (this->has_improvement) {
1881             /*
1882             options_substring.clear();
1883             options_substring = this->tile_improvement_ptr->getTileOptionsSubstring();
1884             */
1885         }
1886
1887
1888         else if (not this->resource_assessed) {
1889             options_substring += "[A]:  ASSESS RESOURCE (";
1890             options_substring += std::to_string(RESOURCE_ASSESSMENT_COST);
1891             options_substring += " K)\n";
1892         }
1893
1894
1895         else if (
1896             (not this->decoration_cleared) and
1897             (this->tile_type != TileType :: OCEAN) and
1898             (this->tile_type != TileType :: LAKE)
1899         ) {
1900             options_substring += "[C]:  CLEAR TILE (";
1901
1902             switch (this->tile_type) {
1903                 case (TileType :: FOREST): {
1904                     options_substring += std::to_string(CLEAR_FOREST_COST);
1905
1906                     break;
1907                 }
1908
1909
1910                 case (TileType :: MOUNTAINS): {
1911                     options_substring += std::to_string(CLEAR_MOUNTAINS_COST);
1912
1913                     break;
1914                 }
1915
1916
1917                 case (TileType :: PLAINS): {
1918                     options_substring += std::to_string(CLEAR_PLAINS_COST);
1919
1920                     break;
1921                 }
1922
1923
1924                 default: {
1925                     //do nothing!
1926
1927                     break;
1928                 }
1929             }
1930
1931             options_substring += " K)\n";
1932         }
1933
1934
1935         else if (
1936             (this->decoration_cleared) or
1937             (this->tile_type == TileType :: OCEAN) or
1938             (this->tile_type == TileType :: LAKE)
1939         ) {
1940             options_substring += "[B]: OPEN BUILD MENU\n";
1941         }
1942     }
1943
1944
1945     else if (this->game_phase == "victory") {
1946         options_substring                       += "       **** VICTORY ****        \n";
1947     }
1948
1949
1950     else {
1951         options_substring                       += "        **** LOSS ****          \n";
1952     }
1953
1954     return options_substring;
1955 }   /* __getTileOptionsString() */
```

4.7.3.13 __getTileResourceSubstring()

```
std::string HexTile::__getTileResourceSubstring (
            void  )  [private]
```

Helper method to assemble and return tile resource substring.

Returns

Tile resource substring.

```
1762 {
1763     std::string resource_substring = "TILE RESOURCE:     ";
1764 
1765     if (this->resource_assessed) {
1766         switch (this->tile_resource) {
1767             case (TileResource :: POOR): {
1768                 resource_substring += "POOR\n";
1769 
1770                 break;
1771             }
1772 
1773 
1774             case (TileResource ::BELOW_AVERAGE): {
1775                 resource_substring += "BELOW AVERAGE\n";
1776 
1777                 break;
1778             }
1779 
1780 
1781             case (TileResource :: AVERAGE): {
1782                 resource_substring += "AVERAGE\n";
1783 
1784                 break;
1785             }
1786 
1787 
1788             case (TileResource :: ABOVE_AVERAGE): {
1789                 resource_substring += "ABOVE AVERAGE\n";
1790 
1791                 break;
1792             }
1793 
1794 
1795             case (TileResource :: GOOD): {
1796                 resource_substring += "GOOD\n";
1797 
1798                 break;
1799             }
1800 
1801 
1802             default: {
1803                 resource_substring += "???\n";
1804 
1805                 break;
1806             }
1807         }
1808     }
1809 
1810     else {
1811         resource_substring += "???\n";
1812     }
1813 
1814     return resource_substring;
1815 }   /* __getTileResourceSubstring() */
```

4.7.3.14 __getTileTypeSubstring()

```
std::string HexTile::__getTileTypeSubstring (
            void  )  [private]
```

Helper method to assemble and return tile type substring.

Returns

Tile type substring.

```
1698 {
1699     std::string type_substring = "TILE TYPE:         ";
1700 
1701     switch (this->tile_type) {
1702         case (TileType :: FOREST): {
1703             type_substring += "FOREST\n";
1704 
1705             break;
1706         }
1707 
1708 
1709         case (TileType :: LAKE): {
1710             type_substring += "LAKE\n";
1711 
1712             break;
1713         }
1714 
1715 
1716         case (TileType :: MOUNTAINS): {
1717             type_substring += "MOUNTAINS\n";
1718 
1719             break;
1720         }
1721 
1722 
1723         case (TileType :: OCEAN): {
1724             type_substring += "OCEAN\n";
1725 
1726             break;
1727         }
1728 
1729 
1730         case (TileType :: PLAINS): {
1731             type_substring += "PLAINS\n";
1732 
1733             break;
1734         }
1735 
1736 
1737         default: {
1738             type_substring += "???\n";
1739 
1740             break;
1741         }
1742     }
1743 
1744     return type_substring;
1745 }   /* __getTileTypeSubstring() */
```

4.7.3.15 __handleKeyPressEvents()

```
void HexTile::__handleKeyPressEvents (
            void  )  [private]
```

Helper method to handle key press events.

```
890 {
891     if (not this->is_selected) {
892         return;
893     }
894 
895 
896     if (this->event_ptr->key.code == sf::Keyboard::Escape) {
897         this->__setIsSelected(false);
898     }
899 
900 
901     if (this->build_menu_open) {
902         switch (this->tile_type) {
903             case (TileType :: FOREST): {
904                 switch (this->event_ptr->key.code) {
905                     case (sf::Keyboard::D): {
906                         this->__buildDieselGenerator();
907 
908                         break;
```

```
909                     }
910
911
912                     case (sf::Keyboard::S): {
913                         this->__buildSolarPV();
914
915                         break;
916                     }
917
918
919                     case (sf::Keyboard::W): {
920                         this->__buildWindTurbine();
921
922                         break;
923                     }
924
925
926                     case (sf::Keyboard::E): {
927                         this->__buildEnergyStorage();
928
929                         break;
930                     }
931
932
933                     default: {
934                         // do nothing!
935
936                         break;
937                     }
938                 }
939
940                 break;
941             }
942
943
944             case (TileType :: LAKE): {
945                 switch (this->event_ptr->key.code) {
946                     case (sf::Keyboard::S): {
947                         this->__buildSolarPV();
948
949                         break;
950                     }
951
952
953                     case (sf::Keyboard::W): {
954                         this->__buildWindTurbine();
955
956                         break;
957                     }
958
959
960                     default: {
961                         // do nothing!
962
963                         break;
964                     }
965                 }
966
967                 break;
968             }
969
970
971             case (TileType :: MOUNTAINS): {
972                 switch (this->event_ptr->key.code) {
973                     case (sf::Keyboard::D): {
974                         this->__buildDieselGenerator();
975
976                         break;
977                     }
978
979
980                     case (sf::Keyboard::S): {
981                         this->__buildSolarPV();
982
983                         break;
984                     }
985
986
987                     case (sf::Keyboard::W): {
988                         this->__buildWindTurbine();
989
990                         break;
991                     }
992
993
994                     case (sf::Keyboard::E): {
995                         this->__buildEnergyStorage();
```

```
996
997                         break;
998                     }
999
1000
1001                    default: {
1002                        // do nothing!
1003
1004                        break;
1005                    }
1006                }
1007
1008                break;
1009            }
1010
1011
1012            case (TileType :: OCEAN): {
1013                switch (this->event_ptr->key.code) {
1014                    case (sf::Keyboard::W): {
1015                        this->__buildWindTurbine();
1016
1017                        break;
1018                    }
1019
1020
1021                    case (sf::Keyboard::T): {
1022                        this->__buildTidalTurbine();
1023
1024                        break;
1025                    }
1026
1027
1028                    case (sf::Keyboard::A): {
1029                        this->__buildWaveEnergyConverter();
1030
1031                        break;
1032                    }
1033
1034
1035                    default: {
1036                        // do nothing!
1037
1038                        break;
1039                    }
1040                }
1041
1042                break;
1043            }
1044
1045
1046            case (TileType :: PLAINS): {
1047                switch (this->event_ptr->key.code) {
1048                    case (sf::Keyboard::D): {
1049                        this->__buildDieselGenerator();
1050
1051                        break;
1052                    }
1053
1054
1055                    case (sf::Keyboard::S): {
1056                        this->__buildSolarPV();
1057
1058                        break;
1059                    }
1060
1061
1062                    case (sf::Keyboard::W): {
1063                        this->__buildWindTurbine();
1064
1065                        break;
1066                    }
1067
1068
1069                    case (sf::Keyboard::E): {
1070                        this->__buildEnergyStorage();
1071
1072                        break;
1073                    }
1074
1075
1076                    default: {
1077                        // do nothing!
1078
1079                        break;
1080                    }
1081                }
1082
```

```
1083                 break;
1084             }
1085
1086
1087             default: {
1088                 //do nothing!
1089
1090                 break;
1091             }
1092         }
1093     }
1094
1095
1096     if (this->game_phase == "build settlement") {
1097         if (
1098             (this->tile_type != TileType :: OCEAN) and
1099             (this->tile_type != TileType :: LAKE)
1100         ) {
1101             if (this->event_ptr->key.code == sf::Keyboard::B) {
1102                 this->__buildSettlement();
1103             }
1104         }
1105     }
1106
1107
1108     else if (this->game_phase == "system management") {
1109         if (this->has_improvement) {
1110             // will be caught by this->tile_improvement_ptr->processEvent();
1111         }
1112
1113
1114         else if (not this->resource_assessed) {
1115             if (this->event_ptr->key.code == sf::Keyboard::A) {
1116                 if (this->credits < RESOURCE_ASSESSMENT_COST) {
1117                     std::cout « "Cannot assess resource: insufficient credits (need "
1118                         « RESOURCE_ASSESSMENT_COST « " K)" « std::endl;
1119
1120                     this->__sendInsufficientCreditsMessage();
1121                 }
1122
1123                 else {
1124                     this->assess();
1125                     this->__sendCreditsSpentMessage(RESOURCE_ASSESSMENT_COST);
1126                     this->__sendTileStateMessage();
1127                     this->__sendGameStateRequest();
1128                 }
1129             }
1130         }
1131
1132
1133         else if (
1134             (not this->decoration_cleared) and
1135             (this->tile_type != TileType :: OCEAN) and
1136             (this->tile_type != TileType :: LAKE)
1137         ) {
1138             if (this->event_ptr->key.code == sf::Keyboard::C) {
1139                 int clear_cost = 0;
1140
1141                 switch (this->tile_type) {
1142                     case (TileType :: FOREST): {
1143                         clear_cost = CLEAR_FOREST_COST;
1144
1145                         break;
1146                     }
1147
1148
1149                     case (TileType :: MOUNTAINS): {
1150                         clear_cost = CLEAR_MOUNTAINS_COST;
1151
1152                         break;
1153                     }
1154
1155
1156                     case (TileType :: PLAINS): {
1157                         clear_cost = CLEAR_PLAINS_COST;
1158
1159                         break;
1160                     }
1161
1162
1163                     default: {
1164                         // do nothing!
1165
1166                         break;
1167                     }
1168                 }
1169
```

```
1170                 if (this->credits < clear_cost) {
1171                     std::cout « "Cannot clear tile: insufficient credits (need "
1172                         « clear_cost « " K)" « std::endl;
1173 
1174                     this->__sendInsufficientCreditsMessage();
1175                 }
1176 
1177                 else {
1178                     this->__clearDecoration();
1179                     this->__sendCreditsSpentMessage(clear_cost);
1180                     this->__sendTileStateMessage();
1181                     this->__sendGameStateRequest();
1182                 }
1183             }
1184         }
1185 
1186 
1187         else if (
1188             (this->decoration_cleared) or
1189             (this->tile_type == TileType :: OCEAN) or
1190             (this->tile_type == TileType :: LAKE)
1191         ) {
1192             if (this->event_ptr->key.code == sf::Keyboard::B) {
1193                 this->__openBuildMenu();
1194             }
1195         }
1196     }
1197 
1198     return;
1199 }   /* __handleKeyPressEvents() */
```

4.7.3.16 __handleMouseButtonEvents()

```
void HexTile::__handleMouseButtonEvents (
            void  )  [private]
```

Helper method to handle mouse button events.

```
1214 {
1215     switch (this->event_ptr->mouseButton.button) {
1216         case (sf::Mouse::Left): {
1217             if (this->__isClicked()) {
1218                 std::cout « "Tile (" « this->position_x « ", " «
1219                     this->position_y « ") was selected" « std::endl;
1220 
1221                 this->__setIsSelected(true);
1222 
1223                 this->__sendTileSelectedMessage();
1224                 this->__sendTileStateMessage();
1225                 this->__sendGameStateRequest();
1226             }
1227 
1228             else {
1229                 this->__setIsSelected(false);
1230             }
1231 
1232             break;
1233         }
1234 
1235 
1236         case (sf::Mouse::Right): {
1237             this->__setIsSelected(false);
1238 
1239             break;
1240         }
1241 
1242 
1243         default: {
1244             // do nothing!
1245 
1246             break;
1247         }
1248     }
1249 
1250     return;
1251 }   /* __handleMouseButtonEvents() */
```

4.7.3.17 __isClicked()

```
bool HexTile::__isClicked (
            void  )  [private]
```

Helper method to determine if tile was clicked on.

Returns

Boolean indicating whether or not tile was clicked on.

```
858 {
859     sf::Vector2i mouse_position = sf::Mouse::getPosition(*render_window_ptr);
860 
861     double mouse_x = mouse_position.x;
862     double mouse_y = mouse_position.y;
863 
864     double distance = sqrt(
865         pow(this->position_x - mouse_x, 2) +
866         pow(this->position_y - mouse_y, 2)
867     );
868 
869     if (distance < this->minor_radius) {
870         return true;
871     }
872     else {
873         return false;
874     }
875 }   /* __isClicked() */
```

4.7.3.18 __openBuildMenu()

```
void HexTile::__openBuildMenu (
            void  )  [private]
```

Helper method to open the tile improvement build menu.

```
1266 {
1267     if (this->build_menu_open) {
1268         return;
1269     }
1270 
1271     this->build_menu_open = true;
1272     this->assets_manager_ptr->getSound("build menu open")->play();
1273 
1274     return;
1275 }   /* __openBuildMenu() */
```

4.7.3.19 __sendAssessNeighboursMessage()

```
void HexTile::__sendAssessNeighboursMessage (
            void  )  [private]
```

Helper method to format and send assess neighbours message.

```
2012 {
2013     Message assess_neighbours_message;
2014 
2015     assess_neighbours_message.channel = HEX_MAP_CHANNEL;
2016     assess_neighbours_message.subject = "assess neighbours";
2017 
2018     this->message_hub_ptr->sendMessage(assess_neighbours_message);
2019 
2020     std::cout « "Assess neighbours message sent by " « this « std::endl;
2021 
2022     return;
2023 }   /* __sendAssessNeighboursMessage() */
```

4.7.3.20 __sendCreditsSpentMessage()

```
void HexTile::__sendCreditsSpentMessage (
            int credits_spent )  [private]
```

Helper method to format and send a credits spent message.

Parameters

credits_spent	The number of credits that were spent.

```
2095 {
2096     Message credits_spent_message;
2097
2098     credits_spent_message.channel = GAME_CHANNEL;
2099     credits_spent_message.subject = "credits spent";
2100
2101     credits_spent_message.int_payload["credits spent"] = credits_spent;
2102
2103     this->message_hub_ptr->sendMessage(credits_spent_message);
2104
2105     std::cout << "Credits spent (" << credits_spent << ") message sent by " << this
2106         << std::endl;
2107     return;
2108 }   /* __sendCreditsSpentMessage() */
```

4.7.3.21 __sendGameStateRequest()

```
void HexTile::__sendGameStateRequest (
            void  )  [private]
```

Helper method to format and send a game state request (message).

```
2038 {
2039     Message game_state_request;
2040
2041     game_state_request.channel = GAME_CHANNEL;
2042     game_state_request.subject = "state request";
2043
2044     this->message_hub_ptr->sendMessage(game_state_request);
2045
2046     std::cout << "Game state request message sent by " << this << std::endl;
2047     return;
2048 }   /* __sendGameStateRequest() */
```

4.7.3.22 __sendInsufficientCreditsMessage()

```
void HexTile::__sendInsufficientCreditsMessage (
            void  )  [private]
```

Helper method to format and send an insufficient credits message.

```
2123 {
2124     Message insufficient_credits_message;
2125
2126     insufficient_credits_message.channel = GAME_CHANNEL;
2127     insufficient_credits_message.subject = "insufficient credits";
2128
2129     this->message_hub_ptr->sendMessage(insufficient_credits_message);
2130
2131     std::cout << "Insufficient credits message sent by " << this << std::endl;
2132
2133     return;
2134 }   /* __sendInsufficientCreditsMessage() */
```

4.7.3.23 __sendTileSelectedMessage()

```
void HexTile::__sendTileSelectedMessage (
            void  )  [private]
```

Helper method to format and send message on tile selection.

```
1647 {
1648     Message tile_selected_message;
1649 
1650     tile_selected_message.channel = TILE_SELECTED_CHANNEL;
1651     tile_selected_message.subject = "tile selected";
1652 
1653     this->message_hub_ptr->sendMessage(tile_selected_message);
1654 
1655     return;
1656 }   /* __sendTileSelectedMessage() */
```

4.7.3.24 __sendTileStateMessage()

```
void HexTile::__sendTileStateMessage (
            void  )  [private]
```

Helper method to format and send tile state message.

```
1970 {
1971     Message tile_state_message;
1972 
1973     tile_state_message.channel = TILE_STATE_CHANNEL;
1974     tile_state_message.subject = "tile state";
1975 
1976 
1977     //                  32 char x 17 line console "--------------------------------\n";
1978     std::string console_string                    = "      **** TILE INFO ****       \n";
1979     console_string                               += "                                \n";
1980 
1981     console_string                               += this->__getTileCoordsSubstring();
1982     console_string                               += "                                \n";
1983 
1984     console_string                               += this->__getTileTypeSubstring();
1985     console_string                               += this->__getTileResourceSubstring();
1986     console_string                               += this->__getTileImprovementSubstring();
1987     console_string                               += "                                \n";
1988 
1989     console_string                               += this->__getTileOptionsSubstring();
1990 
1991     tile_state_message.string_payload["console string"] = console_string;
1992 
1993     this->message_hub_ptr->sendMessage(tile_state_message);
1994 
1995     std::cout « "Tile state message sent by " « this « std::endl;
1996     return;
1997 }   /* __sendTileStateMessage() */
```

4.7.3.25 __sendUpdateGamePhaseMessage()

```
void HexTile::__sendUpdateGamePhaseMessage (
            std::string game_phase )  [private]
```

Helper method to format and send update game phase message.

Parameters

game_phase	The updated game phase.

```
2065 {
2066     Message update_game_phase_message;
2067 
2068     update_game_phase_message.channel = GAME_CHANNEL;
2069     update_game_phase_message.subject = "update game phase";
2070 
2071     update_game_phase_message.string_payload["game phase"] = game_phase;
2072 
2073     this->message_hub_ptr->sendMessage(update_game_phase_message);
2074 
2075     std::cout « "Update game phase message sent by " « this « std::endl;
2076 
2077     return;
2078 }   /* __sendUpdateGamePhaseMessage() */
```

4.7.3.26 __setIsSelected()

```
void HexTile::__setIsSelected (
            bool is_selected )  [private]
```

Helper method to set the is selected attribute (of tile and improvement).

Parameters

is_selected	The value to set the is selected attribute to.

```
763 {
764     this->is_selected = is_selected;
765 
766     if (this->tile_improvement_ptr != NULL) {
767         this->tile_improvement_ptr->is_selected = is_selected;
768 
769         if (is_selected) {
770             switch (this->tile_improvement_ptr->tile_improvement_type) {
771                 case (TileImprovementType :: SETTLEMENT): {
772                     this->assets_manager_ptr->getSound("people and children")->play();
773 
774                     break;
775                 }
776 
777 
778                 default: {
779                     // do nothing!
780 
781                     break;
782                 }
783             }
784         }
785     }
786 
787     if ((not is_selected) and this->build_menu_open) {
788         this->__closeBuildMenu();
789     }
790 
791     return;
792 }   /* __toggleIsSelected() */
```

4.7.3.27 __setResourceText()

```
void HexTile::__setResourceText (
            void  )  [private]
```

Helper method to set up resource text.

```
193 {
194     this->resource_text.setFont(*(assets_manager_ptr->getFont("DroidSansMono")));
195 
```

```
196     this->resource_text.setFillColor(sf::Color(0, 0, 0, 255));
197 
198     if (this->resource_assessed) {
199         switch (this->tile_resource) {
200             case (TileResource :: POOR): {
201                 this->resource_text.setString("-2");
202                 this->resource_text.setFillColor(MONOCHROME_TEXT_RED);
203 
204                 break;
205             }
206 
207             case (TileResource :: BELOW_AVERAGE): {
208                 this->resource_text.setString("-1");
209                 this->resource_text.setFillColor(MONOCHROME_TEXT_RED);
210 
211                 break;
212             }
213 
214             case (TileResource :: AVERAGE): {
215                 this->resource_text.setString("+0");
216 
217                 break;
218             }
219 
220             case (TileResource :: ABOVE_AVERAGE): {
221                 this->resource_text.setString("+1");
222                 this->resource_text.setFillColor(MONOCHROME_TEXT_GREEN);
223 
224                 break;
225             }
226 
227             case (TileResource :: GOOD): {
228                 this->resource_text.setString("+2");
229                 this->resource_text.setFillColor(MONOCHROME_TEXT_GREEN);
230 
231                 break;
232             }
233 
234             default: {
235                 this->resource_text.setString("");
236 
237                 break;
238             }
239         }
240     }
241 
242     else {
243         this->resource_text.setString("");
244     }
245 
246     this->resource_text.setCharacterSize(20);
247 
248     this->resource_text.setOrigin(
249         this->resource_text.getLocalBounds().width / 2,
250         this->resource_text.getLocalBounds().height / 2
251     );
252 
253     this->resource_text.setPosition(
254         this->position_x,
255         this->position_y - 4
256     );
257 
258     this->resource_text.setOutlineThickness(1);
259     this->resource_text.setOutlineColor(sf::Color(0, 0, 0, 255));
260 
261     return;
262 }   /* __setResourceText() */
```

4.7.3.28 __setUpBuildMenu()

```
void HexTile::__setUpBuildMenu (
            void  )  [private]
```

Helper method to set up and place build menu assets (drawable).

```
666 {
667     this->build_menu_options_vec.clear();
668     this->build_menu_options_text_vec.clear();
669 
```

```
670     //  1. set up and place build menu backing and text
671     this->build_menu_backing.setSize(sf::Vector2f(600, 256));
672     this->build_menu_backing.setOrigin(300, 128);
673     this->build_menu_backing.setPosition(400, 400);
674     this->build_menu_backing.setFillColor(MONOCHROME_SCREEN_BACKGROUND);
675     this->build_menu_backing.setOutlineColor(MENU_FRAME_GREY);
676     this->build_menu_backing.setOutlineThickness(4);
677 
678     this->build_menu_backing_text.setString("**** BUILD MENU ****");
679     this->build_menu_backing_text.setFont(
680         *(this->assets_manager_ptr->getFont("Glass_TTY_VT220"))
681     );
682     this->build_menu_backing_text.setCharacterSize(16);
683     this->build_menu_backing_text.setFillColor(MONOCHROME_TEXT_GREEN);
684     this->build_menu_backing_text.setOrigin(
685         this->build_menu_backing_text.getLocalBounds().width / 2, 0
686     );
687     this->build_menu_backing_text.setPosition(400, 400 - 128 + 4);
688 
689     //  2. set up and place build menu option sprites and text
690     switch (this->tile_type) {
691         case (TileType :: FOREST): {
692             this->__setUpDieselGeneratorBuildOption();
693             this->__setUpSolarPVBuildOption();
694             this->__setUpWindTurbineBuildOption();
695             this->__setUpEnergyStorageSystemBuildOption();
696 
697             break;
698         }
699 
700 
701         case (TileType :: LAKE): {
702             this->__setUpSolarPVBuildOption(true);
703             this->__setUpWindTurbineBuildOption(true);
704 
705             break;
706         }
707 
708 
709         case (TileType :: MOUNTAINS): {
710             this->__setUpDieselGeneratorBuildOption();
711             this->__setUpSolarPVBuildOption();
712             this->__setUpWindTurbineBuildOption();
713             this->__setUpEnergyStorageSystemBuildOption();
714 
715             break;
716         }
717 
718 
719         case (TileType :: OCEAN): {
720             this->__setUpWindTurbineBuildOption(false, true);
721             this->__setUpTidalTurbineBuildOption();
722             this->__setUpWaveEnergyConverterBuildOption();
723 
724             break;
725         }
726 
727 
728         case (TileType :: PLAINS): {
729             this->__setUpDieselGeneratorBuildOption();
730             this->__setUpSolarPVBuildOption();
731             this->__setUpWindTurbineBuildOption();
732             this->__setUpEnergyStorageSystemBuildOption();
733 
734             break;
735         }
736 
737 
738         default: {
739             // do nothing!
740 
741             break;
742         }
743     }
744 
745     return;
746 }   /* __setUpBuildMenu() */
```

4.7.3.29 __setUpBuildOption()

```
void HexTile::__setUpBuildOption (
```

```
            std::string texture_key,
            std::string option_string )  [private]
```

Helper method to set up and postion the sprite and text for a build option.

Parameters

texture_key	The key for the appropriate illustration asset for the build option.
option_string	A string for the build option.

```
357 {
358     size_t n_options = this->build_menu_options_vec.size();
359 
360     //  1. set up option sprite(s)
361     this->build_menu_options_vec.push_back({});
362 
363     if (not texture_key.empty()) {
364         sf::Sprite texture_sheet(
365             *(this->assets_manager_ptr->getTexture(texture_key))
366         );
367 
368         int sheet_height = texture_sheet.getLocalBounds().height;
369         int n_subrects = sheet_height / 64;
370 
371         for (int i = 0; i < n_subrects; i++) {
372             this->build_menu_options_vec.back().push_back(
373                 sf::Sprite(
374                     *(this->assets_manager_ptr->getTexture(texture_key)),
375                     sf::IntRect(0, i * 64, 64, 64)
376                 )
377             );
378 
379             this->build_menu_options_vec.back().back().setOrigin(
380                 this->build_menu_options_vec.back().back().getLocalBounds().width / 2,
381                 this->build_menu_options_vec.back().back().getLocalBounds().height
382             );
383 
384             this->build_menu_options_vec.back().back().setPosition(
385                 400 - 300 + 75 + n_options * 150,
386                 400 - 32
387             );
388         }
389     }
390 
391     else {
392         this->build_menu_options_vec.back().push_back(sf::Sprite());
393     }
394 
395 
396     //  2. set up option text
397     this->build_menu_options_text_vec.push_back(
398         sf::Text(
399             option_string,
400             *(this->assets_manager_ptr->getFont("Glass_TTY_VT220")),
401             16
402         )
403     );
404 
405     this->build_menu_options_text_vec.back().setOrigin(
406         this->build_menu_options_text_vec.back().getLocalBounds().width / 2,
407         0
408     );
409 
410     this->build_menu_options_text_vec.back().setPosition(
411         400 - 300 + 75 + n_options * 150,
412         400 - 16 - 4
413     );
414 
415     this->build_menu_options_text_vec.back().setFillColor(MONOCHROME_TEXT_GREEN);
416 
417     return;
418 }   /* __setUpBuildOption() */
```

4.7.3.30 __setUpDieselGeneratorBuildOption()

```
void HexTile::__setUpDieselGeneratorBuildOption (
            void  )  [private]
```

Helper method to set up and position the diesel generator build option.

```
433 {
434     //  1. set up option sprite(s)
435     std::string texture_key = "diesel generator";
436 
437     //  2. set up option string (up to 16 chars wide)
438     //                              "----------------\n"
439     std::string diesel_generator_string = "DIESEL GENERATOR\n";
440     diesel_generator_string            += "                \n";
441     diesel_generator_string            += "CAPACITY: 100 kW\n";
442     diesel_generator_string            += "COST:     ";
443     diesel_generator_string            += std::to_string(DIESEL_GENERATOR_BUILD_COST);
444     diesel_generator_string            += " K\n\n\n";
445     diesel_generator_string            += "BUILD:    [D]   \n";
446 
447     //  3. call general method
448     this->__setUpBuildOption(texture_key, diesel_generator_string);
449 
450     return;
451 }   /* __setUpDieselGeneratorBuildOption() */
```

4.7.3.31 __setUpEnergyStorageSystemBuildOption()

```
void HexTile::__setUpEnergyStorageSystemBuildOption (
             void  )  [private]
```

Helper method to set up and position the wave energy converter build option.

```
633 {
634     //  1. set up option sprite(s)
635     std::string texture_key = "energy storage system";
636 
637     //  2. set up option string (up to 16 chars wide)
638     //                                "----------------\n"
639     std::string energy_storage_system_string    = " ENERGY STORAGE \n";
640     energy_storage_system_string               += "                \n";
641     energy_storage_system_string               += "CAPCTY:  500 kWh\n";
642     energy_storage_system_string               += "COST:     ";
643     energy_storage_system_string               += std::to_string(ENERGY_STORAGE_SYSTEM_BUILD_COST);
644     energy_storage_system_string               += " K\n\n\n";
645     energy_storage_system_string               += "BUILD:    [E]   \n";
646 
647     //  3. call general method
648     this->__setUpBuildOption(texture_key, energy_storage_system_string);
649 
650     return;
651 }   /* __setUpEnergyStorageSystemBuildOption() */
```

4.7.3.32 __setUpMagnifyingGlassSprite()

```
void HexTile::__setUpMagnifyingGlassSprite (
             void  )  [private]
```

Helper method to set up and position magnifying glass sprite.

```
277 {
278     this->magnifying_glass_sprite.setTexture(
279         *(this->assets_manager_ptr->getTexture("magnifying_glass_64x64_1"))
280     );
281 
282     this->magnifying_glass_sprite.setOrigin(
283         this->magnifying_glass_sprite.getLocalBounds().width / 2,
284         this->magnifying_glass_sprite.getLocalBounds().height / 2
285     );
286 
287     this->magnifying_glass_sprite.setPosition(
288         this->position_x,
289         this->position_y
290     );
291 
292     return;
293 }   /* __setUpMagnifyingGlassSprite() */
```

4.7.3.33 __setUpNodeSprite()

```
void HexTile::__setUpNodeSprite (
            void  )  [private]
```

Helper method to set up node sprite.

```
68 {
69     this->node_sprite.setRadius(4);
70 
71     this->node_sprite.setOrigin(
72         this->node_sprite.getLocalBounds().width / 2,
73         this->node_sprite.getLocalBounds().height / 2
74     );
75 
76     this->node_sprite.setPosition(this->position_x, this->position_y);
77 
78     this->node_sprite.setFillColor(sf::Color(255, 0, 0, 255));
79 
80     return;
81 }   /* __setUpNodeSprite() */
```

4.7.3.34 __setUpResourceChipSprite()

```
void HexTile::__setUpResourceChipSprite (
            void  )  [private]
```

Helper method to set up resource chip sprite.

```
166 {
167     this->resource_chip_sprite.setRadius(2 * this->minor_radius / 3);
168 
169     this->resource_chip_sprite.setOrigin(
170         this->resource_chip_sprite.getLocalBounds().width / 2,
171         this->resource_chip_sprite.getLocalBounds().height / 2
172     );
173 
174     this->resource_chip_sprite.setPosition(this->position_x, this->position_y);
175 
176     this->resource_chip_sprite.setFillColor(RESOURCE_CHIP_GREY);
177 
178     return;
179 }   /* __setUpResourceChip() */
```

4.7.3.35 __setUpSelectOutlineSprite()

```
void HexTile::__setUpSelectOutlineSprite (
            void  )  [private]
```

Helper method to set up select outline sprite.

```
130 {
131     int n_points = 6;
132 
133     this->select_outline_sprite.setPointCount(n_points);
134 
135     for (int i = 0; i < n_points; i++) {
136         this->select_outline_sprite.setPoint(
137             i,
138             sf::Vector2f(
139                 this->position_x + this->major_radius * cos((30 + 60 * i) * (M_PI / 180)),
140                 this->position_y + this->major_radius * sin((30 + 60 * i) * (M_PI / 180))
141             )
142         );
143     }
144 
145     this->select_outline_sprite.setOutlineThickness(4);
146     this->select_outline_sprite.setOutlineColor(MONOCHROME_TEXT_RED);
147 
148     this->select_outline_sprite.setFillColor(sf::Color(0, 0, 0, 0));
149 
150     return;
151 }   /* __setUpSelectOutline() */
```

4.7.3.36 __setUpSolarPVBuildOption()

```
void HexTile::__setUpSolarPVBuildOption (
            bool is_lake = false )  [private]
```

Helper method to set up and position the solar PV array build option.

Parameters

is_lake	If being built on a lake.

```
521 {
522     //  1. set up option sprite(s)
523     std::string texture_key = "solar PV array";
524 
525     //  2. set up option string (up to 16 chars wide)
526     int build_cost = SOLAR_PV_BUILD_COST;
527     if (is_lake) {
528         build_cost *= SOLAR_PV_WATER_BUILD_MULTIPLIER;
529     }
530 
531     //                                    "----------------\n"
532     std::string solar_PV_string         = " SOLAR PV ARRAY \n";
533     solar_PV_string                    += "                \n";
534     solar_PV_string                    += "CAPACITY: 100 kW\n";
535     solar_PV_string                    += "COST:     ";
536     solar_PV_string                    += std::to_string(build_cost);
537     solar_PV_string                    += " K";
538 
539     if (is_lake) {
540         solar_PV_string += "\n** LAKE BUILD **\n\n";
541     }
542     else {
543         solar_PV_string += "\n\n\n";
544     }
545 
546     solar_PV_string                    += "BUILD:    [S]   \n";
547 
548     //  3. call general method
549     this->__setUpBuildOption(texture_key, solar_PV_string);
550 
551     return;
552 }   /* __setUpSolarPVBuildOption() */
```

4.7.3.37 __setUpTidalTurbineBuildOption()

```
void HexTile::__setUpTidalTurbineBuildOption (
            void  )  [private]
```

Helper method to set up and position the tidal turbine build option.

```
567 {
568     //  1. set up option sprite(s)
569     std::string texture_key = "tidal turbine";
570 
571     //  2. set up option string (up to 16 chars wide)
572     //                                    "----------------\n"
573     std::string tidal_turbine_string    = " TIDAL TURBINE  \n";
574     tidal_turbine_string               += "                \n";
575     tidal_turbine_string               += "CAPACITY: 100 kW\n";
576     tidal_turbine_string               += "COST:     ";
577     tidal_turbine_string               += std::to_string(TIDAL_TURBINE_BUILD_COST);
578     tidal_turbine_string               += " K\n\n\n";
579     tidal_turbine_string               += "BUILD:    [T]   \n";
580 
581     //  3. call general method
582     this->__setUpBuildOption(texture_key, tidal_turbine_string);
583 
584     return;
585 }   /* __setUpTidalTurbineBuildOption() */
```

4.7.3.38 __setUpTileExplosionReel()

```
void HexTile::__setUpTileExplosionReel (
            void  )  [private]
```

Helper method to set up tile explosion sprite reel.

```
308 {
309     for (int i = 0; i < 4; i++) {
310         for (int j = 0; j < 4; j++) {
311             this->explosion_sprite_reel.push_back(
312                 sf::Sprite(
313                     *(this->assets_manager_ptr->getTexture("tile clear explosion")),
314                     sf::IntRect(j * 64, i * 64, 64, 64)
315                 )
316             );
317 
318             this->explosion_sprite_reel.back().setOrigin(
319                 this->explosion_sprite_reel.back().getLocalBounds().width / 2,
320                 this->explosion_sprite_reel.back().getLocalBounds().height / 2
321             );
322 
323             this->explosion_sprite_reel.back().setPosition(
324                 this->position_x,
325                 this->position_y
326             );
327         }
328     }
329 
330     return;
331 }   /* __setUpTileExplosionReel() */
```

4.7.3.39 __setUpTileSprite()

```
void HexTile::__setUpTileSprite (
            void  )  [private]
```

Helper method to set up tile sprite.

```
96 {
97     int n_points = 6;
98 
99     this->tile_sprite.setPointCount(n_points);
100 
101     for (int i = 0; i < n_points; i++) {
102         this->tile_sprite.setPoint(
103             i,
104             sf::Vector2f(
105                 this->position_x + this->major_radius * cos((30 + 60 * i) * (M_PI / 180)),
106                 this->position_y + this->major_radius * sin((30 + 60 * i) * (M_PI / 180))
107             )
108         );
109     }
110 
111     this->tile_sprite.setOutlineThickness(1);
112     this->tile_sprite.setOutlineColor(sf::Color(175, 175, 175, 255));
113 
114     return;
115 }   /* __setUpTileSprite() */
```

4.7.3.40 __setUpWaveEnergyConverterBuildOption()

```
void HexTile::__setUpWaveEnergyConverterBuildOption (
            void  )  [private]
```

Helper method to set up and position the wave energy converter build option.

```
600 {
601     //  1. set up option sprite(s)
```

```
602     std::string texture_key = "wave energy converter";
603
604     //  2. set up option string (up to 16 chars wide)
605     //                                          "----------------\n"
606     std::string wave_energy_converter_string    = "WAVE ENERGY CVTR\n";
607     wave_energy_converter_string               += "                \n";
608     wave_energy_converter_string               += "CAPACITY: 100 kW\n";
609     wave_energy_converter_string               += "COST:     ";
610     wave_energy_converter_string               += std::to_string(WAVE_ENERGY_CONVERTER_BUILD_COST);
611     wave_energy_converter_string               += " K\n\n\n";
612     wave_energy_converter_string               += "BUILD:    [A]   \n";
613
614     //  3. call general method
615     this->__setUpBuildOption(texture_key, wave_energy_converter_string);
616
617     return;
618 }   /* __setUpWaveEnergyConverterBuildOption() */
```

4.7.3.41 __setUpWindTurbineBuildOption()

```
void HexTile::__setUpWindTurbineBuildOption (
            bool is_lake = false,
            bool is_ocean = false )  [private]
```

Helper method to set up and position the wind turbine build option.

Parameters

is_lake	If being built on a lake tile.
is_ocean	If being built on an ocean tile.

```
470 {
471     //  1. set up option sprite(s)
472     std::string texture_key = "wind turbine";
473
474     //  2. set up option string (up to 16 chars wide)
475     int build_cost = WIND_TURBINE_BUILD_COST;
476     if (is_lake or is_ocean) {
477         build_cost *= WIND_TURBINE_WATER_BUILD_MULTIPLIER;
478     }
479
480     //                                     "----------------\n"
481     std::string wind_turbine_string     = "  WIND TURBINE  \n";
482     wind_turbine_string                += "                \n";
483     wind_turbine_string                += "CAPACITY: 100 kW\n";
484     wind_turbine_string                += "COST:     ";
485     wind_turbine_string                += std::to_string(build_cost);
486     wind_turbine_string                += " K";
487
488     if (is_lake) {
489         wind_turbine_string += "\n** LAKE BUILD **\n\n";
490     }
491     else if (is_ocean) {
492         wind_turbine_string += "\n* OCEAN BUILD * \n\n";
493     }
494     else {
495         wind_turbine_string += "\n\n\n";
496     }
497
498     wind_turbine_string                += "BUILD:    [W]   \n";
499
500     //  3. call general method
501     this->__setUpBuildOption(texture_key, wind_turbine_string);
502
503     return;
504 }   /* __setUpWindTurbineBuildOption() */
```

4.7.3.42 assess()

```
void HexTile::assess (
            void  )
```

Method to assess the tile's resource.

```
2555 {
2556     this->resource_assessed = true;
2557     this->resource_assessment = true;
2558 
2559     this->assets_manager_ptr->getSound("resource assessment")->play();
2560 
2561     this->__setResourceText();
2562     this->__sendTileStateMessage();
2563 
2564     return;
2565 }   /* assess() */
```

4.7.3.43 decorateTile()

```
void HexTile::decorateTile (
            void  )
```

Method to decorate tile.

```
2433 {
2434     switch (this->tile_type) {
2435         case (TileType :: FOREST): {
2436             this->tile_decoration_sprite.setTexture(
2437                 *(this->assets_manager_ptr->getTexture("pine_tree_64x64_1"))
2438             );
2439 
2440             break;
2441         }
2442 
2443         case (TileType :: LAKE): {
2444             this->tile_decoration_sprite.setTexture(
2445                 *(this->assets_manager_ptr->getTexture("water_shimmer_64x64_1"))
2446             );
2447 
2448             break;
2449         }
2450 
2451         case (TileType :: MOUNTAINS): {
2452             this->tile_decoration_sprite.setTexture(
2453                 *(this->assets_manager_ptr->getTexture("mountain_64x64_1"))
2454             );
2455 
2456             break;
2457         }
2458 
2459         case (TileType :: OCEAN): {
2460             this->tile_decoration_sprite.setTexture(
2461                 *(this->assets_manager_ptr->getTexture("water_waves_64x64_1"))
2462             );
2463 
2464             break;
2465         }
2466 
2467         case (TileType :: PLAINS): {
2468             this->tile_decoration_sprite.setTexture(
2469                 *(this->assets_manager_ptr->getTexture("wheat_64x64_1"))
2470             );
2471 
2472             break;
2473         }
2474 
2475         default: {
2476             // do nothing!
2477 
2478             break;
2479         }
2480     }
2481 
2482 
2483     if (this->tile_type == TileType :: OCEAN or this->tile_type == TileType :: LAKE) {
```

```
2484         this->tile_decoration_sprite.setOrigin(
2485             this->tile_decoration_sprite.getLocalBounds().width / 2,
2486             this->tile_decoration_sprite.getLocalBounds().height / 2
2487         );
2488 
2489         this->tile_decoration_sprite.setPosition(
2490             this->position_x,
2491             this->position_y
2492         );
2493 
2494         if ((double)rand() / RAND_MAX > 0.5) {
2495             this->tile_decoration_sprite.setScale(sf::Vector2f(-1, 1));
2496         }
2497     }
2498 
2499     else {
2500         this->tile_decoration_sprite.setOrigin(
2501             this->tile_decoration_sprite.getLocalBounds().width / 2,
2502             this->tile_decoration_sprite.getLocalBounds().height
2503         );
2504 
2505         this->tile_decoration_sprite.setPosition(
2506             this->position_x,
2507             this->position_y + 12
2508         );
2509 
2510         if ((double)rand() / RAND_MAX > 0.5) {
2511             this->tile_decoration_sprite.setScale(sf::Vector2f(-1, 1));
2512         }
2513     }
2514 
2515     return;
2516 }   /* decorateTile(void) */
```

4.7.3.44 draw()

```
void HexTile::draw (
             void  )
```

Method to draw the hex tile to the render window. To be called once per frame.

```
2660 {
2661     //  1. draw hex
2662     this->render_window_ptr->draw(this->tile_sprite);
2663 
2664     //  2. draw node
2665     if (this->show_node) {
2666         this->render_window_ptr->draw(this->node_sprite);
2667     }
2668 
2669     //  3. draw tile decoration
2670     if (not this->decoration_cleared) {
2671         this->render_window_ptr->draw(this->tile_decoration_sprite);
2672     }
2673 
2674     //  4. draw tile improvement
2675     if (this->has_improvement) {
2676         if (not this->tile_improvement_ptr->just_built) {
2677             this->tile_improvement_ptr->draw();
2678         }
2679     }
2680 
2681     //  5. draw resource
2682     if (this->show_resource) {
2683         this->render_window_ptr->draw(this->resource_chip_sprite);
2684         this->render_window_ptr->draw(this->resource_text);
2685     }
2686 
2687     //  6. draw selection outline
2688     if (this->is_selected) {
2689         sf::Color outline_colour = this->select_outline_sprite.getOutlineColor();
2690 
2691         outline_colour.a =
2692             255 * pow(cos((M_PI * this->frame) / (1.5 * FRAMES_PER_SECOND)), 2);
2693 
2694         this->select_outline_sprite.setOutlineColor(outline_colour);
2695 
2696         this->render_window_ptr->draw(this->select_outline_sprite);
2697     }
```

```
2698
2699     //  7. draw resource assessment notification
2700     if (this->resource_assessment) {
2701         int alpha = this->magnifying_glass_sprite.getColor().a;
2702
2703         alpha -= 0.05 * FRAMES_PER_SECOND;
2704         if (alpha < 0) {
2705             alpha = 0;
2706             this->resource_assessment = false;
2707         }
2708
2709         this->magnifying_glass_sprite.setColor(
2710             sf::Color(255, 255, 255, alpha)
2711         );
2712
2713         this->render_window_ptr->draw(this->magnifying_glass_sprite);
2714     }
2715
2716     //  8. draw explosion, then settlement placement
2717     if (this->draw_explosion) {
2718         this->render_window_ptr->draw(this->explosion_sprite_reel[this->explosion_frame]);
2719
2720         if (this->frame % (FRAMES_PER_SECOND / 10) == 0) {
2721             this->explosion_frame++;
2722         }
2723
2724         if (this->explosion_frame >= this->explosion_sprite_reel.size()) {
2725             this->draw_explosion = false;
2726         }
2727     }
2728
2729     else if (this->has_improvement) {
2730         if (this->tile_improvement_ptr->just_built) {
2731             this->tile_improvement_ptr->draw();
2732         }
2733     }
2734
2735     //  9. build menu
2736     if (this->build_menu_open) {
2737         this->render_window_ptr->draw(this->build_menu_backing);
2738         this->render_window_ptr->draw(this->build_menu_backing_text);
2739
2740         for (size_t i = 0; i < this->build_menu_options_vec.size(); i++) {
2741             for (size_t j = 0; j < this->build_menu_options_vec[i].size(); j++) {
2742                 this->render_window_ptr->draw(this->build_menu_options_vec[i][j]);
2743             }
2744             this->render_window_ptr->draw(this->build_menu_options_text_vec[i]);
2745         }
2746     }
2747
2748     this->frame++;
2749     return;
2750 }   /* draw() */
```

4.7.3.45 processEvent()

```
void HexTile::processEvent (
            void  )
```

Method to process HexTile. To be called once per event.

```
2580 {
2581     //  1. process TileImprovement events
2582     if (this->tile_improvement_ptr != NULL) {
2583         this->tile_improvement_ptr->processEvent();
2584     }
2585
2586     //  2. process HexTile events
2587     if (this->event_ptr->type == sf::Event::KeyPressed) {
2588         this->__handleKeyPressEvents();
2589     }
2590
2591     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
2592         this->__handleMouseButtonEvents();
2593     }
2594
2595     return;
2596 }   /* processEvent() */
```

4.7.3.46 processMessage()

```
void HexTile::processMessage (
            void  )
```

Method to process HexTile. To be called once per message.

```
2611 {
2612     //  1. process TileImprovement messages
2613     if (this->tile_improvement_ptr != NULL) {
2614         this->tile_improvement_ptr->processMessage();
2615     }
2616
2617     //  2. process HexTile messages
2618     if (this->is_selected) {
2619         if (not this->message_hub_ptr->isEmpty(GAME_STATE_CHANNEL)) {
2620             Message game_state_message = this->message_hub_ptr->receiveMessage(
2621                 GAME_STATE_CHANNEL
2622             );
2623
2624             if (game_state_message.subject == "game state") {
2625                 this->credits = game_state_message.int_payload["credits"];
2626                 this->game_phase = game_state_message.string_payload["game phase"];
2627
2628                 if (this->tile_improvement_ptr != NULL) {
2629                     this->tile_improvement_ptr->credits = this->credits;
2630                     this->tile_improvement_ptr->game_phase = this->game_phase;
2631                 }
2632
2633                 std::cout « "Game state message received by " « this « std::endl;
2634                 this->__sendTileStateMessage();
2635                 this->message_hub_ptr->popMessage(GAME_STATE_CHANNEL);
2636             }
2637         }
2638
2639         std::cout « "Current credits (HexTile): " « this->credits « " K" «
2640             std::endl;
2641     }
2642
2643     return;
2644 }   /* processMessage() */
```

4.7.3.47 setTileResource() [1/2]

```
void HexTile::setTileResource (
            double input_value )
```

Method to set the tile resource (by numeric input).

Parameters

input_value	A numerical input in the closed interval [0, 1].

```
2382 {
2383     //  1. check input
2384     if (input_value < 0 or input_value > 1) {
2385         std::string error_str = "ERROR  HexTile::setTileResource()  given input value is ";
2386         error_str += "not in the closed interval [0, 1]";
2387
2388         #ifdef _WIN32
2389             std::cout « error_str « std::endl;
2390         #endif  /* _WIN32 */
2391
2392         throw std::runtime_error(error_str);
2393     }
2394
2395     //  2. convert input value to tile resource
2396     TileResource tile_resource;
2397
2398     if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[0]) {
2399         tile_resource = TileResource :: POOR;
2400     }
```

```
2401     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[1]) {
2402         tile_resource = TileResource :: BELOW_AVERAGE;
2403     }
2404     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[2]) {
2405         tile_resource = TileResource :: AVERAGE;
2406     }
2407     else if (input_value <= TILE_RESOURCE_CUMULATIVE_PROBABILITIES[3]) {
2408         tile_resource = TileResource :: ABOVE_AVERAGE;
2409     }
2410     else {
2411         tile_resource = TileResource :: GOOD;
2412     }
2413
2414     //  3. call alternate method
2415     this->setTileResource(tile_resource);
2416
2417     return;
2418 }   /* setTileResource(double) */
```

4.7.3.48 setTileResource() [2/2]

```
void HexTile::setTileResource (
            TileResource tile_resource )
```

Method to set the tile resource (by enum value).

Parameters

tile_resource	The resource (TileResource) value to attribute to the tile.

```
2360 {
2361     this->tile_resource = tile_resource;
2362     this->__setResourceText();
2363
2364     return;
2365 }   /* setTileResource(TileResource) */
```

4.7.3.49 setTileType() [1/2]

```
void HexTile::setTileType (
            double input_value )
```

Method to set the tile type (by numeric input).

Parameters

input_value	A numerical input in the closed interval [0, 1].

```
2310 {
2311     //  1. check input
2312     if (input_value < 0 or input_value > 1) {
2313         std::string error_str = "ERROR  HexTile::setTileType()  given input value is ";
2314         error_str += "not in the closed interval [0, 1]";
2315
2316         #ifdef _WIN32
2317             std::cout « error_str « std::endl;
2318         #endif  /* _WIN32 */
2319
2320         throw std::runtime_error(error_str);
2321     }
2322
2323     //  2. convert input value to tile type
```

```
2324     TileType tile_type;
2325
2326     if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[0]) {
2327         tile_type = TileType :: LAKE;
2328     }
2329     else if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[1]) {
2330         tile_type = TileType :: PLAINS;
2331     }
2332     else if (input_value <= TILE_TYPE_CUMULATIVE_PROBABILITIES[2]) {
2333         tile_type = TileType :: FOREST;
2334     }
2335     else {
2336         tile_type = TileType :: MOUNTAINS;
2337     }
2338
2339     //  3. call alternate method
2340     this->setTileType(tile_type);
2341
2342     return;
2343 }   /* setTileType(double) */
```

4.7.3.50 setTileType() [2/2]

```
void HexTile::setTileType (
             TileType tile_type )
```

Method to set the tile type (by enum value).

Parameters

tile_type	The type (TileType) to set the tile to.

```
2249 {
2250     this->tile_type = tile_type;
2251
2252     switch (this->tile_type) {
2253         case (TileType :: FOREST): {
2254             this->tile_sprite.setFillColor(FOREST_GREEN);
2255
2256             break;
2257         }
2258
2259         case (TileType :: LAKE): {
2260             this->tile_sprite.setFillColor(LAKE_BLUE);
2261
2262             break;
2263         }
2264
2265         case (TileType :: MOUNTAINS): {
2266             this->tile_sprite.setFillColor(MOUNTAINS_GREY);
2267
2268             break;
2269         }
2270
2271         case (TileType :: OCEAN): {
2272             this->tile_sprite.setFillColor(OCEAN_BLUE);
2273
2274             break;
2275         }
2276
2277         case (TileType :: PLAINS): {
2278             this->tile_sprite.setFillColor(PLAINS_YELLOW);
2279
2280             break;
2281         }
2282
2283         default: {
2284             // do nothing!
2285
2286             break;
2287         }
2288     }
2289
2290     this->__setUpBuildMenu();
2291
```

```
2292     return;
2293 }   /* setTileType(TileType) */
```

4.7.3.51 toggleResourceOverlay()

```
void HexTile::toggleResourceOverlay (
             void  )
```

Method to toggle the tile resource overlay.

```
2531 {
2532     if (this->show_resource) {
2533         this->show_resource = false;
2534     }
2535     else {
2536         this->show_resource = true;
2537     }
2538
2539     return;
2540 }   /* toggleResourceOverlay() */
```

4.7.4 Member Data Documentation

4.7.4.1 assets_manager_ptr

```
AssetsManager* HexTile::assets_manager_ptr  [private]
```

A pointer to the assets manager.

4.7.4.2 build_menu_backing

```
sf::RectangleShape HexTile::build_menu_backing
```

A backing for the tile build menu.

4.7.4.3 build_menu_backing_text

```
sf::Text HexTile::build_menu_backing_text
```

A text label for the build menu.

4.7.4.4 build_menu_open

```
bool HexTile::build_menu_open
```

A boolean which indicates if the tile build menu is open.

4.7.4.5 build_menu_options_text_vec

```
std::vector<sf::Text> HexTile::build_menu_options_text_vec
```

A vector of text for the tile build options.

4.7.4.6 build_menu_options_vec

```
std::vector<std::vector<sf::Sprite> > HexTile::build_menu_options_vec
```

A vector of sprites for illustrating the tile build options.

4.7.4.7 credits

```
int HexTile::credits
```

The current balance of credits.

4.7.4.8 decoration_cleared

```
bool HexTile::decoration_cleared
```

A boolean which indicates if the tile decoration has been cleared.

4.7.4.9 draw_explosion

```
bool HexTile::draw_explosion
```

A boolean which indicates whether or not to draw a tile explosion.

4.7.4.10 event_ptr

```
sf::Event* HexTile::event_ptr  [private]
```

A pointer to the event class.

4.7.4.11 explosion_frame

```
size_t HexTile::explosion_frame
```

The current frame of the explosion animation.

4.7.4.12 explosion_sprite_reel

```
std::vector<sf::Sprite> HexTile::explosion_sprite_reel
```

A reel of sprites for a tile explosion animation.

4.7.4.13 frame

```
unsigned long long int HexTile::frame
```

The current frame of this object.

4.7.4.14 game_phase

```
std::string HexTile::game_phase
```

The current phase of the game.

4.7.4.15 has_improvement

```
bool HexTile::has_improvement
```

A boolean which indicates if tile has improvement or not.

4.7.4.16 is_selected

```
bool HexTile::is_selected
```

A boolean which indicates whether or not the tile is selected.

4.7.4.17 magnifying_glass_sprite

```
sf::Sprite HexTile::magnifying_glass_sprite
```

A magnifying glass sprite.

4.7.4.18 major_radius

```
double HexTile::major_radius
```

The radius of the smallest bounding circle.

4.7.4.19 message_hub_ptr

```
MessageHub* HexTile::message_hub_ptr  [private]
```

A pointer to the message hub.

4.7.4.20 minor_radius

```
double HexTile::minor_radius
```

The radius of the largest inscribed circle.

4.7.4.21 node_sprite

```
sf::CircleShape HexTile::node_sprite
```

A circle shape to mark the tile node.

4.7.4.22 position_x

```
double HexTile::position_x
```

The x position of the tile.

4.7.4.23 position_y

```
double HexTile::position_y
```

The y position of the tile.

4.7.4.24 render_window_ptr

```
sf::RenderWindow* HexTile::render_window_ptr  [private]
```

A pointer to the render window.

4.7.4.25 resource_assessed

```
bool HexTile::resource_assessed
```

A boolean which indicates whether or not the resource has been assessed.

4.7.4.26 resource_assessment

```
bool HexTile::resource_assessment
```

A boolean which triggers a resource assessment notification.

4.7.4.27 resource_chip_sprite

```
sf::CircleShape HexTile::resource_chip_sprite
```

A circle shape which represents a resource chip.

4.7.4.28 resource_text

```
sf::Text HexTile::resource_text
```

A text representation of the resource.

4.7.4.29 select_outline_sprite

```
sf::ConvexShape HexTile::select_outline_sprite
```

A convex shape which outlines the tile when selected.

4.7.4.30 show_node

```
bool HexTile::show_node
```

A boolean which indicates whether or not to show the tile node.

4.7.4.31 show_resource

```
bool HexTile::show_resource
```

A boolean which indicates whether or not to show resource value.

4.7.4.32 tile_decoration_sprite

```
sf::Sprite HexTile::tile_decoration_sprite
```

A tile decoration sprite.

4.7.4.33 tile_improvement_ptr

```
TileImprovement* HexTile::tile_improvement_ptr
```

A pointer to the improvement for this tile.

4.7.4.34 tile_resource

```
TileResource HexTile::tile_resource
```

4.7.4.35 tile_sprite

```
sf::ConvexShape HexTile::tile_sprite
```

A convex shape which represents the tile.

4.7.4.36 tile_type

```
TileType HexTile::tile_type
```

The documentation for this class was generated from the following files:

- header/HexTile.h
- source/HexTile.cpp

4.8 Message Struct Reference

A structure which defines a standard message format.

```
#include <MessageHub.h>
```

Public Attributes

- std::string channel = ""
  A string identifying the appropriate channel for this message.
- std::string subject = ""
  A string describing the message subject.
- std::map< std::string, bool > bool_payload = {}
  A boolean payload.
- std::map< std::string, int > int_payload = {}
  A vector payload.
- std::map< std::string, double > double_payload = {}
  A vector payload.
- std::map< std::string, std::string > string_payload = {}
  A string payload.

4.8.1 Detailed Description

A structure which defines a standard message format.

4.8.2 Member Data Documentation

4.8.2.1 bool_payload

```
std::map<std::string, bool> Message::bool_payload = {}
```

A boolean payload.

4.8.2.2 channel

```
std::string Message::channel = ""
```

A string identifying the appropriate channel for this message.

4.8.2.3 double_payload

```
std::map<std::string, double> Message::double_payload = {}
```

A vector payload.

4.8.2.4 int_payload

```
std::map<std::string, int> Message::int_payload = {}
```

A vector payload.

4.8.2.5 string_payload

```
std::map<std::string, std::string> Message::string_payload = {}
```

A string payload.

4.8.2.6 subject

```
std::string Message::subject = ""
```

A string describing the message subject.

The documentation for this struct was generated from the following file:

- header/ESC_core/MessageHub.h

4.9 MessageHub Class Reference

A class which acts as a central hub for inter-object message traffic.

```
#include <MessageHub.h>
```

Public Member Functions

- MessageHub (void)

  Constructor for the MessageHub class.
- bool hasTraffic (void)

  Method to determine if there remains any message traffic.
- void addChannel (std::string)

  Method to add channel to message map.
- void removeChannel (std::string)

  Method to remove channel from message map.
- void sendMessage (Message)

  Method to send a message to the message map. Channels are implemented in a first in, first out manner (i.e. message queue).
- bool isEmpty (std::string)

  Method to check if channel is empty.
- Message receiveMessage (std::string)

  Method to receive the first message in the channel. Channels are implemented in a first in, first out manner (i.e. message queue).
- void popMessage (std::string)

  Method to pop first message off of the given channel. Channels are implemented in a first in, first out manner (i.e. message queue).
- void clearMessages (void)

  Method to clear messages from the MessageHub.
- void clear (void)

  Method to clear the MessageHub.
- ~MessageHub (void)

  Destructor for the MessageHub class.

Private Attributes

- std::map< std::string, std::list< Message > > message_map

  A map <string, list of Message> for sending and receiving messages. Here the key is the channel, and each channel maintains a list (history) of messages.

4.9.1 Detailed Description

A class which acts as a central hub for inter-object message traffic.

4.9.2 Constructor & Destructor Documentation

4.9.2.1 MessageHub()

```
MessageHub::MessageHub (
            void  )
```

Constructor for the MessageHub class.

```
80 {
81     //...
82
83     std::cout « "MessageHub constructed at " « this « std::endl;
84
85     return;
86 }   /* MessageHub() */
```

4.9.2.2 ~MessageHub()

```
MessageHub::~MessageHub (
            void  )
```

Destructor for the MessageHub class.

```
427 {
428     this->clear();
429
430     std::cout « "MessageHub at " « this « " destroyed" « std::endl;
431
432     return;
433 }   /* ~MessageHub() */
```

4.9.3 Member Function Documentation

4.9.3.1 addChannel()

```
void MessageHub::addChannel (
            std::string channel )
```

Method to add channel to message map.

Parameters

channel	The key for the message channel being added.

```
131 {
132     //  1. check if channel is in map (if so, throw error)
133     if (this->message_map.count(channel) > 0) {
134         std::string error_str = "ERROR  MessageHub::addChannel()  channel ";
135         error_str += channel;
136         error_str += " is already in message map";
137 
138         #ifdef _WIN32
139             std::cout « error_str « std::endl;
140         #endif  /* _WIN32 */
141 
142         throw std::runtime_error(error_str);
143     }
144 
145     //  2. add channel to map
146     this->message_map[channel] = {};
147 
148     std::cout « "Channel " « channel « " added to message hub" « std::endl;
149 
150     return;
151 }   /* addChannel() */
```

4.9.3.2 clear()

```
void MessageHub::clear (
             void  )
```

Method to clear the MessageHub.

```
407 {
408 
409     this->clearMessages();
410     this->message_map.clear();
411 
412     return;
413 }   /* clear() */
```

4.9.3.3 clearMessages()

```
void MessageHub::clearMessages (
             void  )
```

Method to clear messages from the MessageHub.

```
381 {
382     std::map<std::string, std::list<Message»::iterator map_iter;
383     for (
384         map_iter = this->message_map.begin();
385         map_iter != this->message_map.end();
386         map_iter++
387     ) {
388         map_iter->second.clear();
389     }
390 
391     return;
392 }   /* clearMessages() */
```

4.9.3.4 hasTraffic()

```
bool MessageHub::hasTraffic (
            void  )
```

Method to determine if there remains any message traffic.

```
101 {
102     std::map<std::string, std::list<Message>::iterator map_iter;
103     for (
104         map_iter = this->message_map.begin();
105         map_iter != this->message_map.end();
106         map_iter++
107     ) {
108         if (not map_iter->second.empty()) {
109             return true;
110         }
111     }
112
113     return false;
114 }   /* hasTraffic() */
```

4.9.3.5 isEmpty()

```
bool MessageHub::isEmpty (
            std::string channel )
```

Method to check if channel is empty.

Parameters

channel	The key for the message channel being checked.

Returns

A boolean indicating whether the channel is empty or not.

```
246 {
247     //  1. check if channel is in map (if not, throw error)
248     if (this->message_map.count(channel) <= 0) {
249         std::string error_str = "ERROR  MessageHub::isEmpty()  channel ";
250         error_str += channel;
251         error_str += " is not in message map";
252
253         #ifdef _WIN32
254             std::cout « error_str « std::endl;
255         #endif  /* _WIN32 */
256
257         throw std::runtime_error(error_str);
258     }
259
260     if (this->message_map[channel].empty()) {
261         return true;
262     }
263     else {
264         return false;
265     }
266 }   /* isEmpty() */
```

4.9.3.6 popMessage()

```
void MessageHub::popMessage (
            std::string channel )
```

Method to pop first message off of the given channel. Channels are implemented in a first in, first out manner (i.e. message queue).

Parameters

channel	The key for the message channel being popped.

```
335 {
336     //  1. check if channel is in map (if not, throw error)
337     if (this->message_map.count(channel) <= 0) {
338         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
339         error_str += channel;
340         error_str += " is not in message map";
341 
342         #ifdef _WIN32
343             std::cout << error_str << std::endl;
344         #endif  /* _WIN32 */
345 
346         throw std::runtime_error(error_str);
347     }
348 
349     //  2. check if channel is empty (if so, throw error)
350     if (this->message_map[channel].empty()) {
351         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
352         error_str += channel;
353         error_str += " is empty";
354 
355         #ifdef _WIN32
356             std::cout << error_str << std::endl;
357         #endif  /* _WIN32 */
358 
359         throw std::runtime_error(error_str);
360     }
361 
362     //  3. pop message
363     this->message_map[channel].pop_front();
364 
365     return;
366 }   /* popMessage() */
```

4.9.3.7 receiveMessage()

```
Message MessageHub::receiveMessage (
            std::string channel )
```

Method to receive the first message in the channel. Channels are implemented in a first in, first out manner (i.e. message queue).

Parameters

channel	The key for the message channel being received from.

Returns

The first message in the given channel.

```
286 {
287     //  1. check if channel is in map (if not, throw error)
288     if (this->message_map.count(channel) <= 0) {
289         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
290         error_str += channel;
291         error_str += " is not in message map";
292 
293         #ifdef _WIN32
294             std::cout << error_str << std::endl;
295         #endif  /* _WIN32 */
296 
```

```
297         throw std::runtime_error(error_str);
298     }
299
300     //  2. check if channel is empty (if so, throw error)
301     if (this->message_map[channel].empty()) {
302         std::string error_str = "ERROR  MessageHub::receiveMessage()  channel ";
303         error_str += channel;
304         error_str += " is empty";
305
306         #ifdef _WIN32
307             std::cout << error_str << std::endl;
308         #endif  /* _WIN32 */
309
310         throw std::runtime_error(error_str);
311     }
312
313     //  3. receive message
314     Message message = this->message_map[channel].front();
315
316     return message;
317 }   /* receiveMessage() */
```

4.9.3.8 removeChannel()

```
void MessageHub::removeChannel (
            std::string channel )
```

Method to remove channel from message map.

Parameters

channel	The key for the message channel being removed.

```
168 {
169     //  1. check if channel is in map (if not, throw error)
170     if (this->message_map.count(channel) <= 0) {
171         std::string error_str = "ERROR  MessageHub::removeChannel()  channel ";
172         error_str += channel;
173         error_str += " is not in message map";
174
175         #ifdef _WIN32
176             std::cout << error_str << std::endl;
177         #endif  /* _WIN32 */
178
179         throw std::runtime_error(error_str);
180     }
181
182     //  2. remove channel from map
183     this->message_map[channel].clear();
184     this->message_map.erase(channel);
185
186     std::cout << "Channel " << channel << " removed from message hub" << std::endl;
187
188     return;
189 }   /* removeChannel() */
```

4.9.3.9 sendMessage()

```
void MessageHub::sendMessage (
            Message message )
```

Method to send a message to the message map. Channels are implemented in a first in, first out manner (i.e. message queue).

Parameters

message	The message to be sent.

```
207 {
208     //  1. check if channel is in map (if not, throw error)
209     std::string channel = message.channel;
210 
211     if (this->message_map.count(channel) <= 0) {
212         std::string error_str = "ERROR  MessageHub::sendMessage()  channel ";
213         error_str += channel;
214         error_str += " is not in message map";
215 
216         #ifdef _WIN32
217             std::cout « error_str « std::endl;
218         #endif  /* _WIN32 */
219 
220         throw std::runtime_error(error_str);
221     }
222 
223     //  2. send message to message map
224     this->message_map[channel].push_back(message);
225 
226     return;
227 }   /* sendMessage() */
```

4.9.4 Member Data Documentation

4.9.4.1 message_map

`std::map<std::string, std::list<Message> > MessageHub::message_map  [private]`

A map <string, list of Message> for sending and receiving messages. Here the key is the channel, and each channel maintains a list (history) of messages.

The documentation for this class was generated from the following files:

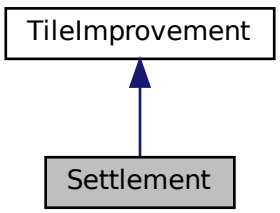
- header/ESC_core/MessageHub.h
- source/ESC_core/MessageHub.cpp

4.10 Settlement Class Reference

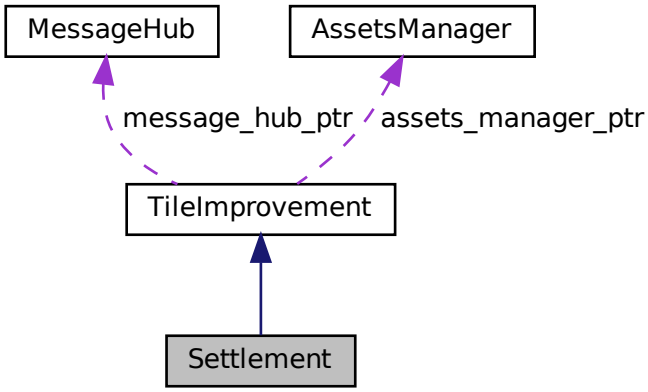
A settlement class (child class of TileImprovement).

`#include <Settlement.h>`

Inheritance diagram for Settlement:



Collaboration diagram for Settlement:



Public Member Functions

- Settlement (double, double, sf::Event *, sf::RenderWindow *, AssetsManager *, MessageHub *)

  Constructor for the Settlement class.
- void processEvent (void)

  Method to process Settlement. To be called once per event.
- void processMessage (void)

  Method to process Settlement. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ~Settlement (void)

  Destructor for the Settlement class.

Public Attributes

- bool skip_smoke_processing

  A boolean which indicates whether or not to skip smoke processing.
- double smoke_da

  The per frame delta in smoke particle alpha value.
- double smoke_dx

  The per frame delta in smoke particle x position.
- double smoke_dy

  The per frame delta in smoke particle y position.
- double smoke_prob

  The probability of spawning a new smoke prob in any given frame.
- std::list< sf::Sprite > smoke_sprite_list

  A list of smoke sprite (for chimney animation).

Private Member Functions

- void __setUpTileImprovementSpriteStatic (void)

  Helper method to set up tile improvement sprite (static).
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.10.1 Detailed Description

A settlement class (child class of TileImprovement).

4.10.2 Constructor & Destructor Documentation

4.10.2.1 Settlement()

```
Settlement::Settlement (
            double position_x,
            double position_y,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the Settlement class.

Ref: Wikipedia [2023]

Parameters

position_x	The x position of the tile.
position_y	The y position of the tile.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
201   :
202 TileImprovement(
203     position_x,
204     position_y,
205     event_ptr,
206     render_window_ptr,
207     assets_manager_ptr,
208     message_hub_ptr
209 )
```

```
210 {
211     //  1. set attributes
212
213     //  1.1. private
214     //...
215
216     //  1.2. public
217     this->tile_improvement_type = TileImprovementType :: SETTLEMENT;
218
219     this->skip_smoke_processing = true;
220
221     this->smoke_da = 1e-8 * SECONDS_PER_FRAME;
222     this->smoke_dx = 5 * SECONDS_PER_FRAME;
223     this->smoke_dy = -10 * SECONDS_PER_FRAME;
224     this->smoke_prob = 2 * SECONDS_PER_FRAME;
225
226     this->smoke_sprite_list = {};
227
228     this->tile_improvement_string = "SETTLEMENT";
229
230     this->__setUpTileImprovementSpriteStatic();
231
232     std::cout « "Settlement constructed at " « this « std::endl;
233
234     return;
235 }   /* Settlement() */
```

4.10.2.2 ~Settlement()

```
Settlement::~Settlement (
            void  )  [virtual]
```

Destructor for the Settlement class.

```
387 {
388     std::cout « "Settlement at " « this « " destroyed" « std::endl;
389
390     return;
391 }   /* ~Settlement() */
```

4.10.3 Member Function Documentation

4.10.3.1 __handleKeyPressEvents()

```
void Settlement::__handleKeyPressEvents (
            void  )  [private], [virtual]
```

Helper method to handle key press events.

Reimplemented from TileImprovement.

```
103 {
104     switch (this->event_ptr->key.code) {
105         //...
106
107
108         default: {
109             // do nothing!
110
111             break;
112         }
113     }
114
115     return;
116 }   /* __handleKeyPressEvents() */
```

4.10.3.2 __handleMouseButtonEvents()

```
void Settlement::__handleMouseButtonEvents (
            void  )  [private], [virtual]
```

Helper method to handle mouse button events.

Reimplemented from TileImprovement.

```
131 {
132     switch (this->event_ptr->mouseButton.button) {
133         case (sf::Mouse::Left): {
134             //...
135 
136             break;
137         }
138 
139 
140         case (sf::Mouse::Right): {
141             //...
142 
143             break;
144         }
145 
146 
147         default: {
148             // do nothing!
149 
150             break;
151         }
152     }
153 
154     return;
155 }   /* __handleMouseButtonEvents() */
```

4.10.3.3 __setUpTileImprovementSpriteStatic()

```
void Settlement::__setUpTileImprovementSpriteStatic (
            void  )  [private]
```

Helper method to set up tile improvement sprite (static).

```
68 {
69     this->tile_improvement_sprite_static.setTexture(
70         *(this->assets_manager_ptr->getTexture("brick_house_64x64_1"))
71     );
72 
73     this->tile_improvement_sprite_static.setOrigin(
74         this->tile_improvement_sprite_static.getLocalBounds().width / 2,
75         this->tile_improvement_sprite_static.getLocalBounds().height
76     );
77 
78     this->tile_improvement_sprite_static.setPosition(
79         this->position_x,
80         this->position_y - 32
81     );
82 
83     this->tile_improvement_sprite_static.setColor(
84         sf::Color(255, 255, 255, 0)
85     );
86 
87     return;
88 }   /* __setUpTileImprovementSpriteStatic() */
```

4.10.3.4 draw()

```
void Settlement::draw (
            void  )  [virtual]
```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from TileImprovement.

```
295 {
296     //  1. if just built, call base method and return
297     if (this->just_built) {
298         TileImprovement :: draw();
299 
300         return;
301     }
302 
303     //  2. draw static sprite and chimney smoke effects
304     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
305 
306     std::list<sf::Sprite>::iterator iter = this->smoke_sprite_list.begin();
307 
308     double alpha = 255;
309 
310     while (iter != this->smoke_sprite_list.end()) {
311         this->render_window_ptr->draw(*iter);
312 
313         if (not this->skip_smoke_processing) {
314             alpha = (*iter).getColor().a;
315 
316             alpha -= this->smoke_da;
317 
318             if (alpha <= 0) {
319                 iter = this->smoke_sprite_list.erase(iter);
320                 continue;
321             }
322 
323             (*iter).setColor(sf::Color(255, 255, 255, alpha));
324 
325             (*iter).move(
326                 this->smoke_dx + 2 * (((double)rand() / RAND_MAX) - 1) / FRAMES_PER_SECOND,
327                 this->smoke_dy
328             );
329 
330             (*iter).rotate(((double)rand() / RAND_MAX));
331         }
332 
333         iter++;
334     }
335 
336 
337     if (not this->skip_smoke_processing) {
338         if ((double)rand() / RAND_MAX < smoke_prob) {
339             this->smoke_sprite_list.push_back(
340                 sf::Sprite(*(this->assets_manager_ptr->getTexture("emissions")))
341             );
342 
343             this->smoke_sprite_list.back().setOrigin(
344                 this->smoke_sprite_list.back().getLocalBounds().width / 2,
345                 this->smoke_sprite_list.back().getLocalBounds().height / 2
346             );
347 
348             this->smoke_sprite_list.back().setPosition(
349                 this->position_x + 9,
350                 this->position_y - 33
351             );
352         }
353     }
354 
355 
356     if (this->is_selected) {
357         if (this->skip_smoke_processing) {
358             this->skip_smoke_processing = false;
359         }
360 
361         else {
362             this->skip_smoke_processing = true;
363         }
364     }
365 
366     else {
367         this->skip_smoke_processing = false;
368     }
369 
```

```
370     this->frame++;
371     return;
372 }   /* draw() */
```

4.10.3.5 processEvent()

```
void Settlement::processEvent (
             void  )  [virtual]
```

Method to process Settlement. To be called once per event.

Reimplemented from TileImprovement.

```
250 {
251     if (this->event_ptr->type == sf::Event::KeyPressed) {
252         this->__handleKeyPressEvents();
253     }
254 
255     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
256         this->__handleMouseButtonEvents();
257     }
258 
259     return;
260 }   /* processEvent() */
```

4.10.3.6 processMessage()

```
void Settlement::processMessage (
             void  )  [virtual]
```

Method to process Settlement. To be called once per message.

Reimplemented from TileImprovement.

```
275 {
276     //...
277 
278     return;
279 }   /* processMessage() */
```

4.10.4 Member Data Documentation

4.10.4.1 skip_smoke_processing

```
bool Settlement::skip_smoke_processing
```

A boolean which indicates whether or not to skip smoke processing.

4.10.4.2 smoke_da

```
double Settlement::smoke_da
```

The per frame delta in smoke particle alpha value.

4.10.4.3 smoke_dx

```
double Settlement::smoke_dx
```

The per frame delta in smoke particle x position.

4.10.4.4 smoke_dy

```
double Settlement::smoke_dy
```

The per frame delta in smoke particle y position.

4.10.4.5 smoke_prob

```
double Settlement::smoke_prob
```

The probability of spawning a new smoke prob in any given frame.

4.10.4.6 smoke_sprite_list

```
std::list<sf::Sprite> Settlement::smoke_sprite_list
```

A list of smoke sprite (for chimney animation).

The documentation for this class was generated from the following files:

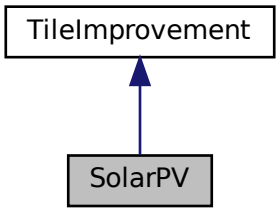
- header/Settlement.h
- source/Settlement.cpp

4.11 SolarPV Class Reference

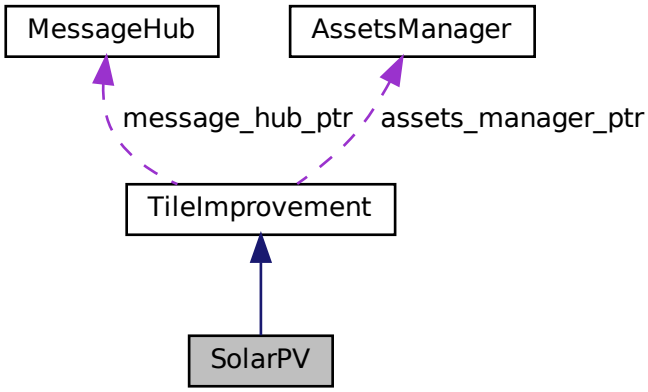
A settlement class (child class of TileImprovement).

`#include <SolarPV.h>`

Inheritance diagram for SolarPV:



Collaboration diagram for SolarPV:



Public Member Functions

- SolarPV (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)
  Constructor for the SolarPV class.
- void processEvent (void)
  Method to process SolarPV. To be called once per event.
- void processMessage (void)
  Method to process SolarPV. To be called once per message.
- void draw (void)
  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ∼SolarPV (void)
  Destructor for the SolarPV class.

Private Member Functions

- void __setUpTileImprovementSpriteStatic (void)

  Helper method to set up tile improvement sprite (static).
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.11.1 Detailed Description

A settlement class (child class of TileImprovement).

4.11.2 Constructor & Destructor Documentation

4.11.2.1 SolarPV()

```
SolarPV::SolarPV (
            double position_x,
            double position_y,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the SolarPV class.

Ref: Wikipedia [2023]

Parameters

position_x	The x position of the tile.
position_y	The y position of the tile.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
201   :
202 TileImprovement(
203     position_x,
204     position_y,
205     event_ptr,
206     render_window_ptr,
207     assets_manager_ptr,
208     message_hub_ptr
209 )
```

```
210 {
211     //  1. set attributes
212
213     //  1.1. private
214     //...
215
216     //  1.2. public
217     this->tile_improvement_type = TileImprovementType :: SOLAR_PV;
218
219     this->is_running = false;
220
221     this->tile_improvement_string = "SOLAR PV ARRAY";
222
223     this->__setUpTileImprovementSpriteStatic();
224
225     std::cout « "SolarPV constructed at " « this « std::endl;
226
227     return;
228 }   /* SolarPV() */
```

4.11.2.2 ~SolarPV()

```
SolarPV::~SolarPV (
             void  )  [virtual]
```

Destructor for the SolarPV class.

```
317 {
318     std::cout « "SolarPV at " « this « " destroyed" « std::endl;
319
320     return;
321 }   /* ~SolarPV() */
```

4.11.3 Member Function Documentation

4.11.3.1 __handleKeyPressEvents()

```
void SolarPV::__handleKeyPressEvents (
             void  )  [private], [virtual]
```

Helper method to handle key press events.

Reimplemented from TileImprovement.

```
103 {
104     switch (this->event_ptr->key.code) {
105         //...
106
107
108         default: {
109             // do nothing!
110
111             break;
112         }
113     }
114
115     return;
116 }   /* __handleKeyPressEvents() */
```

4.11.3.2 __handleMouseButtonEvents()

```
void SolarPV::__handleMouseButtonEvents (
            void  )  [private], [virtual]
```

Helper method to handle mouse button events.

Reimplemented from TileImprovement.

```
131 {
132     switch (this->event_ptr->mouseButton.button) {
133         case (sf::Mouse::Left): {
134             //...
135 
136             break;
137         }
138 
139 
140         case (sf::Mouse::Right): {
141             //...
142 
143             break;
144         }
145 
146 
147         default: {
148             // do nothing!
149 
150             break;
151         }
152     }
153 
154     return;
155 }   /* __handleMouseButtonEvents() */
```

4.11.3.3 __setUpTileImprovementSpriteStatic()

```
void SolarPV::__setUpTileImprovementSpriteStatic (
            void  )  [private]
```

Helper method to set up tile improvement sprite (static).

```
68 {
69     this->tile_improvement_sprite_static.setTexture(
70         *(this->assets_manager_ptr->getTexture("solar PV array"))
71     );
72 
73     this->tile_improvement_sprite_static.setOrigin(
74         this->tile_improvement_sprite_static.getLocalBounds().width / 2,
75         this->tile_improvement_sprite_static.getLocalBounds().height
76     );
77 
78     this->tile_improvement_sprite_static.setPosition(
79         this->position_x,
80         this->position_y - 32
81     );
82 
83     this->tile_improvement_sprite_static.setColor(
84         sf::Color(255, 255, 255, 0)
85     );
86 
87     return;
88 }   /* __setUpTileImprovementSpriteStatic() */
```

4.11.3.4 draw()

```
void SolarPV::draw (
            void  )  [virtual]
```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from TileImprovement.

```
288 {
289     //  1. if just built, call base method and return
290     if (this->just_built) {
291         TileImprovement :: draw();
292 
293         return;
294     }
295 
296 
297     //  1. draw static sprite
298     this->render_window_ptr->draw(this->tile_improvement_sprite_static);
299 
300     this->frame++;
301     return;
302 }   /* draw() */
```

4.11.3.5 processEvent()

```
void SolarPV::processEvent (
            void  )  [virtual]
```

Method to process SolarPV. To be called once per event.

Reimplemented from TileImprovement.

```
243 {
244     if (this->event_ptr->type == sf::Event::KeyPressed) {
245         this->__handleKeyPressEvents();
246     }
247 
248     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
249         this->__handleMouseButtonEvents();
250     }
251 
252     return;
253 }   /* processEvent() */
```

4.11.3.6 processMessage()

```
void SolarPV::processMessage (
            void  )  [virtual]
```

Method to process SolarPV. To be called once per message.

Reimplemented from TileImprovement.

```
268 {
269     //...
270 
271     return;
272 }   /* processMessage() */
```

The documentation for this class was generated from the following files:

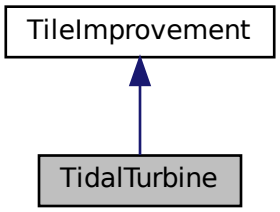
- header/SolarPV.h
- source/SolarPV.cpp

4.12 TidalTurbine Class Reference

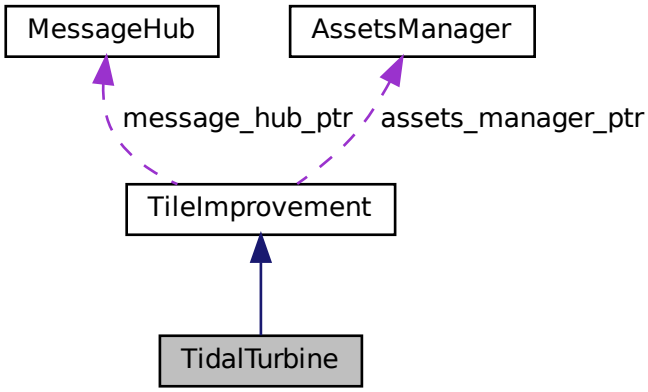
A settlement class (child class of TileImprovement).

`#include <TidalTurbine.h>`

Inheritance diagram for TidalTurbine:



Collaboration diagram for TidalTurbine:



Public Member Functions

- TidalTurbine (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)

  Constructor for the TidalTurbine class.
- void processEvent (void)

  Method to process TidalTurbine. To be called once per event.
- void processMessage (void)

  Method to process TidalTurbine. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ∼TidalTurbine (void)

  Destructor for the TidalTurbine class.

Private Member Functions

- void __setUpTileImprovementSpriteAnimated (void)

  Helper method to set up tile improvement sprite (static).
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.12.1 Detailed Description

A settlement class (child class of TileImprovement).

4.12.2 Constructor & Destructor Documentation

4.12.2.1 TidalTurbine()

```
TidalTurbine::TidalTurbine (
            double position_x,
            double position_y,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the TidalTurbine class.

Ref: Wikipedia [2023]

Parameters

position_x	The x position of the tile.
position_y	The y position of the tile.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
212   :
213 TileImprovement(
214     position_x,
215     position_y,
216     event_ptr,
217     render_window_ptr,
218     assets_manager_ptr,
219     message_hub_ptr
220 )
```

```
221 {
222     //  1. set attributes
223
224     //  1.1. private
225     //...
226
227     //  1.2. public
228     this->tile_improvement_type = TileImprovementType :: TIDAL_TURBINE;
229
230     this->is_running = false;
231
232     this->tile_improvement_string = "TIDAL TURBINE";
233
234     this->__setUpTileImprovementSpriteAnimated();
235
236     std::cout « "TidalTurbine constructed at " « this « std::endl;
237
238     return;
239 }   /* TidalTurbine() */
```

4.12.2.2 ~TidalTurbine()

```
TidalTurbine::~TidalTurbine (
            void  )  [virtual]
```

Destructor for the TidalTurbine class.

```
340 {
341     std::cout « "TidalTurbine at " « this « " destroyed" « std::endl;
342
343     return;
344 }   /* ~TidalTurbine() */
```

4.12.3 Member Function Documentation

4.12.3.1 __handleKeyPressEvents()

```
void TidalTurbine::__handleKeyPressEvents (
            void  )  [private], [virtual]
```

Helper method to handle key press events.

Reimplemented from TileImprovement.

```
114 {
115     switch (this->event_ptr->key.code) {
116         //...
117
118
119         default: {
120             // do nothing!
121
122             break;
123         }
124     }
125
126     return;
127 }   /* __handleKeyPressEvents() */
```

4.12.3.2 __handleMouseButtonEvents()

```
void TidalTurbine::__handleMouseButtonEvents (
            void  )  [private], [virtual]
```

Helper method to handle mouse button events.

Reimplemented from TileImprovement.

```
142 {
143     switch (this->event_ptr->mouseButton.button) {
144         case (sf::Mouse::Left): {
145             //...
146 
147             break;
148         }
149 
150 
151         case (sf::Mouse::Right): {
152             //...
153 
154             break;
155         }
156 
157 
158         default: {
159             // do nothing!
160 
161             break;
162         }
163     }
164 
165     return;
166 }   /* __handleMouseButtonEvents() */
```

4.12.3.3 __setUpTileImprovementSpriteAnimated()

```
void TidalTurbine::__setUpTileImprovementSpriteAnimated (
            void  )  [private]
```

Helper method to set up tile improvement sprite (static).

```
68 {
69     sf::Sprite diesel_generator_sheet(
70         *(this->assets_manager_ptr->getTexture("tidal turbine"))
71     );
72 
73     int n_elements = diesel_generator_sheet.getLocalBounds().height / 64;
74 
75     for (int i = 0; i < n_elements; i++) {
76         this->tile_improvement_sprite_animated.push_back(
77             sf::Sprite(
78                 *(this->assets_manager_ptr->getTexture("tidal turbine")),
79                 sf::IntRect(0, i * 64, 64, 64)
80             )
81         );
82 
83         this->tile_improvement_sprite_animated.back().setOrigin(
84             this->tile_improvement_sprite_animated.back().getLocalBounds().width / 2,
85             this->tile_improvement_sprite_animated.back().getLocalBounds().height
86         );
87 
88         this->tile_improvement_sprite_animated.back().setPosition(
89             this->position_x,
90             this->position_y - 32
91         );
92 
93         this->tile_improvement_sprite_animated.back().setColor(
94             sf::Color(255, 255, 255, 0)
95         );
96     }
97 
98     return;
99 }   /* __setUpTileImprovementSpriteAnimated() */
```

4.12.3.4 draw()

```
void TidalTurbine::draw (
            void  )  [virtual]
```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from TileImprovement.

```
299 {
300     //  1. if just built, call base method and return
301     if (this->just_built) {
302         TileImprovement :: draw();
303 
304         return;
305     }
306 
307 
308     //  1. draw first element of animated sprite
309     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
310 
311 
312     //  2. draw second element of animated sprite
313     if (this->is_running) {
314         //...
315     }
316 
317     else {
318         //...
319     }
320 
321     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
322 
323     this->frame++;
324     return;
325 }   /* draw() */
```

4.12.3.5 processEvent()

```
void TidalTurbine::processEvent (
            void  )  [virtual]
```

Method to process TidalTurbine. To be called once per event.

Reimplemented from TileImprovement.

```
254 {
255     if (this->event_ptr->type == sf::Event::KeyPressed) {
256         this->__handleKeyPressEvents();
257     }
258 
259     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
260         this->__handleMouseButtonEvents();
261     }
262 
263     return;
264 }   /* processEvent() */
```

4.12.3.6 processMessage()

```
void TidalTurbine::processMessage (
            void  )  [virtual]
```

Method to process TidalTurbine. To be called once per message.

Reimplemented from TileImprovement.

```
279 {
280     //...
281 
282     return;
283 }   /* processMessage() */
```

The documentation for this class was generated from the following files:

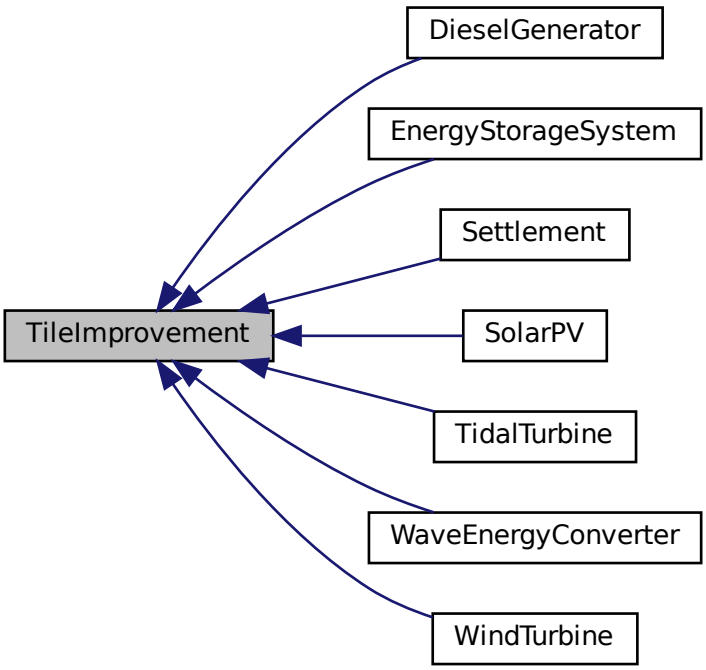
- header/TidalTurbine.h
- source/TidalTurbine.cpp

4.13 TileImprovement Class Reference

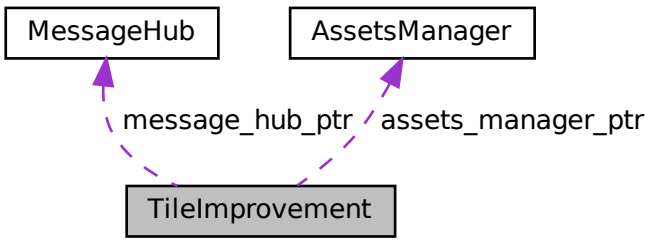
A base class for the tile improvement hierarchy.

`#include <TileImprovement.h>`

Inheritance diagram for TileImprovement:



Collaboration diagram for TileImprovement:



Public Member Functions

- TileImprovement (double, double, sf::Event *, sf::RenderWindow *, AssetsManager *, MessageHub *)

  Constructor for the TileImprovement class.
- virtual void processEvent (void)

  Method to process TileImprovement. To be called once per event.
- virtual void processMessage (void)

  Method to process TileImprovement. To be called once per message.
- virtual void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ~TileImprovement (void)

  Destructor for the TileImprovement class.

Public Attributes

- TileImprovementType tile_improvement_type

  The type of the tile improvement.
- bool is_running

  A boolean which indicates whether or not the improvement is running.
- bool is_selected

  A boolean which indicates whether or not the tile is selected.
- bool just_built

  A boolean which indicates that the improvement was just built.
- unsigned long long int frame

  The current frame of this object.
- int credits

  The current balance of credits.
- double position_x

  The x position of the tile improvement.
- double position_y

  The y position of the tile improvement.
- std::string game_phase

  The current phase of the game.
- std::string tile_improvement_string

  A string representation of the tile improvement type.
- sf::Sprite tile_improvement_sprite_static

  A static sprite, for decorating the tile.
- std::vector< sf::Sprite > tile_improvement_sprite_animated

  An animated sprite, for the ContextMenu visual screen.

Protected Member Functions

- virtual void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- virtual void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Protected Attributes

- sf::Event * event_ptr

  A pointer to the event class.
- sf::RenderWindow * render_window_ptr

  A pointer to the render window.
- AssetsManager * assets_manager_ptr

  A pointer to the assets manager.
- MessageHub * message_hub_ptr

  A pointer to the message hub.

4.13.1 Detailed Description

A base class for the tile improvement hierarchy.

4.13.2 Constructor & Destructor Documentation

4.13.2.1 TileImprovement()

```
TileImprovement::TileImprovement (
            double position_x,
            double position_y,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the TileImprovement class.

Ref: Wikipedia [2023]

Parameters

position_x	The x position of the tile.
position_y	The y position of the tile.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
167 {
168     //  1. set attributes
169
170     //  1.1. protected
171     this->event_ptr = event_ptr;
172     this->render_window_ptr = render_window_ptr;
173
174     this->assets_manager_ptr = assets_manager_ptr;
175     this->message_hub_ptr = message_hub_ptr;
176
```

```
177     //  1.2. public
178     this->is_selected = true;
179     this->just_built = true;
180 
181     this->frame = 0;
182     this->credits = 0;
183 
184     this->position_x = position_x;
185     this->position_y = position_y;
186 
187     this->game_phase = "build settlement";
188 
189     std::cout « "TileImprovement constructed at " « this « std::endl;
190 
191     return;
192 }   /* TileImprovement() */
```

4.13.2.2 ~TileImprovement()

```
TileImprovement::~TileImprovement (
              void  )  [virtual]
```

Destructor for the TileImprovement class.

```
381 {
382     std::cout « "TileImprovement at " « this « " destroyed" « std::endl;
383 
384     return;
385 }   /* ~TileImprovement() */
```

4.13.3 Member Function Documentation

4.13.3.1 __handleKeyPressEvents()

```
void TileImprovement::__handleKeyPressEvents (
              void  )  [protected], [virtual]
```

Helper method to handle key press events.

Reimplemented in WindTurbine, WaveEnergyConverter, TidalTurbine, SolarPV, Settlement, EnergyStorageSystem, and DieselGenerator.

```
68 {
69     switch (this->event_ptr->key.code) {
70         //...
71 
72 
73         default: {
74             // do nothing!
75 
76             break;
77         }
78     }
79 
80     return;
81 }   /* __handleKeyPressEvents() */
```

4.13.3.2 __handleMouseButtonEvents()

```
void TileImprovement::__handleMouseButtonEvents (
            void  )  [protected], [virtual]
```

Helper method to handle mouse button events.

Reimplemented in WindTurbine, WaveEnergyConverter, TidalTurbine, SolarPV, Settlement, EnergyStorageSystem, and DieselGenerator.

```
96 {
97     switch (this->event_ptr->mouseButton.button) {
98         case (sf::Mouse::Left): {
99             //...
100
101             break;
102         }
103
104
105         case (sf::Mouse::Right): {
106             //...
107
108             break;
109         }
110
111
112         default: {
113             // do nothing!
114
115             break;
116         }
117     }
118
119     return;
120 }   /* __handleMouseButtonEvents() */
```

4.13.3.3 draw()

```
void TileImprovement::draw (
            void  )  [virtual]
```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented in WindTurbine, WaveEnergyConverter, TidalTurbine, SolarPV, Settlement, EnergyStorageSystem, and DieselGenerator.

```
252 {
253     if (this->tile_improvement_sprite_static.getTexture() != NULL) {
254         int alpha = this->tile_improvement_sprite_static.getColor().a;
255
256         alpha += 0.04 * FRAMES_PER_SECOND;
257
258         this->tile_improvement_sprite_static.setColor(
259             sf::Color(255, 255, 255, alpha)
260         );
261
262         this->tile_improvement_sprite_static.move(0, 25 * SECONDS_PER_FRAME);
263
264         if (
265             (alpha >= 255) or
266             (this->tile_improvement_sprite_static.getPosition().y >= this->position_y + 12)
267         ) {
268             this->tile_improvement_sprite_static.setColor(
269                 sf::Color(255, 255, 255, 255)
270             );
271
272             this->tile_improvement_sprite_static.setPosition(
273                 this->position_x,
274                 this->position_y + 12
275             );
276
277             this->just_built = false;
278             this->assets_manager_ptr->getSound("place improvement")->play();
279         }
```

```
280
281         this->render_window_ptr->draw(this->tile_improvement_sprite_static);
282     }
283
284
285     else {
286         int alpha = 0;
287
288         for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
289             alpha = this->tile_improvement_sprite_animated[i].getColor().a;
290
291             alpha += 0.04 * FRAMES_PER_SECOND;
292
293             this->tile_improvement_sprite_animated[i].setColor(
294                 sf::Color(255, 255, 255, alpha)
295             );
296
297             this->tile_improvement_sprite_animated[i].move(0, 25 * SECONDS_PER_FRAME);
298
299             if (
300                 (alpha >= 255) or
301                 (this->tile_improvement_sprite_animated[i].getPosition().y >= this->position_y + 12)
302             ) {
303                 this->tile_improvement_sprite_animated[i].setColor(
304                     sf::Color(255, 255, 255, 255)
305                 );
306
307                 this->tile_improvement_sprite_animated[i].setPosition(
308                     this->position_x,
309                     this->position_y + 12
310                 );
311             }
312
313             this->render_window_ptr->draw(this->tile_improvement_sprite_animated[i]);
314         }
315
316         if (
317             (alpha >= 255) or
318             (this->tile_improvement_sprite_animated[0].getPosition().y >= this->position_y + 12)
319         ) {
320             this->just_built = false;
321             this->assets_manager_ptr->getSound("place improvement")->play();
322
323             switch (this->tile_improvement_type) {
324                 case (TileImprovementType :: WIND_TURBINE): {
325                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
326                         this->tile_improvement_sprite_animated[i].setOrigin(32, 32);
327                         this->tile_improvement_sprite_animated[i].move(0, -32);
328                     }
329
330                     break;
331                 }
332
333
334                 case (TileImprovementType :: TIDAL_TURBINE): {
335                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
336                         this->tile_improvement_sprite_animated[i].setOrigin(32, 45);
337                         this->tile_improvement_sprite_animated[i].move(0, -19);
338                     }
339
340                     break;
341                 }
342
343
344                 case (TileImprovementType :: WAVE_ENERGY_CONVERTER): {
345                     for (size_t i = 0; i < this->tile_improvement_sprite_animated.size(); i++) {
346                         this->tile_improvement_sprite_animated[i].setOrigin(32, 32);
347                         this->tile_improvement_sprite_animated[i].move(0, -32);
348                     }
349
350                     break;
351                 }
352
353
354                 default: {
355                     // do nothing!
356
357                     break;
358                 }
359             }
360         }
361     }
362
363
364     this->frame++;
365     return;
366 }   /* draw() */
```

4.13.3.4 processEvent()

```
void TileImprovement::processEvent (
            void  )  [virtual]
```

Method to process TileImprovement. To be called once per event.

Reimplemented in WindTurbine, WaveEnergyConverter, TidalTurbine, SolarPV, Settlement, EnergyStorageSystem, and DieselGenerator.

```
207 {
208     if (this->event_ptr->type == sf::Event::KeyPressed) {
209         this->__handleKeyPressEvents();
210     }
211 
212     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
213         this->__handleMouseButtonEvents();
214     }
215 
216     return;
217 }   /* processEvent() */
```

4.13.3.5 processMessage()

```
void TileImprovement::processMessage (
            void  )  [virtual]
```

Method to process TileImprovement. To be called once per message.

Reimplemented in WindTurbine, WaveEnergyConverter, TidalTurbine, SolarPV, Settlement, EnergyStorageSystem, and DieselGenerator.

```
232 {
233     //...
234 
235     return;
236 }   /* processMessage() */
```

4.13.4 Member Data Documentation

4.13.4.1 assets_manager_ptr

```
AssetsManager* TileImprovement::assets_manager_ptr  [protected]
```

A pointer to the assets manager.

4.13.4.2 credits

```
int TileImprovement::credits
```

The current balance of credits.

4.13.4.3 event_ptr

```
sf::Event* TileImprovement::event_ptr  [protected]
```

A pointer to the event class.

4.13.4.4 frame

```
unsigned long long int TileImprovement::frame
```

The current frame of this object.

4.13.4.5 game_phase

```
std::string TileImprovement::game_phase
```

The current phase of the game.

4.13.4.6 is_running

```
bool TileImprovement::is_running
```

A boolean which indicates whether or not the improvement is running.

4.13.4.7 is_selected

```
bool TileImprovement::is_selected
```

A boolean which indicates whether or not the tile is selected.

4.13.4.8 just_built

```
bool TileImprovement::just_built
```

A boolean which indicates that the improvement was just built.

4.13.4.9 message_hub_ptr

```
MessageHub* TileImprovement::message_hub_ptr  [protected]
```

A pointer to the message hub.

4.13.4.10 position_x

```
double TileImprovement::position_x
```

The x position of the tile improvement.

4.13.4.11 position_y

```
double TileImprovement::position_y
```

The y position of the tile improvement.

4.13.4.12 render_window_ptr

```
sf::RenderWindow* TileImprovement::render_window_ptr  [protected]
```

A pointer to the render window.

4.13.4.13 tile_improvement_sprite_animated

```
std::vector<sf::Sprite> TileImprovement::tile_improvement_sprite_animated
```

An animated sprite, for the ContextMenu visual screen.

4.13.4.14 tile_improvement_sprite_static

```
sf::Sprite TileImprovement::tile_improvement_sprite_static
```

A static sprite, for decorating the tile.

4.13.4.15 tile_improvement_string

```
std::string TileImprovement::tile_improvement_string
```

A string representation of the tile improvement type.

4.13.4.16 tile_improvement_type

```
TileImprovementType TileImprovement::tile_improvement_type
```

The type of the tile improvement.

The documentation for this class was generated from the following files:

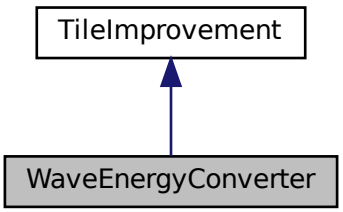
- header/TileImprovement.h
- source/TileImprovement.cpp

4.14 WaveEnergyConverter Class Reference

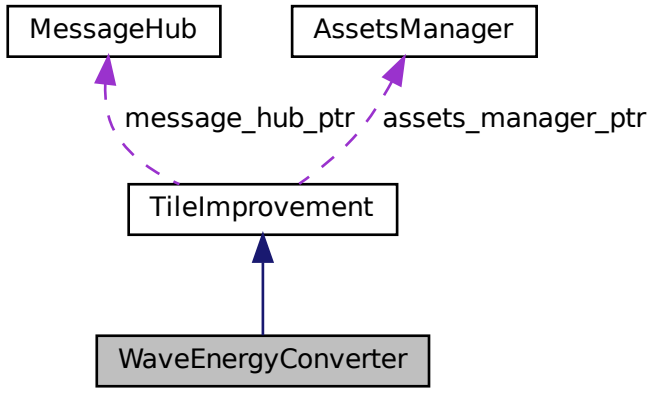
A settlement class (child class of TileImprovement).

```
#include <WaveEnergyConverter.h>
```

Inheritance diagram for WaveEnergyConverter:



Collaboration diagram for WaveEnergyConverter:



Public Member Functions

- WaveEnergyConverter (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)

  Constructor for the WaveEnergyConverter class.
- void processEvent (void)

  Method to process WaveEnergyConverter. To be called once per event.
- void processMessage (void)

  Method to process WaveEnergyConverter. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ∼WaveEnergyConverter (void)

  Destructor for the WaveEnergyConverter class.

Private Member Functions

- void __setUpTileImprovementSpriteAnimated (void)

  Helper method to set up tile improvement sprite (static).
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.14.1 Detailed Description

A settlement class (child class of TileImprovement).

4.14.2 Constructor & Destructor Documentation

4.14.2.1 WaveEnergyConverter()

```
WaveEnergyConverter::WaveEnergyConverter (
            double position_x,
            double position_y,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the WaveEnergyConverter class.

Ref: Wikipedia [2023]

Parameters

position_x	The x position of the tile.
position_y	The y position of the tile.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
212   :
213 TileImprovement(
214     position_x,
215     position_y,
216     event_ptr,
217     render_window_ptr,
218     assets_manager_ptr,
219     message_hub_ptr
220 )
221 {
222     //  1. set attributes
223
224     //  1.1. private
225     //...
226
227     //  1.2. public
228     this->tile_improvement_type = TileImprovementType :: WAVE_ENERGY_CONVERTER;
229
230     this->is_running = false;
231
232     this->tile_improvement_string = "WAVE ENERGY";
233
234     this->__setUpTileImprovementSpriteAnimated();
235
236     std::cout « "WaveEnergyConverter constructed at " « this « std::endl;
237
238     return;
239 }   /* WaveEnergyConverter() */
```

4.14.2.2 ~WaveEnergyConverter()

```
WaveEnergyConverter::~WaveEnergyConverter (
            void  )  [virtual]
```

Destructor for the WaveEnergyConverter class.

```
340 {
341     std::cout « "WaveEnergyConverter at " « this « " destroyed" « std::endl;
342 
343     return;
344 }   /* ~WaveEnergyConverter() */
```

4.14.3 Member Function Documentation

4.14.3.1 __handleKeyPressEvents()

```
void WaveEnergyConverter::__handleKeyPressEvents (
            void  )  [private], [virtual]
```

Helper method to handle key press events.

Reimplemented from TileImprovement.

```
114 {
115     switch (this->event_ptr->key.code) {
116         //...
117 
118 
119         default: {
120             // do nothing!
121 
122             break;
123         }
124     }
125 
126     return;
127 }   /* __handleKeyPressEvents() */
```

4.14.3.2 __handleMouseButtonEvents()

```
void WaveEnergyConverter::__handleMouseButtonEvents (
            void  )  [private], [virtual]
```

Helper method to handle mouse button events.

Reimplemented from TileImprovement.

```
142 {
143     switch (this->event_ptr->mouseButton.button) {
144         case (sf::Mouse::Left): {
145             //...
146 
147             break;
148         }
149 
150 
151         case (sf::Mouse::Right): {
152             //...
153 
154             break;
155         }
156 
157 
158         default: {
159             // do nothing!
160 
161             break;
162         }
163     }
164 
165     return;
166 }   /* __handleMouseButtonEvents() */
```

4.14.3.3 __setUpTileImprovementSpriteAnimated()

```
void WaveEnergyConverter::__setUpTileImprovementSpriteAnimated (
            void  )  [private]
```

Helper method to set up tile improvement sprite (static).

```
68 {
69     sf::Sprite diesel_generator_sheet(
70         *(this->assets_manager_ptr->getTexture("wave energy converter"))
71     );
72 
73     int n_elements = diesel_generator_sheet.getLocalBounds().height / 64;
74 
75     for (int i = 0; i < n_elements; i++) {
76         this->tile_improvement_sprite_animated.push_back(
77             sf::Sprite(
78                 *(this->assets_manager_ptr->getTexture("wave energy converter")),
79                 sf::IntRect(0, i * 64, 64, 64)
80             )
81         );
82 
83         this->tile_improvement_sprite_animated.back().setOrigin(
84             this->tile_improvement_sprite_animated.back().getLocalBounds().width / 2,
85             this->tile_improvement_sprite_animated.back().getLocalBounds().height
86         );
87 
88         this->tile_improvement_sprite_animated.back().setPosition(
89             this->position_x,
90             this->position_y - 32
91         );
92 
93         this->tile_improvement_sprite_animated.back().setColor(
94             sf::Color(255, 255, 255, 0)
95         );
96     }
97 
98     return;
99 }   /* __setUpTileImprovementSpriteAnimated() */
```

4.14.3.4 draw()

```
void WaveEnergyConverter::draw (
            void  )  [virtual]
```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from TileImprovement.

```
299 {
300     //  1. if just built, call base method and return
301     if (this->just_built) {
302         TileImprovement :: draw();
303 
304         return;
305     }
306 
307 
308     //  1. draw first element of animated sprite
309     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
310 
311 
312     //  2. draw second element of animated sprite
313     if (this->is_running) {
314         //...
315     }
316 
317     else {
318         //...
319     }
320 
321     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
322 
323     this->frame++;
324     return;
325 }   /* draw() */
```

4.14.3.5 processEvent()

```
void WaveEnergyConverter::processEvent (
            void  )  [virtual]
```

Method to process WaveEnergyConverter. To be called once per event.

Reimplemented from TileImprovement.

```
254 {
255     if (this->event_ptr->type == sf::Event::KeyPressed) {
256         this->__handleKeyPressEvents();
257     }
258
259     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
260         this->__handleMouseButtonEvents();
261     }
262
263     return;
264 }   /* processEvent() */
```

4.14.3.6 processMessage()

```
void WaveEnergyConverter::processMessage (
            void  )  [virtual]
```

Method to process WaveEnergyConverter. To be called once per message.

Reimplemented from TileImprovement.

```
279 {
280     //...
281
282     return;
283 }   /* processMessage() */
```

The documentation for this class was generated from the following files:

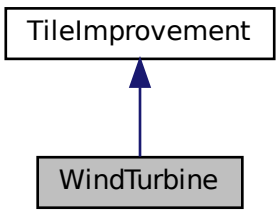
- header/WaveEnergyConverter.h
- source/WaveEnergyConverter.cpp

4.15 WindTurbine Class Reference

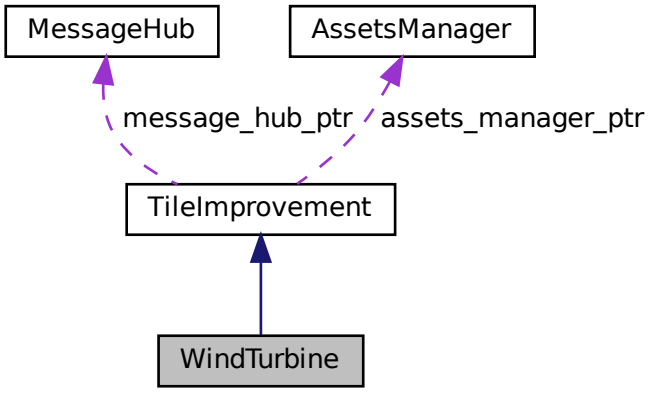
A settlement class (child class of TileImprovement).

`#include <WindTurbine.h>`

Inheritance diagram for WindTurbine:



Collaboration diagram for WindTurbine:



Public Member Functions

- WindTurbine (double, double, sf::Event ∗, sf::RenderWindow ∗, AssetsManager ∗, MessageHub ∗)

  Constructor for the WindTurbine class.
- void processEvent (void)

  Method to process WindTurbine. To be called once per event.
- void processMessage (void)

  Method to process WindTurbine. To be called once per message.
- void draw (void)

  Method to draw the hex tile to the render window. To be called once per frame.
- virtual ∼WindTurbine (void)

  Destructor for the WindTurbine class.

Private Member Functions

- void __setUpTileImprovementSpriteAnimated (void)

  Helper method to set up tile improvement sprite (static).
- void __handleKeyPressEvents (void)

  Helper method to handle key press events.
- void __handleMouseButtonEvents (void)

  Helper method to handle mouse button events.

Additional Inherited Members

4.15.1 Detailed Description

A settlement class (child class of TileImprovement).

4.15.2 Constructor & Destructor Documentation

4.15.2.1 WindTurbine()

```
WindTurbine::WindTurbine (
            double position_x,
            double position_y,
            sf::Event * event_ptr,
            sf::RenderWindow * render_window_ptr,
            AssetsManager * assets_manager_ptr,
            MessageHub * message_hub_ptr )
```

Constructor for the WindTurbine class.

Ref: Wikipedia [2023]

Parameters

position_x	The x position of the tile.
position_y	The y position of the tile.
event_ptr	Pointer to the event class.
render_window_ptr	Pointer to the render window.
assets_manager_ptr	Pointer to the assets manager.
message_hub_ptr	Pointer to the message hub.

```
212   :
213 TileImprovement(
214     position_x,
215     position_y,
216     event_ptr,
217     render_window_ptr,
218     assets_manager_ptr,
219     message_hub_ptr
220 )
221 {
222     //  1. set attributes
223
224     //  1.1. private
225     //...
226
227     //  1.2. public
228     this->tile_improvement_type = TileImprovementType :: WIND_TURBINE;
229
230     this->is_running = false;
231
232     this->tile_improvement_string = "WIND TURBINE";
233
234     this->__setUpTileImprovementSpriteAnimated();
235
236     std::cout « "WindTurbine constructed at " « this « std::endl;
237
238     return;
239 }   /* WindTurbine() */
```

4.15.2.2 ~WindTurbine()

```
WindTurbine::~WindTurbine (
            void  )  [virtual]
```

Destructor for the WindTurbine class.

```
340 {
341     std::cout « "WindTurbine at " « this « " destroyed" « std::endl;
342 
343     return;
344 }   /* ~WindTurbine() */
```

4.15.3 Member Function Documentation

4.15.3.1 __handleKeyPressEvents()

```
void WindTurbine::__handleKeyPressEvents (
             void  )  [private], [virtual]
```

Helper method to handle key press events.

Reimplemented from TileImprovement.

```
114 {
115     switch (this->event_ptr->key.code) {
116         //...
117 
118 
119         default: {
120             // do nothing!
121 
122             break;
123         }
124     }
125 
126     return;
127 }   /* __handleKeyPressEvents() */
```

4.15.3.2 __handleMouseButtonEvents()

```
void WindTurbine::__handleMouseButtonEvents (
             void  )  [private], [virtual]
```

Helper method to handle mouse button events.

Reimplemented from TileImprovement.

```
142 {
143     switch (this->event_ptr->mouseButton.button) {
144         case (sf::Mouse::Left): {
145             //...
146 
147             break;
148         }
149 
150 
151         case (sf::Mouse::Right): {
152             //...
153 
154             break;
155         }
156 
157 
158         default: {
159             // do nothing!
160 
161             break;
162         }
163     }
164 
165     return;
166 }   /* __handleMouseButtonEvents() */
```

4.15.3.3 __setUpTileImprovementSpriteAnimated()

```
void WindTurbine::__setUpTileImprovementSpriteAnimated (
            void  )  [private]
```

Helper method to set up tile improvement sprite (static).

```
68 {
69     sf::Sprite diesel_generator_sheet(
70         *(this->assets_manager_ptr->getTexture("wind turbine"))
71     );
72
73     int n_elements = diesel_generator_sheet.getLocalBounds().height / 64;
74
75     for (int i = 0; i < n_elements; i++) {
76         this->tile_improvement_sprite_animated.push_back(
77             sf::Sprite(
78                 *(this->assets_manager_ptr->getTexture("wind turbine")),
79                 sf::IntRect(0, i * 64, 64, 64)
80             )
81         );
82
83         this->tile_improvement_sprite_animated.back().setOrigin(
84             this->tile_improvement_sprite_animated.back().getLocalBounds().width / 2,
85             this->tile_improvement_sprite_animated.back().getLocalBounds().height
86         );
87
88         this->tile_improvement_sprite_animated.back().setPosition(
89             this->position_x,
90             this->position_y - 32
91         );
92
93         this->tile_improvement_sprite_animated.back().setColor(
94             sf::Color(255, 255, 255, 0)
95         );
96     }
97
98     return;
99 }   /* __setUpTileImprovementSpriteAnimated() */
```

4.15.3.4 draw()

```
void WindTurbine::draw (
            void  )  [virtual]
```

Method to draw the hex tile to the render window. To be called once per frame.

Reimplemented from TileImprovement.

```
299 {
300     //  1. if just built, call base method and return
301     if (this->just_built) {
302         TileImprovement :: draw();
303
304         return;
305     }
306
307
308     //  1. draw first element of animated sprite
309     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[0]);
310
311
312     //  2. draw second element of animated sprite
313     if (this->is_running) {
314         //...
315     }
316
317     else {
318         //...
319     }
320
321     this->render_window_ptr->draw(this->tile_improvement_sprite_animated[1]);
322
323     this->frame++;
324     return;
325 }   /* draw() */
```

4.15.3.5 processEvent()

```
void WindTurbine::processEvent (
            void  )  [virtual]
```

Method to process WindTurbine. To be called once per event.

Reimplemented from TileImprovement.

```
254 {
255     if (this->event_ptr->type == sf::Event::KeyPressed) {
256         this->__handleKeyPressEvents();
257     }
258 
259     if (this->event_ptr->type == sf::Event::MouseButtonPressed) {
260         this->__handleMouseButtonEvents();
261     }
262 
263     return;
264 }   /* processEvent() */
```

4.15.3.6 processMessage()

```
void WindTurbine::processMessage (
            void  )  [virtual]
```

Method to process WindTurbine. To be called once per message.

Reimplemented from TileImprovement.

```
279 {
280     //...
281 
282     return;
283 }   /* processMessage() */
```

The documentation for this class was generated from the following files:

- header/WindTurbine.h
- source/WindTurbine.cpp

Chapter 5

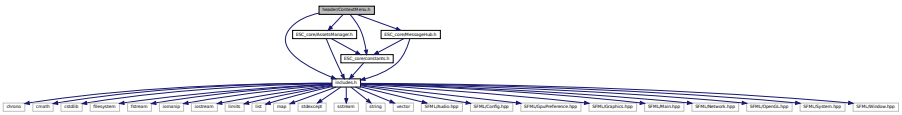
File Documentation

5.1 header/ContextMenu.h File Reference

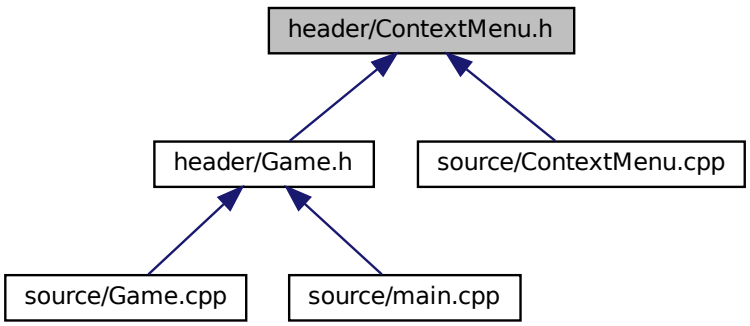
Header file for the ContextMenu class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

Include dependency graph for ContextMenu.h:



This graph shows which files directly or indirectly include this file:



Classes

- class ContextMenu

  A class which defines a context menu for the game.

Enumerations

- enum ConsoleState {
  NONE_STATE , READY , MENU , TILE ,
  N_CONSOLE_STATES }

  An enumeration of the different console screen states.

5.1.1 Detailed Description

Header file for the ContextMenu class.

5.1.2 Enumeration Type Documentation

5.1.2.1 ConsoleState

```
enum ConsoleState
```

An enumeration of the different console screen states.

Enumerator

NONE_STATE	None state (for initialization)
READY	Ready (default) state.
MENU	Game menu state.
TILE	Tile context state.
N_CONSOLE_STATES	A simple hack to get the number of console screen states.

```
68                  {
69     NONE_STATE,
70     READY,
71     MENU,
72     TILE,
73     N_CONSOLE_STATES
74 };
```

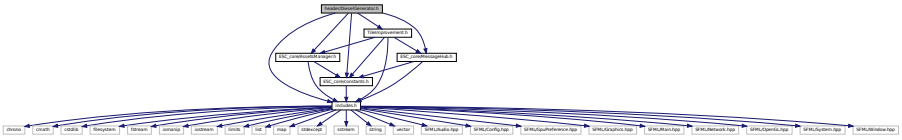
5.2 header/DieselGenerator.h File Reference

Header file for the DieselGenerator class.

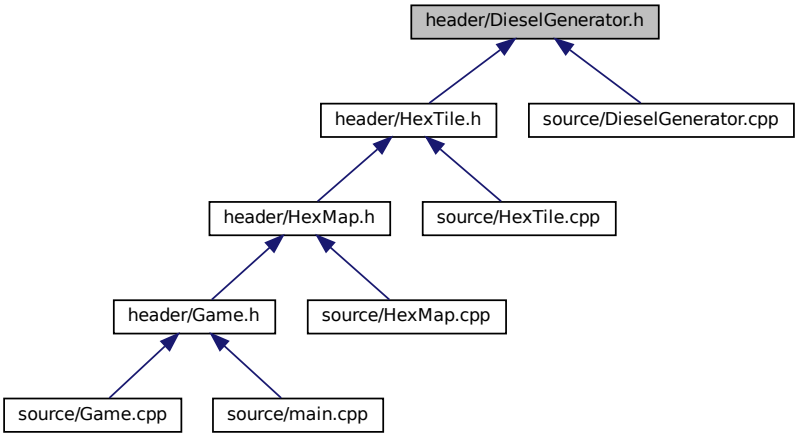
```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
```

```
#include "ESC_core/MessageHub.h"
#include "TileImprovement.h"
```

Include dependency graph for DieselGenerator.h:



This graph shows which files directly or indirectly include this file:



Classes

- class DieselGenerator

  A settlement class (child class of TileImprovement).

5.2.1 Detailed Description

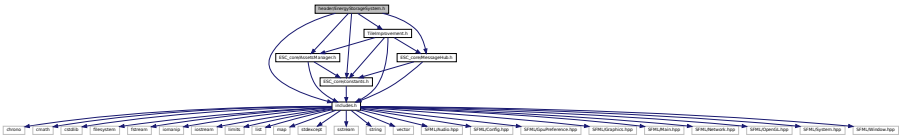
Header file for the DieselGenerator class.

5.3 header/EnergyStorageSystem.h File Reference

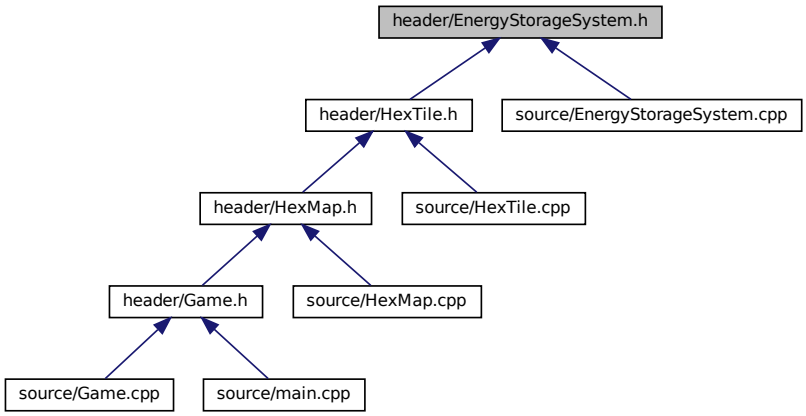
Header file for the EnergyStorageSystem class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

```
#include "TileImprovement.h"
```
Include dependency graph for EnergyStorageSystem.h:



This graph shows which files directly or indirectly include this file:



Classes

- class EnergyStorageSystem

  A settlement class (child class of TileImprovement).

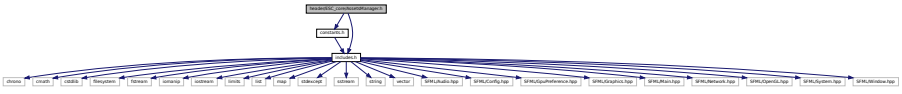
5.3.1 Detailed Description

Header file for the EnergyStorageSystem class.

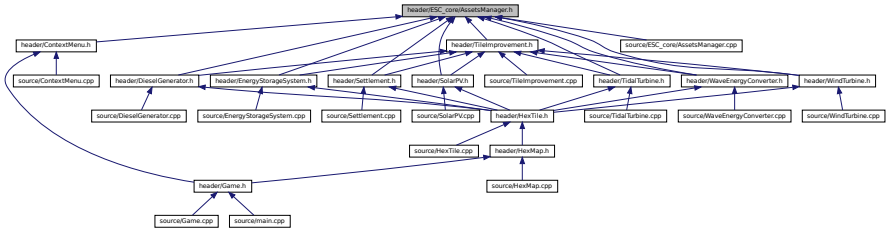
5.4 header/ESC_core/AssetsManager.h File Reference

Header file for the AssetsManager class.

```
#include "constants.h"
#include "includes.h"
```
Include dependency graph for AssetsManager.h:



This graph shows which files directly or indirectly include this file:



Classes

- class AssetsManager

  A class which manages visual and sound assets.

5.4.1 Detailed Description

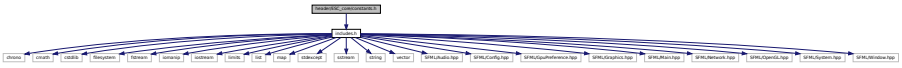
Header file for the AssetsManager class.

5.5 header/ESC_core/constants.h File Reference

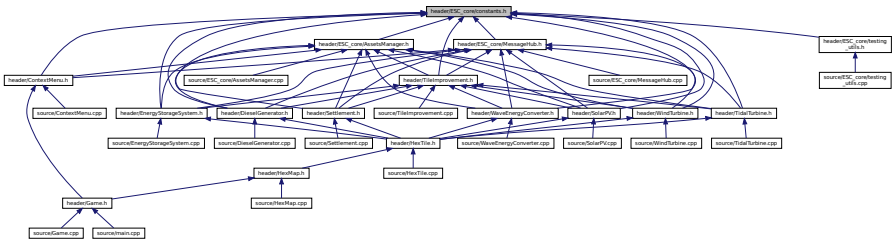
Header file for various constants.

```
#include "includes.h"
```

Include dependency graph for constants.h:



This graph shows which files directly or indirectly include this file:



Functions

- const sf::Color FOREST_GREEN (34, 139, 34)

  The base colour of a forest tile.
- const sf::Color LAKE_BLUE (0, 102, 204)

  The base colour of a lake (water) tile.
- const sf::Color MOUNTAINS_GREY (97, 110, 113)

  The base colour of a mountains tile.
- const sf::Color OCEAN_BLUE (0, 51, 102)

  The base colour of an ocean (water) tile.
- const sf::Color PLAINS_YELLOW (245, 222, 133)

  The base colour of a plains tile.
- const sf::Color RESOURCE_CHIP_GREY (175, 175, 175, 250)

  The base colour of the resource chip (backing).
- const sf::Color MENU_FRAME_GREY (185, 187, 182)

  The base colour of the context menu frame.
- const sf::Color MONOCHROME_SCREEN_BACKGROUND (40, 40, 40)

  The base colour of old monochrome screens.
- const sf::Color VISUAL_SCREEN_FRAME_GREY (151, 151, 143)

  The base colour of the framing of the visual screen.
- const sf::Color MONOCHROME_TEXT_GREEN (0, 255, 102)

  The base colour of old monochrome text (green).
- const sf::Color MONOCHROME_TEXT_AMBER (255, 176, 0)

  The base colour of old monochrome text (amber).
- const sf::Color MONOCHROME_TEXT_RED (255, 44, 0)

  The base colour of old monochrome text (red).

Variables

- const double FLOAT_TOLERANCE = 1e-6

  Tolerance for floating point equality tests.
- const unsigned long long int SECONDS_PER_YEAR = 31537970
- const unsigned long long int SECONDS_PER_MONTH = 2628164
- const int FRAMES_PER_SECOND = 60

  Target frames per second.
- const double SECONDS_PER_FRAME = 1.0 / 60

  Target seconds per frame (just reciprocal of target frames per second).
- const int GAME_WIDTH = 1200

  Width of the game space.
- const int GAME_HEIGHT = 800

  Height of the game space.
- const std::vector< double > TILE_TYPE_CUMULATIVE_PROBABILITIES

  Cumulative probabilities for each tile type (to support procedural generation).
- const std::vector< double > TILE_RESOURCE_CUMULATIVE_PROBABILITIES

  Cumulative probabilities for each tile resource (to support procedural generation).
- const std::string TILE_SELECTED_CHANNEL = "TILE SELECTED CHANNEL"

  A message channel for tile selection messages.
- const std::string NO_TILE_SELECTED_CHANNEL = "NO TILE SELECTED CHANNEL"

  A message channel for no tile selected messages.
- const std::string TILE_STATE_CHANNEL = "TILE STATE CHANNEL"

A message channel for tile state messages.

- const std::string HEX_MAP_CHANNEL = "HEX MAP CHANNEL"

  A message channel for hex map messages.
- const int CLEAR_FOREST_COST = 40

  The cost of clearing a forest tile.
- const int CLEAR_MOUNTAINS_COST = 250

  The cost of clearing a mountains tile.
- const int CLEAR_PLAINS_COST = 20

  The cost of clearing a plains tile.
- const int DIESEL_GENERATOR_BUILD_COST = 100

  The cost of building (or ugrading) a diesel generator.
- const int WIND_TURBINE_BUILD_COST = 400

  The cost of building (or upgrading) a wind turbine.
- const double WIND_TURBINE_WATER_BUILD_MULTIPLIER = 1.25

  The additional cost of building on water.
- const int SOLAR_PV_BUILD_COST = 300

  The cost of building (or upgrading) a solar PV array.
- const double SOLAR_PV_WATER_BUILD_MULTIPLIER = 1.5

  The additional cost of building on water.
- const int TIDAL_TURBINE_BUILD_COST = 600

  The cost of building (or upgrading) a tidal turbine.
- const int WAVE_ENERGY_CONVERTER_BUILD_COST = 800

  The cost of building (or upgrading) a wave energy converter.
- const int ENERGY_STORAGE_SYSTEM_BUILD_COST = 400

  The cost of building (or upgrading) an energy storage system.
- const int STARTING_CREDITS = 500

  The starting balance of credits.
- const int EMISSIONS_LIFETIME_LIMIT_TONNES = 1500

  The CO2-equivalent mass of emissions that would result from burning 1,000,000 L of diesel fuel.
- const int RESOURCE_ASSESSMENT_COST = 20

  The cost of doing a resource assessment.
- const int BUILD_SETTLEMENT_COST = 250

  The cost of building a settlement.
- const int STARTING_POPULATION = 100

  The starting population of a settlement.
- const double CO2E_KG_PER_LITRE_DIESEL = 3.1596

  The CO2-equivalent mass of emissions that result from burning one litre of diesel fuel.
- const std::string GAME_CHANNEL = "GAME CHANNEL"

  A message channel for game messages.
- const std::string GAME_STATE_CHANNEL = "GAME STATE CHANNEL"

  A message channel for game state messages.

5.5.1 Detailed Description

Header file for various constants.

5.5.2 Function Documentation

5.5.2.1 FOREST_GREEN()

```
const sf::Color FOREST_GREEN (
            34 ,
            139 ,
            34  )
```

The base colour of a forest tile.

5.5.2.2 LAKE_BLUE()

```
const sf::Color LAKE_BLUE (
            0 ,
            102 ,
            204  )
```

The base colour of a lake (water) tile.

5.5.2.3 MENU_FRAME_GREY()

```
const sf::Color MENU_FRAME_GREY (
            185 ,
            187 ,
            182  )
```

The base colour of the context menu frame.

5.5.2.4 MONOCHROME_SCREEN_BACKGROUND()

```
const sf::Color MONOCHROME_SCREEN_BACKGROUND (
            40 ,
            40 ,
            40  )
```

The base colour of old monochrome screens.

5.5.2.5 MONOCHROME_TEXT_AMBER()

```
const sf::Color MONOCHROME_TEXT_AMBER (
            255 ,
            176 ,
            0  )
```

The base colour of old monochrome text (amber).

5.5.2.6 MONOCHROME_TEXT_GREEN()

```
const sf::Color MONOCHROME_TEXT_GREEN (
            0 ,
            255 ,
            102  )
```

The base colour of old monochrome text (green).

5.5.2.7 MONOCHROME_TEXT_RED()

```
const sf::Color MONOCHROME_TEXT_RED (
            255 ,
            44 ,
            0  )
```

The base colour of old monochrome text (red).

5.5.2.8 MOUNTAINS_GREY()

```
const sf::Color MOUNTAINS_GREY (
            97 ,
            110 ,
            113  )
```

The base colour of a mountains tile.

5.5.2.9 OCEAN_BLUE()

```
const sf::Color OCEAN_BLUE (
            0 ,
            51 ,
            102  )
```

The base colour of an ocean (water) tile.

5.5.2.10 PLAINS_YELLOW()

```
const sf::Color PLAINS_YELLOW (
            245 ,
            222 ,
            133  )
```

The base colour of a plains tile.

5.5.2.11 RESOURCE_CHIP_GREY()

```
const sf::Color RESOURCE_CHIP_GREY (
            175 ,
            175 ,
            175 ,
            250  )
```

The base colour of the resource chip (backing).

5.5.2.12 VISUAL_SCREEN_FRAME_GREY()

```
const sf::Color VISUAL_SCREEN_FRAME_GREY (
            151 ,
            151 ,
            143  )
```

The base colour of the framing of the visual screen.

5.5.3 Variable Documentation

5.5.3.1 BUILD_SETTLEMENT_COST

```
const int BUILD_SETTLEMENT_COST = 250
```

The cost of building a settlement.

5.5.3.2 CLEAR_FOREST_COST

```
const int CLEAR_FOREST_COST = 40
```

The cost of clearing a forest tile.

5.5.3.3 CLEAR_MOUNTAINS_COST

```
const int CLEAR_MOUNTAINS_COST = 250
```

The cost of clearing a mountains tile.

5.5.3.4 CLEAR_PLAINS_COST

```
const int CLEAR_PLAINS_COST = 20
```

The cost of clearing a plains tile.

5.5.3.5 CO2E_KG_PER_LITRE_DIESEL

```
const double CO2E_KG_PER_LITRE_DIESEL = 3.1596
```

The CO2-equivalent mass of emissions that result from burning one litre of diesel fuel.

5.5.3.6 DIESEL_GENERATOR_BUILD_COST

```
const int DIESEL_GENERATOR_BUILD_COST = 100
```

The cost of building (or ugrading) a diesel generator.

5.5.3.7 EMISSIONS_LIFETIME_LIMIT_TONNES

```
const int EMISSIONS_LIFETIME_LIMIT_TONNES = 1500
```

The CO2-equivalent mass of emissions that would result from burning 1,000,000 L of diesel fuel.

5.5.3.8 ENERGY_STORAGE_SYSTEM_BUILD_COST

```
const int ENERGY_STORAGE_SYSTEM_BUILD_COST = 400
```

The cost of building (or upgrading) an energy storage system.

5.5.3.9 FLOAT_TOLERANCE

```
const double FLOAT_TOLERANCE = 1e-6
```

Tolerance for floating point equality tests.

5.5.3.10 FRAMES_PER_SECOND

```
const int FRAMES_PER_SECOND = 60
```

Target frames per second.

5.5.3.11 GAME_CHANNEL

```
const std::string GAME_CHANNEL = "GAME CHANNEL"
```

A message channel for game messages.

5.5.3.12 GAME_HEIGHT

```
const int GAME_HEIGHT = 800
```

Height of the game space.

5.5.3.13 GAME_STATE_CHANNEL

```
const std::string GAME_STATE_CHANNEL = "GAME STATE CHANNEL"
```

A message channel for game state messages.

5.5.3.14 GAME_WIDTH

```
const int GAME_WIDTH = 1200
```

Width of the game space.

5.5.3.15 HEX_MAP_CHANNEL

```
const std::string HEX_MAP_CHANNEL = "HEX MAP CHANNEL"
```

A message channel for hex map messages.

5.5.3.16 NO_TILE_SELECTED_CHANNEL

```
const std::string NO_TILE_SELECTED_CHANNEL = "NO TILE SELECTED CHANNEL"
```

A message channel for no tile selected messages.

5.5.3.17 RESOURCE_ASSESSMENT_COST

```
const int RESOURCE_ASSESSMENT_COST = 20
```

The cost of doing a resource assessment.

5.5.3.18 SECONDS_PER_FRAME

```
const double SECONDS_PER_FRAME = 1.0 / 60
```

Target seconds per frame (just reciprocal of target frames per second).

5.5.3.19 SECONDS_PER_MONTH

```
const unsigned long long int SECONDS_PER_MONTH = 2628164
```

5.5.3.20 SECONDS_PER_YEAR

```
const unsigned long long int SECONDS_PER_YEAR = 31537970
```

5.5.3.21 SOLAR_PV_BUILD_COST

```
const int SOLAR_PV_BUILD_COST = 300
```

The cost of building (or upgrading) a solar PV array.

5.5.3.22 SOLAR_PV_WATER_BUILD_MULTIPLIER

```
const double SOLAR_PV_WATER_BUILD_MULTIPLIER = 1.5
```

The additional cost of building on water.

5.5.3.23 STARTING_CREDITS

```
const int STARTING_CREDITS = 500
```

The starting balance of credits.

5.5.3.24 STARTING_POPULATION

```
const int STARTING_POPULATION = 100
```

The starting population of a settlement.

5.5.3.25 TIDAL_TURBINE_BUILD_COST

```
const int TIDAL_TURBINE_BUILD_COST = 600
```

The cost of building (or upgrading) a tidal turbine.

5.5.3.26 TILE_RESOURCE_CUMULATIVE_PROBABILITIES

```
const std::vector<double> TILE_RESOURCE_CUMULATIVE_PROBABILITIES
```

Initial value:

```
= {
    0.10,
    0.30,
    0.70,
    0.90,
    1.00
}
```

Cumulative probabilities for each tile resource (to support procedural generation).

5.5.3.27 TILE_SELECTED_CHANNEL

```
const std::string TILE_SELECTED_CHANNEL = "TILE SELECTED CHANNEL"
```

A message channel for tile selection messages.

5.5.3.28 TILE_STATE_CHANNEL

```
const std::string TILE_STATE_CHANNEL = "TILE STATE CHANNEL"
```

A message channel for tile state messages.

5.5.3.29 TILE_TYPE_CUMULATIVE_PROBABILITIES

```
const std::vector<double> TILE_TYPE_CUMULATIVE_PROBABILITIES
```

Initial value:

```
= {
    0.25,
    0.50,
    0.75,
    1.00
}
```

Cumulative probabilities for each tile type (to support procedural generation).

5.5.3.30 WAVE_ENERGY_CONVERTER_BUILD_COST

```
const int WAVE_ENERGY_CONVERTER_BUILD_COST = 800
```

The cost of building (or upgrading) a wave energy converter.

5.5.3.31 WIND_TURBINE_BUILD_COST

```
const int WIND_TURBINE_BUILD_COST = 400
```

The cost of building (or upgrading) a wind turbine.

5.5.3.32 WIND_TURBINE_WATER_BUILD_MULTIPLIER

```
const double WIND_TURBINE_WATER_BUILD_MULTIPLIER = 1.25
```

The additional cost of building on water.

5.6 header/ESC_core/doxygen_cite.h File Reference

Header file which simply cites the doxygen tool.

5.6.1 Detailed Description

Header file which simply cites the doxygen tool.

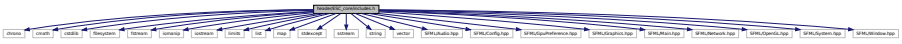
Ref: van Heesch. [2023]

5.7 header/ESC_core/includes.h File Reference

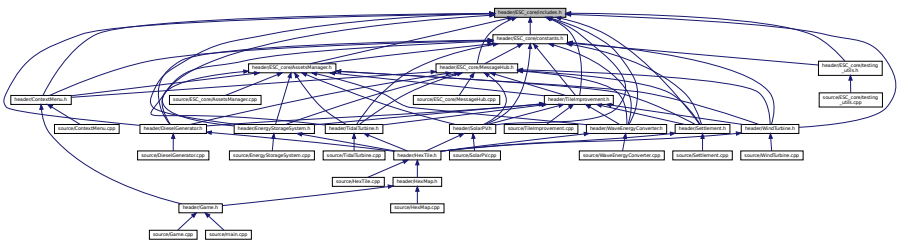
Header file for various includes.

```
#include <chrono>
#include <cmath>
#include <cstdlib>
#include <filesystem>
#include <fstream>
#include <iomanip>
#include <iostream>
#include <limits>
#include <list>
#include <map>
#include <stdexcept>
#include <sstream>
#include <string>
#include <vector>
#include <SFML/Audio.hpp>
#include <SFML/Config.hpp>
#include <SFML/GpuPreference.hpp>
#include <SFML/Graphics.hpp>
#include <SFML/Main.hpp>
#include <SFML/Network.hpp>
#include <SFML/OpenGL.hpp>
#include <SFML/System.hpp>
#include <SFML/Window.hpp>
```

Include dependency graph for includes.h:



This graph shows which files directly or indirectly include this file:



5.7.1 Detailed Description

Header file for various includes.

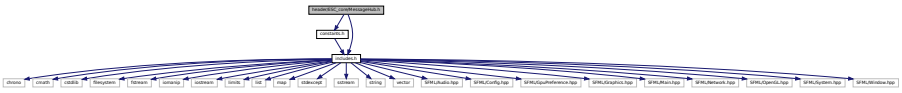
Ref: Gomila [2023]

5.8 header/ESC_core/MessageHub.h File Reference

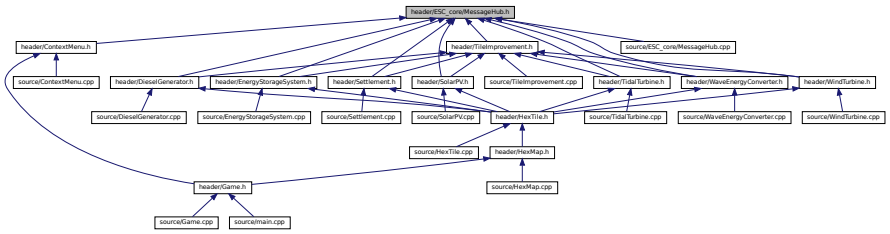
Header file for the MessageHub class.

```
#include "constants.h"
#include "includes.h"
```

Include dependency graph for MessageHub.h:



This graph shows which files directly or indirectly include this file:



Classes

- struct Message

  A structure which defines a standard message format.
- class MessageHub

  A class which acts as a central hub for inter-object message traffic.

5.8.1 Detailed Description

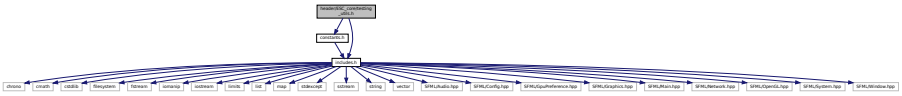
Header file for the MessageHub class.

5.9 header/ESC_core/testing_utils.h File Reference

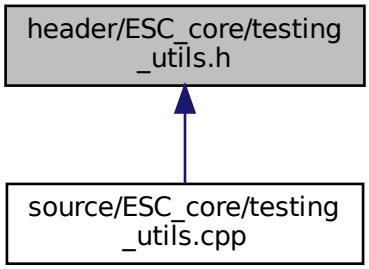
Header file for various testing utilities.

```
#include "constants.h"
#include "includes.h"
```

Include dependency graph for testing_utils.h:



This graph shows which files directly or indirectly include this file:



Functions

- void printGreen (std::string)

  A function that sends green text to std::cout.
- void printGold (std::string)

  A function that sends gold text to std::cout.
- void printRed (std::string)

  A function that sends red text to std::cout.
- void testFloatEquals (double, double, std::string, int)

  Tests for the equality of two floating point numbers x and y (to within FLOAT_TOLERANCE).
- void testGreaterThan (double, double, std::string, int)

  Tests if x > y.
- void testGreaterThanOrEqualTo (double, double, std::string, int)

  Tests if x >= y.
- void testLessThan (double, double, std::string, int)

  Tests if x < y.
- void testLessThanOrEqualTo (double, double, std::string, int)

  Tests if x <= y.
- void testTruth (bool, std::string, int)

  Tests if the given statement is true.
- void expectedErrorNotDetected (std::string, int)

  A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

5.9.1 Detailed Description

Header file for various testing utilities.

This is a library of utility functions used throughout the various test suites.

5.9.2 Function Documentation

5.9.2.1 expectedErrorNotDetected()

```
void expectedErrorNotDetected (
            std::string file,
            int line )
```

A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

Parameters

file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
464 {
465     std::string error_str = "\n ERROR  failed to throw expected error prior to line ";
466     error_str += std::to_string(line);
467     error_str += " of ";
468     error_str += file;
469 
470     #ifdef _WIN32
471         std::cout « error_str « std::endl;
472     #endif
473 
474     throw std::runtime_error(error_str);
475     return;
476 }   /* expectedErrorNotDetected() */
```

5.9.2.2 printGold()

```
void printGold (
            std::string input_str )
```

A function that sends gold text to std::cout.

Parameters

input_str	The text of the string to be sent to std::cout.

```
116 {
117     std::cout « "\x1B[33m" « input_str « "\033[0m";
118     return;
119 }   /* printGold() */
```

5.9.2.3 printGreen()

```
void printGreen (
            std::string input_str )
```

A function that sends green text to std::cout.

Parameters

input_str	The text of the string to be sent to std::cout.

```
96 {
97     std::cout « "\x1B[32m" « input_str « "\033[0m";
98     return;
99 }   /* printGreen() */
```

5.9.2.4 printRed()

```
void printRed (
            std::string input_str )
```

A function that sends red text to std::cout.

Parameters

input_str	The text of the string to be sent to std::cout.

```
136 {
137     std::cout « "\x1B[31m" « input_str « "\033[0m";
138     return;
139 }   /* printRed() */
```

5.9.2.5 testFloatEquals()

```
void testFloatEquals (
            double x,
            double y,
            std::string file,
            int line )
```

Tests for the equality of two floating point numbers *x* and *y* (to within FLOAT_TOLERANCE).

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
170 {
171     if (fabs(x - y) <= FLOAT_TOLERANCE) {
172         return;
```

```
173     }
174
175     std::string error_str = "ERROR: testFloatEquals():\t in ";
176     error_str += file;
177     error_str += "\tline ";
178     error_str += std::to_string(line);
179     error_str += ":\t\n";
180     error_str += std::to_string(x);
181     error_str += " and ";
182     error_str += std::to_string(y);
183     error_str += " are not equal to within +/- ";
184     error_str += std::to_string(FLOAT_TOLERANCE);
185     error_str += "\n";
186
187     #ifdef _WIN32
188         std::cout << error_str << std::endl;
189     #endif
190
191     throw std::runtime_error(error_str);
192     return;
193 }   /* testFloatEquals() */
```

5.9.2.6 testGreaterThan()

```
void testGreaterThan (
             double x,
             double y,
             std::string file,
             int line )
```

Tests if x > y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
223 {
224     if (x > y) {
225         return;
226     }
227
228     std::string error_str = "ERROR: testGreaterThan():\t in ";
229     error_str += file;
230     error_str += "\tline ";
231     error_str += std::to_string(line);
232     error_str += ":\t\n";
233     error_str += std::to_string(x);
234     error_str += " is not greater than ";
235     error_str += std::to_string(y);
236     error_str += "\n";
237
238     #ifdef _WIN32
239         std::cout << error_str << std::endl;
240     #endif
241
242     throw std::runtime_error(error_str);
243     return;
244 }   /* testGreaterThan() */
```

5.9.2.7 testGreaterThanOrEqualTo()

```
void testGreaterThanOrEqualTo (
             double x,
```

```
            double y,
            std::string file,
            int line )
```

Tests if x >= y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
274 {
275     if (x >= y) {
276         return;
277     }
278
279     std::string error_str = "ERROR: testGreaterThanOrEqualTo():\t in ";
280     error_str += file;
281     error_str += "\tline ";
282     error_str += std::to_string(line);
283     error_str += ":\t\n";
284     error_str += std::to_string(x);
285     error_str += " is not greater than or equal to ";
286     error_str += std::to_string(y);
287     error_str += "\n";
288
289     #ifdef _WIN32
290         std::cout << error_str << std::endl;
291     #endif
292
293     throw std::runtime_error(error_str);
294     return;
295 }   /* testGreaterThanOrEqualTo() */
```

5.9.2.8 testLessThan()

```
void testLessThan (
            double x,
            double y,
            std::string file,
            int line )
```

Tests if x < y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
325 {
326     if (x < y) {
327         return;
328     }
329
330     std::string error_str = "ERROR: testLessThan():\t in ";
331     error_str += file;
332     error_str += "\tline ";
333     error_str += std::to_string(line);
334     error_str += ":\t\n";
```

```
335     error_str += std::to_string(x);
336     error_str += " is not less than ";
337     error_str += std::to_string(y);
338     error_str += "\n";
339 
340     #ifdef _WIN32
341         std::cout « error_str « std::endl;
342     #endif
343 
344     throw std::runtime_error(error_str);
345     return;
346 }   /* testLessThan() */
```

5.9.2.9 testLessThanOrEqualTo()

```
void testLessThanOrEqualTo (
             double x,
             double y,
             std::string file,
             int line )
```

Tests if x <= y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
376 {
377     if (x <= y) {
378         return;
379     }
380 
381     std::string error_str = "ERROR: testLessThanOrEqualTo():\t in ";
382     error_str += file;
383     error_str += "\tline ";
384     error_str += std::to_string(line);
385     error_str += ":\t\n";
386     error_str += std::to_string(x);
387     error_str += " is not less than or equal to ";
388     error_str += std::to_string(y);
389     error_str += "\n";
390 
391     #ifdef _WIN32
392         std::cout « error_str « std::endl;
393     #endif
394 
395     throw std::runtime_error(error_str);
396     return;
397 }   /* testLessThanOrEqualTo() */
```

5.9.2.10 testTruth()

```
void testTruth (
             bool statement,
             std::string file,
             int line )
```

Tests if the given statement is true.

Parameters

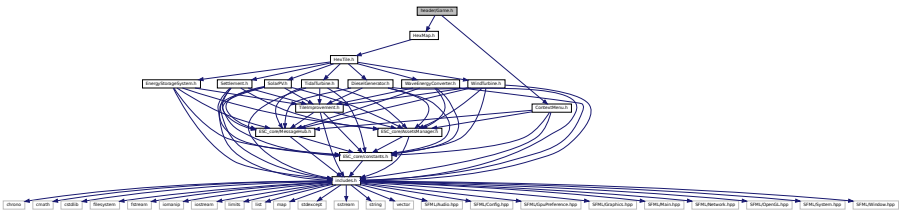
statement	The statement whose truth is to be tested ("1 == 0", for example).
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
424 {
425     if (statement) {
426         return;
427     }
428
429     std::string error_str = "ERROR: testTruth():\t in ";
430     error_str += file;
431     error_str += "\tline ";
432     error_str += std::to_string(line);
433     error_str += ":\t\n";
434     error_str += "Given statement is not true";
435
436     #ifdef _WIN32
437         std::cout « error_str « std::endl;
438     #endif
439
440     throw std::runtime_error(error_str);
441     return;
442 }   /* testTruth() */
```

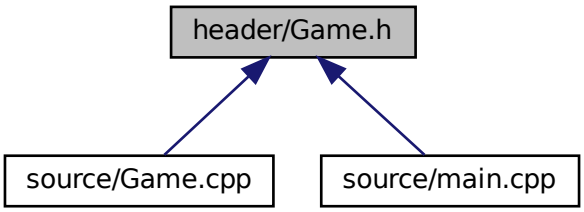
5.10 header/Game.h File Reference

```
#include "HexMap.h"
#include "ContextMenu.h"
```

Include dependency graph for Game.h:



This graph shows which files directly or indirectly include this file:



Classes

- class Game

  A class which acts as the central class for the game, by containing all other classes and implementing the game loop.

Enumerations

- enum GamePhase {
  BUILD_SETTLEMENT , SYSTEM_MANAGEMENT , LOSS_EMISSIONS , LOSS_DEMAND ,
  LOSS_CREDITS , VICTORY , N_GAME_PHASES }

  An enumeration of the various game phases.

5.10.1 Enumeration Type Documentation

5.10.1.1 GamePhase

```
enum GamePhase
```

An enumeration of the various game phases.

Enumerator

BUILD_SETTLEMENT	The settlement building phase.
SYSTEM_MANAGEMENT	The system management phase (main phase of play).
LOSS_EMISSIONS	A loss due to excessive emissions.
LOSS_DEMAND	A loss due to failing to meet the demand.
LOSS_CREDITS	A loss due to running out of credits.
VICTORY	A victory (12 consecutive months of zero emissions).
N_GAME_PHASES	A simple hack to get the number of elements in GamePhase.

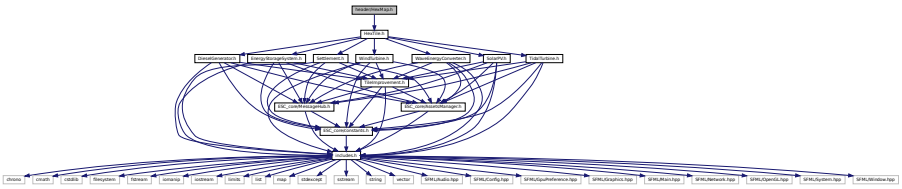
```
66                {
67      BUILD_SETTLEMENT,
68      SYSTEM_MANAGEMENT,
69      LOSS_EMISSIONS,
70      LOSS_DEMAND,
71      LOSS_CREDITS,
72      VICTORY,
73      N_GAME_PHASES
74  };  /* GamePhase */
```

5.11 header/HexMap.h File Reference

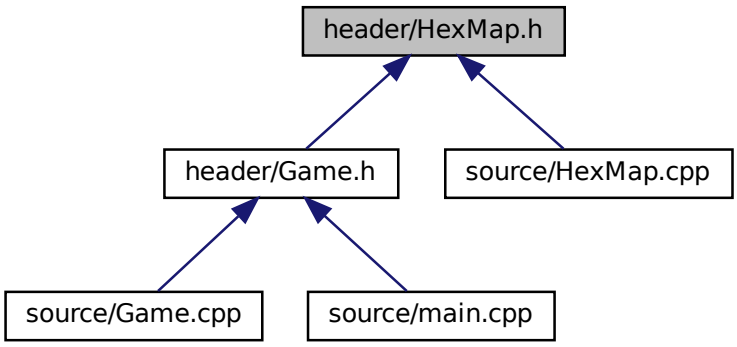
Header file for the HexMap class.

```
#include "HexTile.h"
```

Include dependency graph for HexMap.h:



This graph shows which files directly or indirectly include this file:



Classes

- class HexMap

  A class which defines a hex map of hex tiles.

5.11.1 Detailed Description

Header file for the HexMap class.

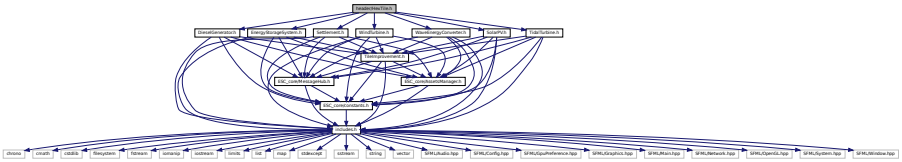
5.12 header/HexTile.h File Reference

Header file for the Game class.

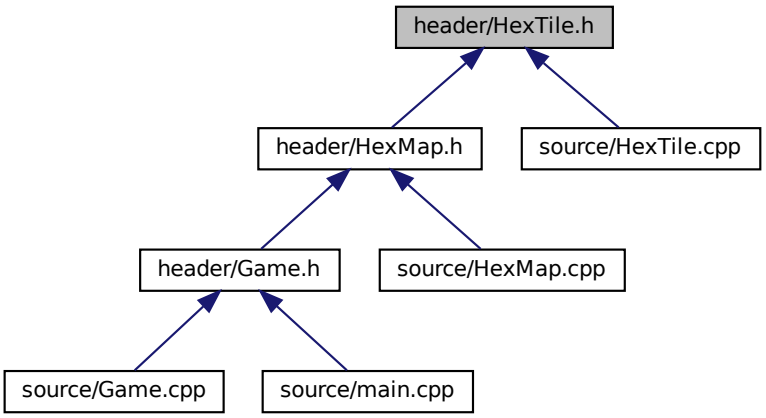
```
#include "DieselGenerator.h"
#include "EnergyStorageSystem.h"
#include "Settlement.h"
#include "SolarPV.h"
#include "TidalTurbine.h"
#include "WaveEnergyConverter.h"
```

```
#include "WindTurbine.h"
```

Include dependency graph for HexTile.h:



This graph shows which files directly or indirectly include this file:



Classes

- class HexTile

  A class which defines a hex tile of the hex map.

Enumerations

- enum TileType {
  NONE_TYPE , FOREST , LAKE , MOUNTAINS ,
  OCEAN , PLAINS , N_TILE_TYPES }

  An enumeration of the different tile types.
- enum TileResource {
  POOR , BELOW_AVERAGE , AVERAGE , ABOVE_AVERAGE ,
  GOOD , N_TILE_RESOURCES }

  An enumeration of the different tile resource values.

5.12.1 Detailed Description

Header file for the Game class.

Header file for the HexTile class.

5.12.2 Enumeration Type Documentation

5.12.2.1 TileResource

```
enum TileResource
```

An enumeration of the different tile resource values.

Enumerator

POOR	A poor resource value.
BELOW_AVERAGE	A below average resource value.
AVERAGE	An average resource value.
ABOVE_AVERAGE	An above average resource value.
GOOD	A good resource value.
N_TILE_RESOURCES	A simple hack to get the number of elements in TileResource.

```
88                  {
89     POOR,
90     BELOW_AVERAGE,
91     AVERAGE,
92     ABOVE_AVERAGE,
93     GOOD,
94     N_TILE_RESOURCES
95 };  /* TileResource */
```

5.12.2.2 TileType

```
enum TileType
```

An enumeration of the different tile types.

Enumerator

NONE_TYPE	A dummy tile (for initialization).
FOREST	A forest tile.
LAKE	A lake tile.
MOUNTAINS	A mountains tile.
OCEAN	An ocean tile.
PLAINS	A plains tile.
N_TILE_TYPES	A simple hack to get the number of elements in TileType.

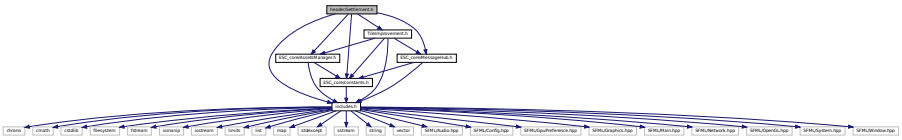
```
71              {
72     NONE_TYPE,
73     FOREST,
74     LAKE,
75     MOUNTAINS,
76     OCEAN,
77     PLAINS,
78     N_TILE_TYPES
79 }; /* TileType */
```

5.13 header/Settlement.h File Reference

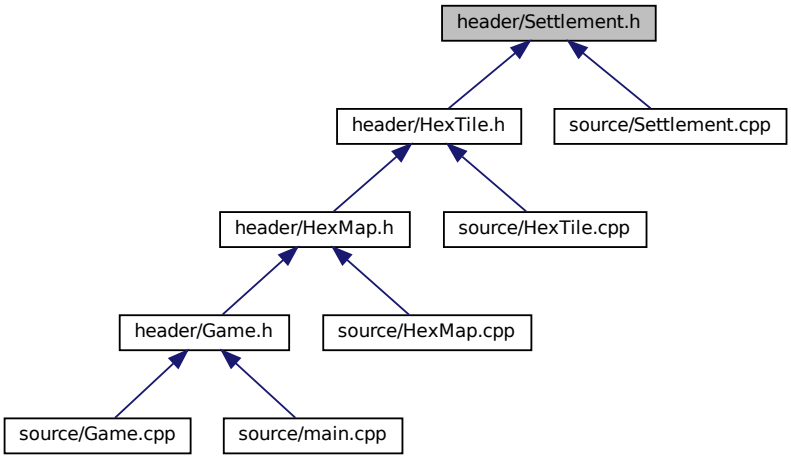
Header file for the Settlement class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
#include "TileImprovement.h"
```

Include dependency graph for Settlement.h:



This graph shows which files directly or indirectly include this file:



Classes

- class Settlement

  A settlement class (child class of TileImprovement).

5.13.1 Detailed Description

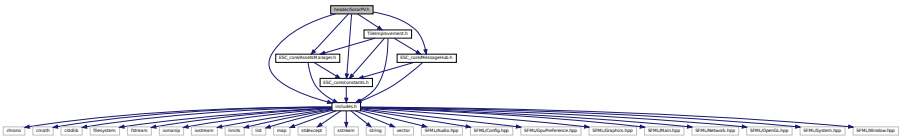
Header file for the Settlement class.

5.14 header/SolarPV.h File Reference

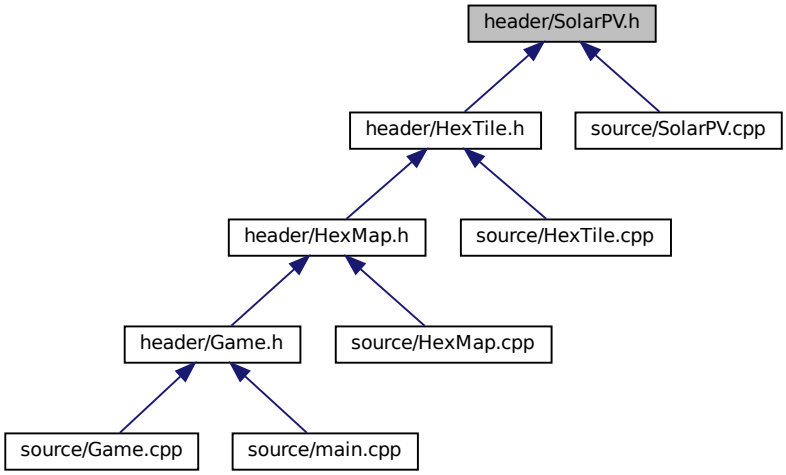
Header file for the SolarPV class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
#include "TileImprovement.h"
```

Include dependency graph for SolarPV.h:



This graph shows which files directly or indirectly include this file:



Classes

- class SolarPV

  A settlement class (child class of TileImprovement).

5.14.1 Detailed Description

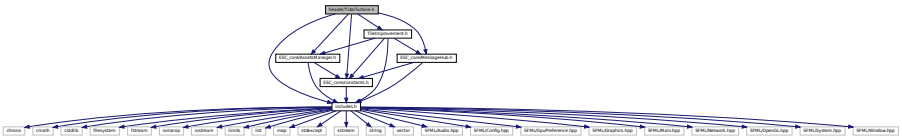
Header file for the SolarPV class.

5.15 header/TidalTurbine.h File Reference

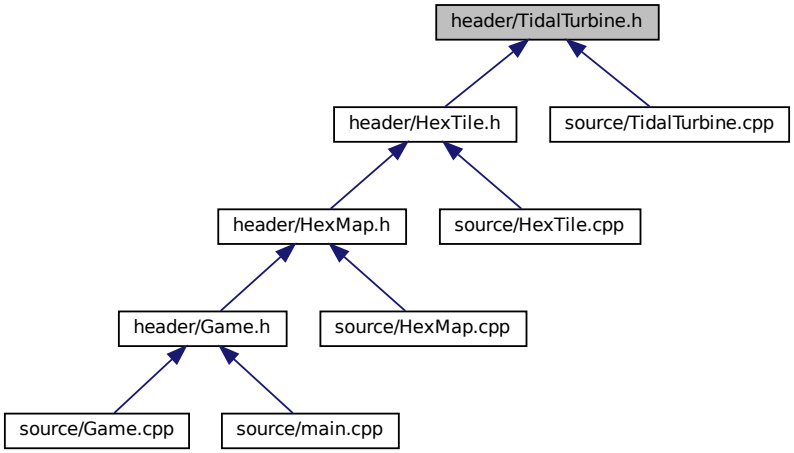
Header file for the TidalTurbine class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
#include "TileImprovement.h"
```

Include dependency graph for TidalTurbine.h:



This graph shows which files directly or indirectly include this file:



Classes

- class TidalTurbine

  A settlement class (child class of TileImprovement).

5.15.1 Detailed Description

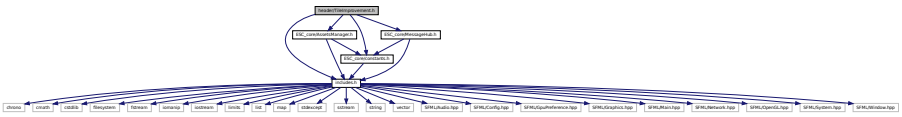
Header file for the TidalTurbine class.

5.16 header/TileImprovement.h File Reference

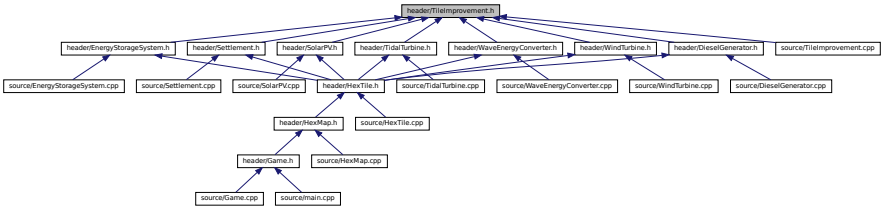
Header file for the TileImprovement class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
```

Include dependency graph for TileImprovement.h:



This graph shows which files directly or indirectly include this file:



Classes

- class TileImprovement

  A base class for the tile improvement hierarchy.

Enumerations

- enum TileImprovementType {
  SETTLEMENT , DIESEL_GENERATOR , SOLAR_PV , WIND_TURBINE ,
  TIDAL_TURBINE , WAVE_ENERGY_CONVERTER , ENERGY_STORAGE_SYSTEM , N_TILE_IMPROVEMENT_TYPES
  }

  An enumeration of the different tile improvement types.

5.16.1 Detailed Description

Header file for the TileImprovement class.

5.16.2 Enumeration Type Documentation

5.16.2.1 TileImprovementType

```
enum TileImprovementType
```

An enumeration of the different tile improvement types.

Enumerator

SETTLEMENT	A settlement.
DIESEL_GENERATOR	A diesel generator.
SOLAR_PV	A solar PV array.
WIND_TURBINE	A wind turbine.
TIDAL_TURBINE	A tidal turbine.
WAVE_ENERGY_CONVERTER	A wave energy converter.
ENERGY_STORAGE_SYSTEM	An energy storage system.
N_TILE_IMPROVEMENT_TYPES	A simple hack to get the number of elements in TileImprovementType.

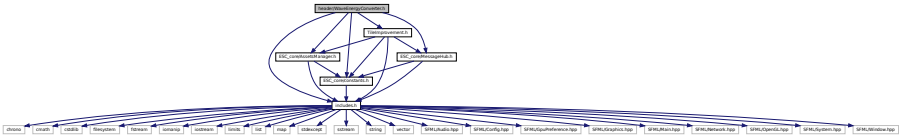
```
68                          {
69     SETTLEMENT,
70     DIESEL_GENERATOR,
71     SOLAR_PV,
72     WIND_TURBINE,
73     TIDAL_TURBINE,
74     WAVE_ENERGY_CONVERTER,
75     ENERGY_STORAGE_SYSTEM,
76     N_TILE_IMPROVEMENT_TYPES
77 };  /* TileImprovementType */
```

5.17 header/WaveEnergyConverter.h File Reference

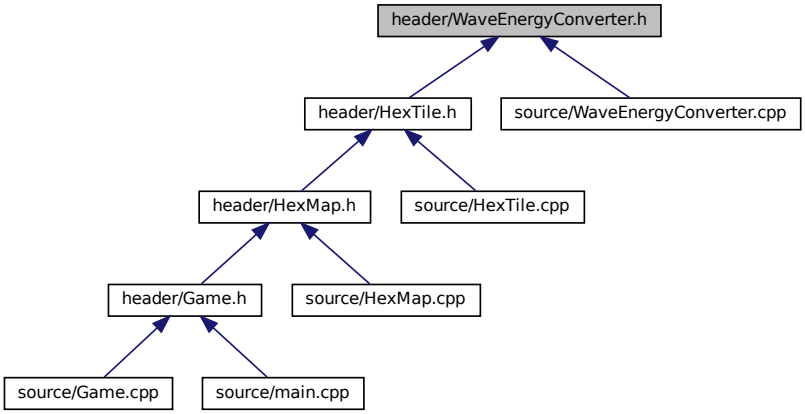
Header file for the WaveEnergyConverter class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
#include "TileImprovement.h"
```

Include dependency graph for WaveEnergyConverter.h:



This graph shows which files directly or indirectly include this file:



Classes

- class WaveEnergyConverter

  A settlement class (child class of TileImprovement).

5.17.1 Detailed Description

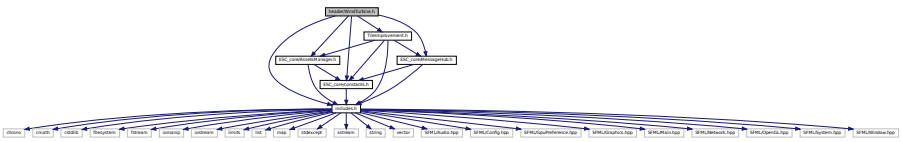
Header file for the WaveEnergyConverter class.

5.18 header/WindTurbine.h File Reference

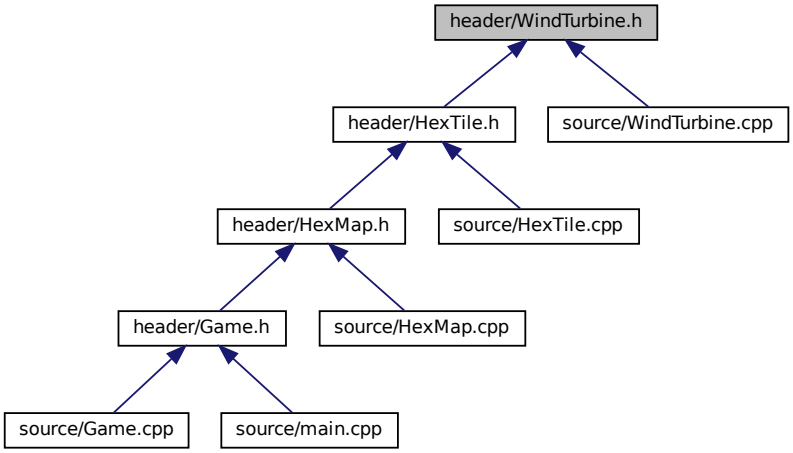
Header file for the WindTurbine class.

```
#include "ESC_core/constants.h"
#include "ESC_core/includes.h"
#include "ESC_core/AssetsManager.h"
#include "ESC_core/MessageHub.h"
#include "TileImprovement.h"
```

Include dependency graph for WindTurbine.h:



This graph shows which files directly or indirectly include this file:



Classes

- class WindTurbine

  A settlement class (child class of TileImprovement).

5.18.1 Detailed Description

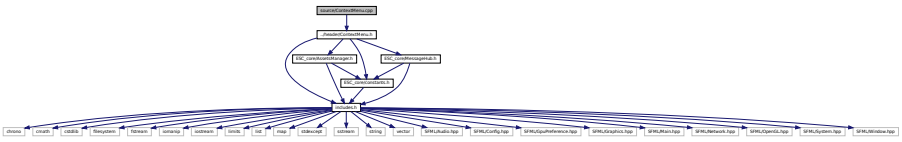
Header file for the WindTurbine class.

5.19 source/ContextMenu.cpp File Reference

Implementation file for the ContextMenu class.

```
#include "../header/ContextMenu.h"
```

Include dependency graph for ContextMenu.cpp:



5.19.1 Detailed Description

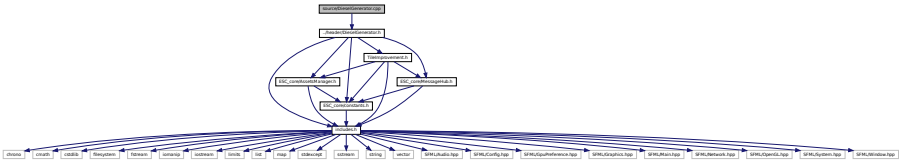
Implementation file for the ContextMenu class.

A class which defines a context menu for the game.

5.20 source/DieselGenerator.cpp File Reference

Implementation file for the DieselGenerator class.

```
#include "../header/DieselGenerator.h"
```
Include dependency graph for DieselGenerator.cpp:



5.20.1 Detailed Description

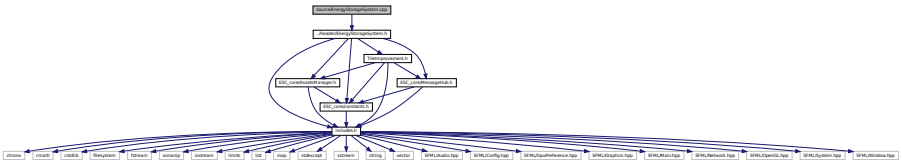
Implementation file for the DieselGenerator class.

A base class for the tile improvement hierarchy.

5.21 source/EnergyStorageSystem.cpp File Reference

Implementation file for the EnergyStorageSystem class.

```
#include "../header/EnergyStorageSystem.h"
```
Include dependency graph for EnergyStorageSystem.cpp:



5.21.1 Detailed Description

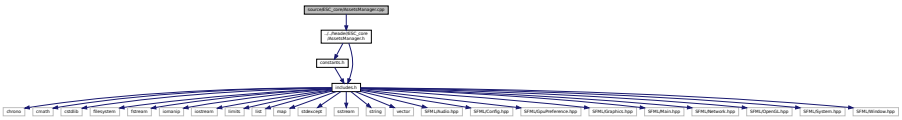
Implementation file for the EnergyStorageSystem class.

A base class for the tile improvement hierarchy.

5.22 source/ESC_core/AssetsManager.cpp File Reference

Implementation file for the AssetsManager class.

```
#include "../../header/ESC_core/AssetsManager.h"
```
Include dependency graph for AssetsManager.cpp:



5.22.1 Detailed Description

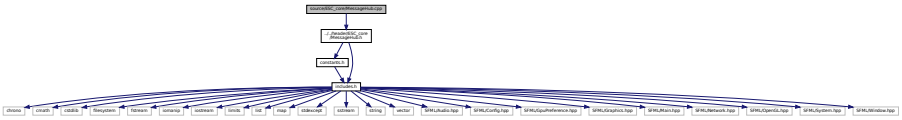
Implementation file for the AssetsManager class.

A class which manages visual and sound assets.

5.23 source/ESC_core/MessageHub.cpp File Reference

Implementation file for the MessageHub class.

```
#include "../../header/ESC_core/MessageHub.h"
```
Include dependency graph for MessageHub.cpp:



5.23.1 Detailed Description

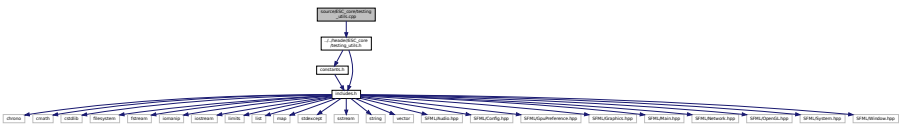
Implementation file for the MessageHub class.

A class which acts as a central hub for inter-object message traffic.

5.24 source/ESC_core/testing_utils.cpp File Reference

Implementation file for various testing utilities.

```
#include "../../header/ESC_core/testing_utils.h"
```
Include dependency graph for testing_utils.cpp:



Functions

- void printGreen (std::string input_str)

  A function that sends green text to std::cout.
- void printGold (std::string input_str)

  A function that sends gold text to std::cout.
- void printRed (std::string input_str)

  A function that sends red text to std::cout.
- void testFloatEquals (double x, double y, std::string file, int line)

  Tests for the equality of two floating point numbers x and y (to within FLOAT_TOLERANCE).
- void testGreaterThan (double x, double y, std::string file, int line)

  Tests if x > y.
- void testGreaterThanOrEqualTo (double x, double y, std::string file, int line)

  Tests if x >= y.
- void testLessThan (double x, double y, std::string file, int line)

  Tests if x < y.
- void testLessThanOrEqualTo (double x, double y, std::string file, int line)

  Tests if x <= y.
- void testTruth (bool statement, std::string file, int line)

  Tests if the given statement is true.
- void expectedErrorNotDetected (std::string file, int line)

  A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

5.24.1 Detailed Description

Implementation file for various testing utilities.

This is a library of utility functions used throughout the various test suites.

5.24.2 Function Documentation

5.24.2.1 expectedErrorNotDetected()

```
void expectedErrorNotDetected (
            std::string file,
            int line )
```

A utility function to print out a meaningful error message whenever an expected error fails to be thrown/caught/detected.

Parameters

file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
464 {
465     std::string error_str = "\n ERROR  failed to throw expected error prior to line ";
466     error_str += std::to_string(line);
```

```
467     error_str += " of ";
468     error_str += file;
469
470     #ifdef _WIN32
471         std::cout « error_str « std::endl;
472     #endif
473
474     throw std::runtime_error(error_str);
475     return;
476 }   /* expectedErrorNotDetected() */
```

5.24.2.2 printGold()

```
void printGold (
              std::string input_str )
```

A function that sends gold text to std::cout.

Parameters

input_str	The text of the string to be sent to std::cout.

```
116 {
117     std::cout « "\x1B[33m" « input_str « "\033[0m";
118     return;
119 }   /* printGold() */
```

5.24.2.3 printGreen()

```
void printGreen (
              std::string input_str )
```

A function that sends green text to std::cout.

Parameters

input_str	The text of the string to be sent to std::cout.

```
96 {
97     std::cout « "\x1B[32m" « input_str « "\033[0m";
98     return;
99 }   /* printGreen() */
```

5.24.2.4 printRed()

```
void printRed (
              std::string input_str )
```

A function that sends red text to std::cout.

Parameters

input_str	The text of the string to be sent to std::cout.

```
136 {
137     std::cout « "\x1B[31m" « input_str « "\033[0m";
138     return;
139 }   /* printRed() */
```

5.24.2.5 testFloatEquals()

```
void testFloatEquals (
              double x,
              double y,
              std::string file,
              int line )
```

Tests for the equality of two floating point numbers *x* and *y* (to within FLOAT_TOLERANCE).

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
170 {
171     if (fabs(x - y) <= FLOAT_TOLERANCE) {
172         return;
173     }
174 
175     std::string error_str = "ERROR: testFloatEquals():\t in ";
176     error_str += file;
177     error_str += "\tline ";
178     error_str += std::to_string(line);
179     error_str += ":\t\n";
180     error_str += std::to_string(x);
181     error_str += " and ";
182     error_str += std::to_string(y);
183     error_str += " are not equal to within +/- ";
184     error_str += std::to_string(FLOAT_TOLERANCE);
185     error_str += "\n";
186 
187     #ifdef _WIN32
188         std::cout « error_str « std::endl;
189     #endif
190 
191     throw std::runtime_error(error_str);
192     return;
193 }   /* testFloatEquals() */
```

5.24.2.6 testGreaterThan()

```
void testGreaterThan (
              double x,
              double y,
              std::string file,
              int line )
```

Tests if x $>$ y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
223 {
224     if (x > y) {
225         return;
226     }
227
228     std::string error_str = "ERROR: testGreaterThan():\t in ";
229     error_str += file;
230     error_str += "\tline ";
231     error_str += std::to_string(line);
232     error_str += ":\t\n";
233     error_str += std::to_string(x);
234     error_str += " is not greater than ";
235     error_str += std::to_string(y);
236     error_str += "\n";
237
238     #ifdef _WIN32
239         std::cout « error_str « std::endl;
240     #endif
241
242     throw std::runtime_error(error_str);
243     return;
244 }   /* testGreaterThan() */
```

5.24.2.7 testGreaterThanOrEqualTo()

```
void testGreaterThanOrEqualTo (
              double x,
              double y,
              std::string file,
              int line )
```

Tests if x >= y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
274 {
275     if (x >= y) {
276         return;
277     }
278
279     std::string error_str = "ERROR: testGreaterThanOrEqualTo():\t in ";
280     error_str += file;
281     error_str += "\tline ";
282     error_str += std::to_string(line);
283     error_str += ":\t\n";
284     error_str += std::to_string(x);
285     error_str += " is not greater than or equal to ";
286     error_str += std::to_string(y);
287     error_str += "\n";
288
289     #ifdef _WIN32
290         std::cout « error_str « std::endl;
291     #endif
292
293     throw std::runtime_error(error_str);
```

```
294     return;
295 }   /* testGreaterThanOrEqualTo() */
```

5.24.2.8 testLessThan()

```
void testLessThan (
            double x,
            double y,
            std::string file,
            int line )
```

Tests if x < y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
325 {
326     if (x < y) {
327         return;
328     }
329 
330     std::string error_str = "ERROR: testLessThan():\t in ";
331     error_str += file;
332     error_str += "\tline ";
333     error_str += std::to_string(line);
334     error_str += ":\t\n";
335     error_str += std::to_string(x);
336     error_str += " is not less than ";
337     error_str += std::to_string(y);
338     error_str += "\n";
339 
340     #ifdef _WIN32
341         std::cout « error_str « std::endl;
342     #endif
343 
344     throw std::runtime_error(error_str);
345     return;
346 }   /* testLessThan() */
```

5.24.2.9 testLessThanOrEqualTo()

```
void testLessThanOrEqualTo (
            double x,
            double y,
            std::string file,
            int line )
```

Tests if x <= y.

Parameters

x	The first of two numbers to test.
y	The second of two numbers to test.
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
376 {
377     if (x <= y) {
378         return;
379     }
380 
381     std::string error_str = "ERROR: testLessThanOrEqualTo():\t in ";
382     error_str += file;
383     error_str += "\tline ";
384     error_str += std::to_string(line);
385     error_str += ":\t\n";
386     error_str += std::to_string(x);
387     error_str += " is not less than or equal to ";
388     error_str += std::to_string(y);
389     error_str += "\n";
390 
391     #ifdef _WIN32
392         std::cout « error_str « std::endl;
393     #endif
394 
395     throw std::runtime_error(error_str);
396     return;
397 }   /* testLessThanOrEqualTo() */
```

5.24.2.10 testTruth()

```
void testTruth (
              bool statement,
              std::string file,
              int line )
```

Tests if the given statement is true.

Parameters

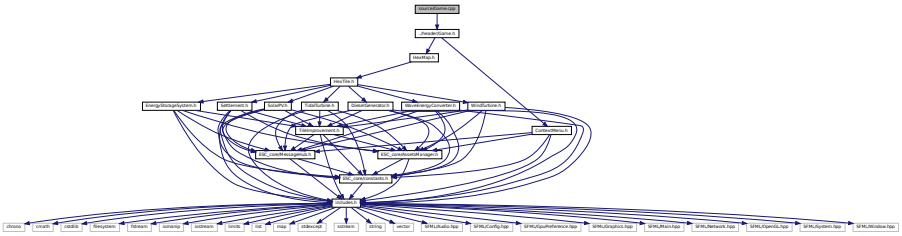
statement	The statement whose truth is to be tested ("1 == 0", for example).
file	The file in which the test is applied (you should be able to just pass in "__FILE__").
line	The line of the file in which the test is applied (you should be able to just pass in "__LINE__").

```
424 {
425     if (statement) {
426         return;
427     }
428 
429     std::string error_str = "ERROR: testTruth():\t in ";
430     error_str += file;
431     error_str += "\tline ";
432     error_str += std::to_string(line);
433     error_str += ":\t\n";
434     error_str += "Given statement is not true";
435 
436     #ifdef _WIN32
437         std::cout « error_str « std::endl;
438     #endif
439 
440     throw std::runtime_error(error_str);
441     return;
442 }   /* testTruth() */
```

5.25 source/Game.cpp File Reference

Implementation file for the Game class.

`#include "../header/Game.h"`
Include dependency graph for Game.cpp:



5.25.1 Detailed Description

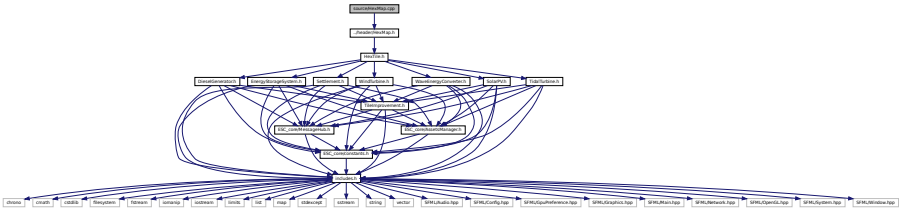
Implementation file for the Game class.

A class which defines a tile of a hex map.

5.26 source/HexMap.cpp File Reference

Implementation file for the HexMap class.

`#include "../header/HexMap.h"`
Include dependency graph for HexMap.cpp:



5.26.1 Detailed Description

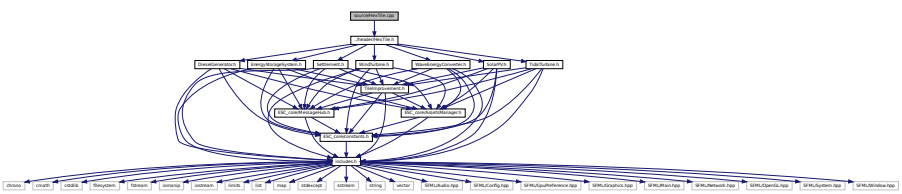
Implementation file for the HexMap class.

A class which defines a hex map of hex tiles.

5.27 source/HexTile.cpp File Reference

Implementation file for the HexTile class.

`#include "../header/HexTile.h"`
Include dependency graph for HexTile.cpp:



5.27.1 Detailed Description

Implementation file for the HexTile class.

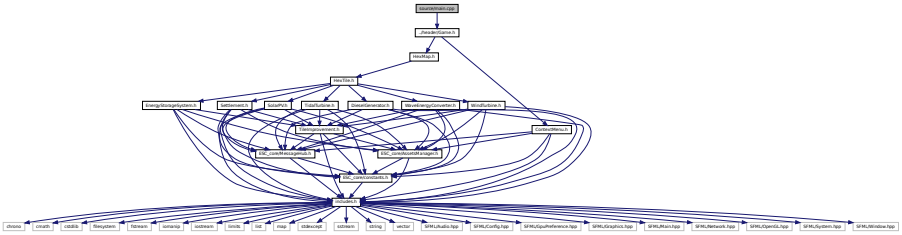
A class which defines a tile of a hex map.

5.28 source/main.cpp File Reference

Implementation file for main() for Road To Zero.

```
#include "../header/Game.h"
```

Include dependency graph for main.cpp:



Functions

- void loadAssets (AssetsManager *assets_manager_ptr)

  Helper function to load game assets.
- sf::RenderWindow * constructRenderWindow (void)

  Helper function to construct render window.
- int main (int argc, char **argv)

5.28.1 Detailed Description

Implementation file for main() for Road To Zero.

5.28.2 Function Documentation

5.28.2.1 constructRenderWindow()

```
sf::RenderWindow * constructRenderWindow (
            void  )
```

Helper function to construct render window.

Returns

Pointer to the render window.

```
294 {
295     sf::RenderWindow* render_window_ptr = new sf::RenderWindow(
296         sf::VideoMode(GAME_WIDTH, GAME_HEIGHT),
297         "Road To Zero"
298     );
299 
300     return render_window_ptr;
301 }   /* constructRenderWindow() */
```

5.28.2.2 loadAssets()

```
void loadAssets (
            AssetsManager * assets_manager_ptr )
```

Helper function to load game assets.

Parameters

assets_manager_ptr	Pointer to the assets manager.

```
66 {
67     //  1. load font assets
68     assets_manager_ptr->loadFont("assets/fonts/DroidSansMono.ttf", "DroidSansMono");
69     assets_manager_ptr->loadFont("assets/fonts/Glass_TTY_VT220.ttf", "Glass_TTY_VT220");
70 
71 
72     //  2. load tile sheets
73     assets_manager_ptr->loadTexture(
74         "assets/tile_sheets/pine_tree_64x64_1_CC-BY.png",
75         "pine_tree_64x64_1"
76     );
77 
78     assets_manager_ptr->loadTexture(
79         "assets/tile_sheets/wheat_64x64_1_CC-BY.png",
80         "wheat_64x64_1"
81     );
82 
83     assets_manager_ptr->loadTexture(
84         "assets/tile_sheets/mountain_64x64_1_CC-BY.png",
85         "mountain_64x64_1"
86     );
87 
88     assets_manager_ptr->loadTexture(
89         "assets/tile_sheets/water_waves_64x64_1_CC-BY.png",
90         "water_waves_64x64_1"
91     );
92 
93     assets_manager_ptr->loadTexture(
94         "assets/tile_sheets/water_shimmer_64x64_1_CC-BY.png",
95         "water_shimmer_64x64_1"
96     );
97 
98     assets_manager_ptr->loadTexture(
99         "assets/tile_sheets/brick_house_64x64_1_CC-BY.png",
100         "brick_house_64x64_1"
101     );
102 
103     assets_manager_ptr->loadTexture(
104         "assets/tile_sheets/magnifying_glass_64x64_1_CC-BY.png",
105         "magnifying_glass_64x64_1"
106     );
107 
108     assets_manager_ptr->loadTexture(
109         "assets/tile_sheets/exp2_0_CC0.png",
110         "tile clear explosion"
111     );
112 
113     assets_manager_ptr->loadTexture(
114         "assets/tile_sheets/emissions_8x8_1_CC-BY.png",
115         "emissions"
116     );
117 
118     assets_manager_ptr->loadTexture(
119         "assets/tile_sheets/diesel_generator_64x64_2_CC-BY.png",
120         "diesel generator"
121     );
122 
123     assets_manager_ptr->loadTexture(
124         "assets/tile_sheets/solar_PV_64x64_1_CC-BY.png",
125         "solar PV array"
126     );
127 
128     assets_manager_ptr->loadTexture(
129         "assets/tile_sheets/wind_turbine_64x64_2_CC-BY.png",
130         "wind turbine"
131     );
132 
133     assets_manager_ptr->loadTexture(
134         "assets/tile_sheets/energy_storage_system_64x64_1_CC-BY.png",
135         "energy storage system"
```

```
136     );
137
138     assets_manager_ptr->loadTexture(
139         "assets/tile_sheets/tidal_turbine_64x64_2_CC-BY.png",
140         "tidal turbine"
141     );
142
143     assets_manager_ptr->loadTexture(
144         "assets/tile_sheets/wave_energy_converter_64x64_2_CC-BY.png",
145         "wave energy converter"
146     );
147
148
149     //  3. load sounds
150     assets_manager_ptr->loadSound(
151         "assets/audio/samples/mixkit-magical-coin-win-1936_MixkitFree.ogg",
152         "coin ring"
153     );
154
155     assets_manager_ptr->loadSound(
156         "assets/audio/samples/mixkit-positive-notification-951_MixkitFree.ogg",
157         "positive notification"
158     );
159
160     assets_manager_ptr->loadSound(
161         "assets/audio/samples/mixkit-sci-fi-click-900_MixkitFree.ogg",
162         "sci-fi click"
163     );
164
165     assets_manager_ptr->loadSound(
166         "assets/audio/samples/mixkit-apartment-buzzer-bell-press-932_MixkitFree.ogg",
167         "insufficient credits"
168     );
169
170     assets_manager_ptr->loadSound(
171         "assets/audio/samples/mixkit-data-scanner-2487_MixkitFree.ogg",
172         "resource assessment"
173     );
174
175     assets_manager_ptr->loadSound(
176         "assets/audio/samples/mixkit-interface-click-1126_MixkitFree.ogg",
177         "console string print"
178     );
179
180     assets_manager_ptr->loadSound(
181         "assets/audio/samples/mixkit-video-game-retro-click-237_MixkitFree.ogg",
182         "resource overlay toggle on"
183     );
184
185     assets_manager_ptr->loadSound(
186         "assets/audio/samples/mixkit-video-game-retro-click-237_REVERSED_MixkitFree.ogg",
187         "resource overlay toggle off"
188     );
189
190     assets_manager_ptr->loadSound(
191         "assets/audio/samples/mixkit-explosion-with-rocks-debris-1703_MixkitFree.ogg",
192         "clear mountains tile"
193     );
194
195     assets_manager_ptr->loadSound(
196         "assets/audio/samples/mixkit-arcade-game-explosion-2759_MixkitFree.ogg",
197         "clear non-mountains tile"
198     );
199
200     assets_manager_ptr->loadSound(
201         "assets/audio/samples/mixkit-electronic-retro-block-hit-2185_MixkitFree.ogg",
202         "place improvement"
203     );
204
205     assets_manager_ptr->loadSound(
206         "assets/audio/samples/mixkit-video-game-lock-2851_REVERSED_MixkitFree.ogg",
207         "build menu open"
208     );
209
210     assets_manager_ptr->loadSound(
211         "assets/audio/samples/mixkit-video-game-lock-2851_MixkitFree.ogg",
212         "build menu close"
213     );
214
215     assets_manager_ptr->loadSound(
216         "assets/audio/samples/mixkit-jump-into-the-water-1180_MixkitFree.ogg",
217         "splash"
218     );
219
220     assets_manager_ptr->loadSound(
221         "assets/audio/samples/505316__nuncaconoci__diesel_CC0.ogg",
222         "diesel running"
```

```
223     );
224
225     assets_manager_ptr->loadSound(
226         "assets/audio/samples/33460__pempi__320d_2_CC-BY.ogg",
227         "diesel start"
228     );
229
230     assets_manager_ptr->loadSound(
231         "assets/audio/samples/132724__andy_gardner__wind-turbine-blades_CC-BY.ogg",
232         "wind turbine running"
233     );
234
235     assets_manager_ptr->loadSound(
236         "assets/audio/samples/58416__darren1979__oceanwaves_CC-SAMPLING.ogg",
237         "ocean waves"
238     );
239
240     assets_manager_ptr->loadSound(
241         "assets/audio/samples/369927__mephisto_egmont__water-flowing-in-tubes_CC-BY.ogg",
242         "water flow"
243     );
244
245     assets_manager_ptr->loadSound(
246
       "assets/audio/samples/647663__jotraing__electric-train-motor-idle-loop-new-generation-rollingstock_CC0.ogg",
247         "energy storage system idle"
248     );
249
250     assets_manager_ptr->loadSound(
251         "assets/audio/samples/mixkit-epic-futuristic-movie-accent-2913_MixkitFree.ogg",
252         "game title screen"
253     );
254
255     assets_manager_ptr->loadSound(
256         "assets/audio/samples/mixkit-calm-park-with-people-and-children_MixkitFree.ogg",
257         "people and children"
258     );
259
260
261     //  4. load tracks
262     assets_manager_ptr->loadTrack(
263         "assets/audio/tracks/TreeStarMoon_Dobranoc_CC0.ogg",
264         "Tree Star Moon - Dobranoc"
265     );
266
267     assets_manager_ptr->loadTrack(
268         "assets/audio/tracks/TreeStarMoon_Lighthouse_CC0.ogg",
269         "Tree Star Moon - Lighthouse"
270     );
271
272     assets_manager_ptr->loadTrack(
273         "assets/audio/tracks/TreeStarMoon_SkyFarm_CC0.ogg",
274         "Tree Star Moon - Sky Farm"
275     );
276
277     return;
278 }   /* loadAssets() */
```

5.28.2.3 main()

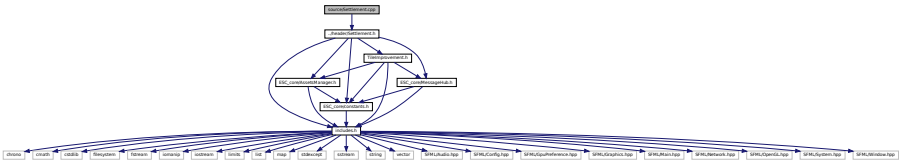
```
int main (
              int argc,
              char ** argv )
310 {
311     //  1. load assets
312     AssetsManager assets_manager;
313     loadAssets(&assets_manager);
314
315     //  2. construct render window
316     sf::RenderWindow* render_window_ptr = constructRenderWindow();
317
318     //  3. start game loop
319     bool quit_game = false;
320     assets_manager.playTrack();
321
322     while (not quit_game) {
323         Game game(render_window_ptr, &assets_manager);
324         quit_game = game.run();
325     }
```

```
326
327     //  4. clean up
328     render_window_ptr->close();
329     delete render_window_ptr;
330
331     return 0;
332 }   /* main() */
```

5.29 source/Settlement.cpp File Reference

Implementation file for the Settlement class.

`#include "../header/Settlement.h"`
Include dependency graph for Settlement.cpp:



5.29.1 Detailed Description

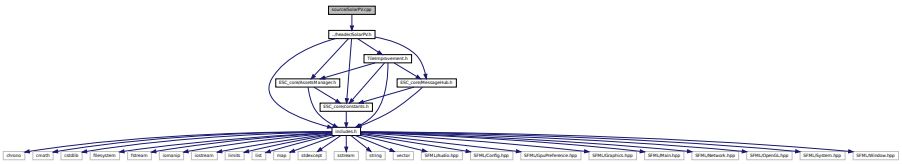
Implementation file for the Settlement class.

A base class for the tile improvement hierarchy.

5.30 source/SolarPV.cpp File Reference

Implementation file for the SolarPV class.

`#include "../header/SolarPV.h"`
Include dependency graph for SolarPV.cpp:



5.30.1 Detailed Description

Implementation file for the SolarPV class.

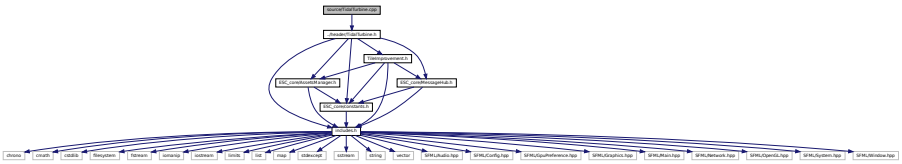
A base class for the tile improvement hierarchy.

5.31 source/TidalTurbine.cpp File Reference

Implementation file for the TidalTurbine class.

```
#include "../header/TidalTurbine.h"
```

Include dependency graph for TidalTurbine.cpp:



5.31.1 Detailed Description

Implementation file for the TidalTurbine class.

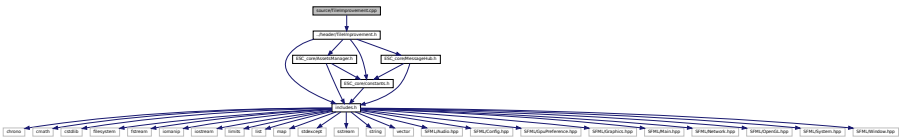
A base class for the tile improvement hierarchy.

5.32 source/TileImprovement.cpp File Reference

Implementation file for the TileImprovement class.

```
#include "../header/TileImprovement.h"
```

Include dependency graph for TileImprovement.cpp:



5.32.1 Detailed Description

Implementation file for the TileImprovement class.

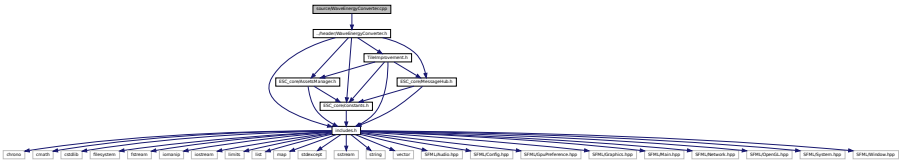
A base class for the tile improvement hierarchy.

5.33 source/WaveEnergyConverter.cpp File Reference

Implementation file for the WaveEnergyConverter class.

```
#include "../header/WaveEnergyConverter.h"
```

Include dependency graph for WaveEnergyConverter.cpp:



5.33.1 Detailed Description

Implementation file for the WaveEnergyConverter class.

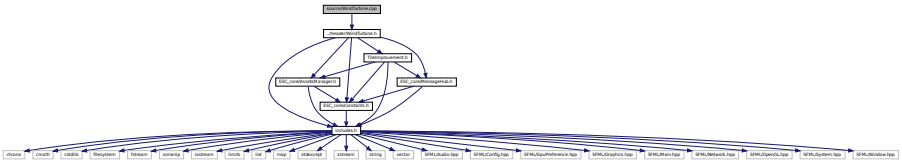
A base class for the tile improvement hierarchy.

5.34 source/WindTurbine.cpp File Reference

Implementation file for the WindTurbine class.

```
#include "../header/WindTurbine.h"
```

Include dependency graph for WindTurbine.cpp:



5.34.1 Detailed Description

Implementation file for the WindTurbine class.

A base class for the tile improvement hierarchy.

Bibliography

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