From: "Gravatt, Dan" </O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE;GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=AA541C35E726461A8D36825C87A211A2-GRAVATT,DAN>

To: Brooks
Karl;Cacho
Julia

CC: "Tapia, Cecilia" <Tapia.Cecilia@epa.gov>
"Asher, Audrey" <Asher.Audrey@epa.gov>

Date: 8/29/2013 7:05:05 AM

Subject: West Lake Landfill: cost estimate materials for today's briefing

Attachments: West Lake final SFS briefing.pdf
Supplemental Feasibility Study - West Lake Landfill OU-1 12-28-11 Table 10.pdf

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Karl, per your voicemail and the meeting invitation, here are the materials I think are responsive to your (and the Senator's) questions on the cost estimates for the remedies at West Lake. The table is Table 10 from the Supplemental Feasibility Study (December, 2011) which summarizes how the remedy alternatives meet the nine evaluation criteria including cost. The Powerpoint was created by SUPR to brief you and EPA HQ on the results of the SFS in the December 2011-January 2012 timeframe. Slide 29 of that Powerpoint gives a good side-by-side comparison of the remedies and their costs.

Daniel R. Gravatt, PG
US EPA Region 7 SUPR/MOKS
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Phone (913)-551-7324

Principles and integrity are expensive, but they are among the very few things worth having.

The West Lake Landfill OU-1 Supplemental Feasibility Study

Dan Gravatt
U.S. Environmental Protection Agency
Region 7

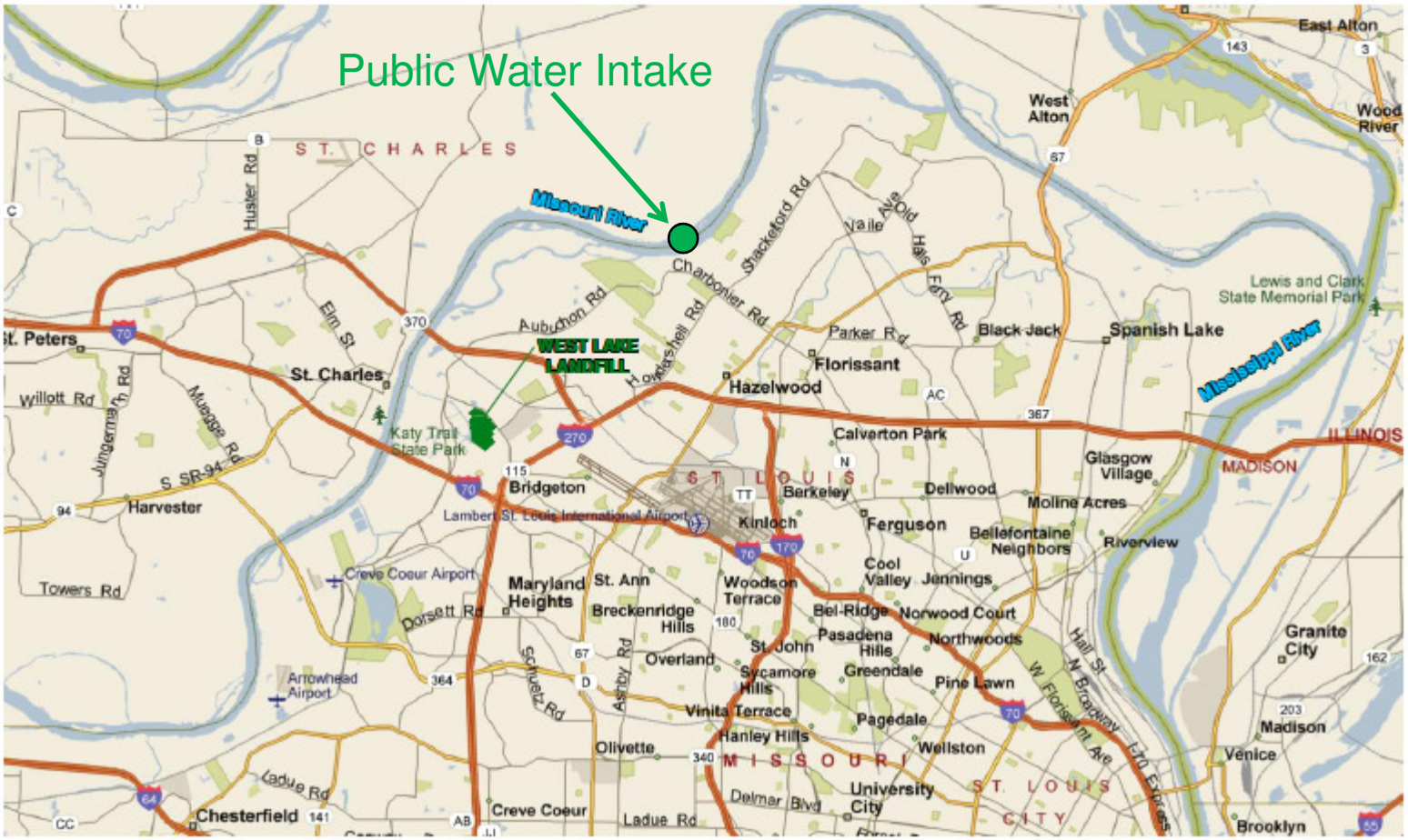


Figure 1

General Location Map

West Lake Landfill OU-1 Supplemental Feasibility Study

EMSI Engineering Management Support, Inc.

Site Boundaries

EMSI, 2006

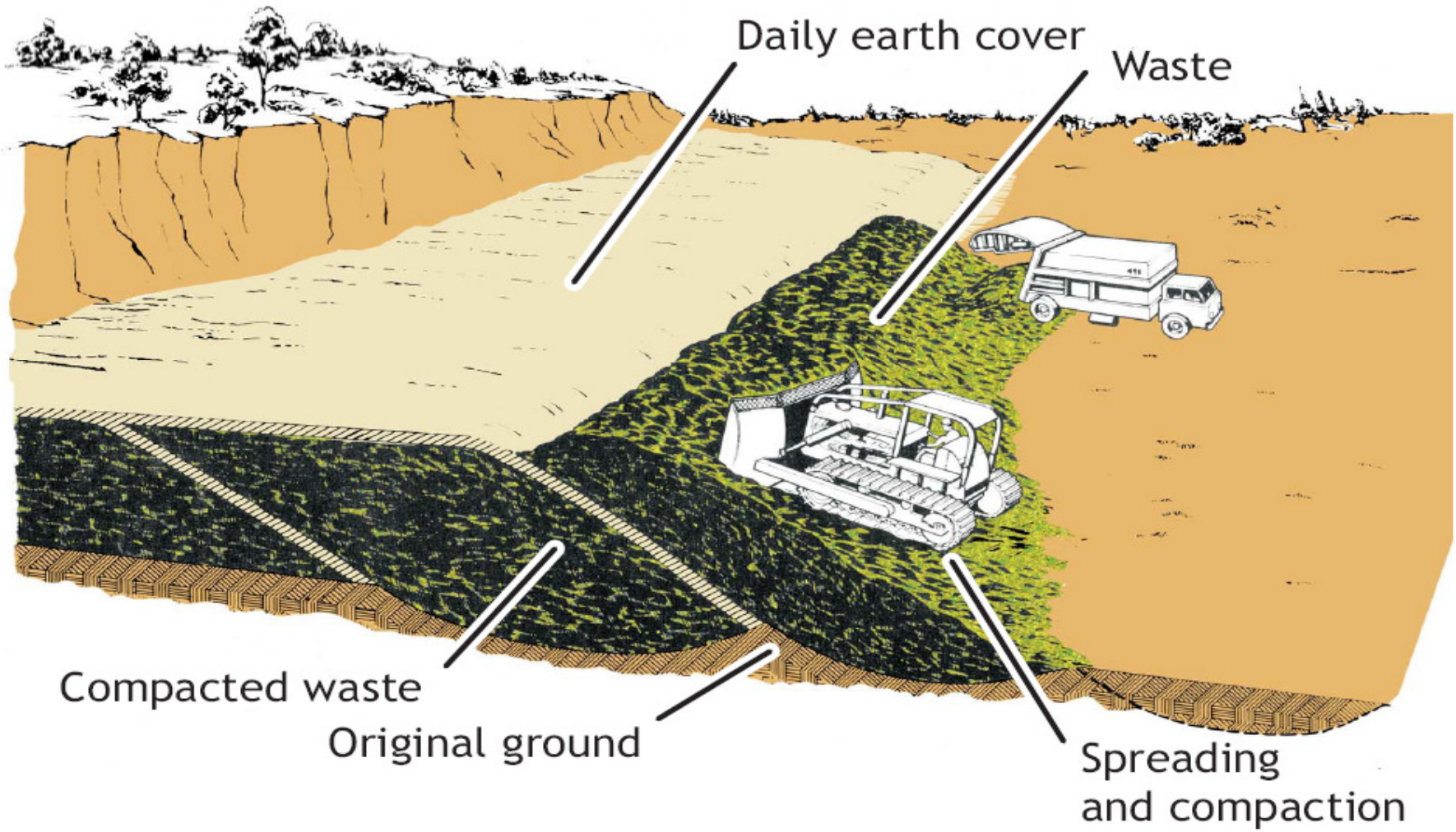
How West Lake Landfill became radiologically contaminated

- Manhattan Project work in St. Louis (Mallinckrodt)
- 8,700 tons leached barium sulfate cake (uranium 0.03% - 0.1%) left over after other, more valuable ore residues sent to Colorado for reprocessing
- Uranium concentrations and leach potential too low for commercial reprocessing
- Mixed with 39,000 tons of soil
- Given to the landfill and used as daily and intermediate cover at OU-1 Areas 1 and 2
- Contaminated soil was placed between July and October 1973

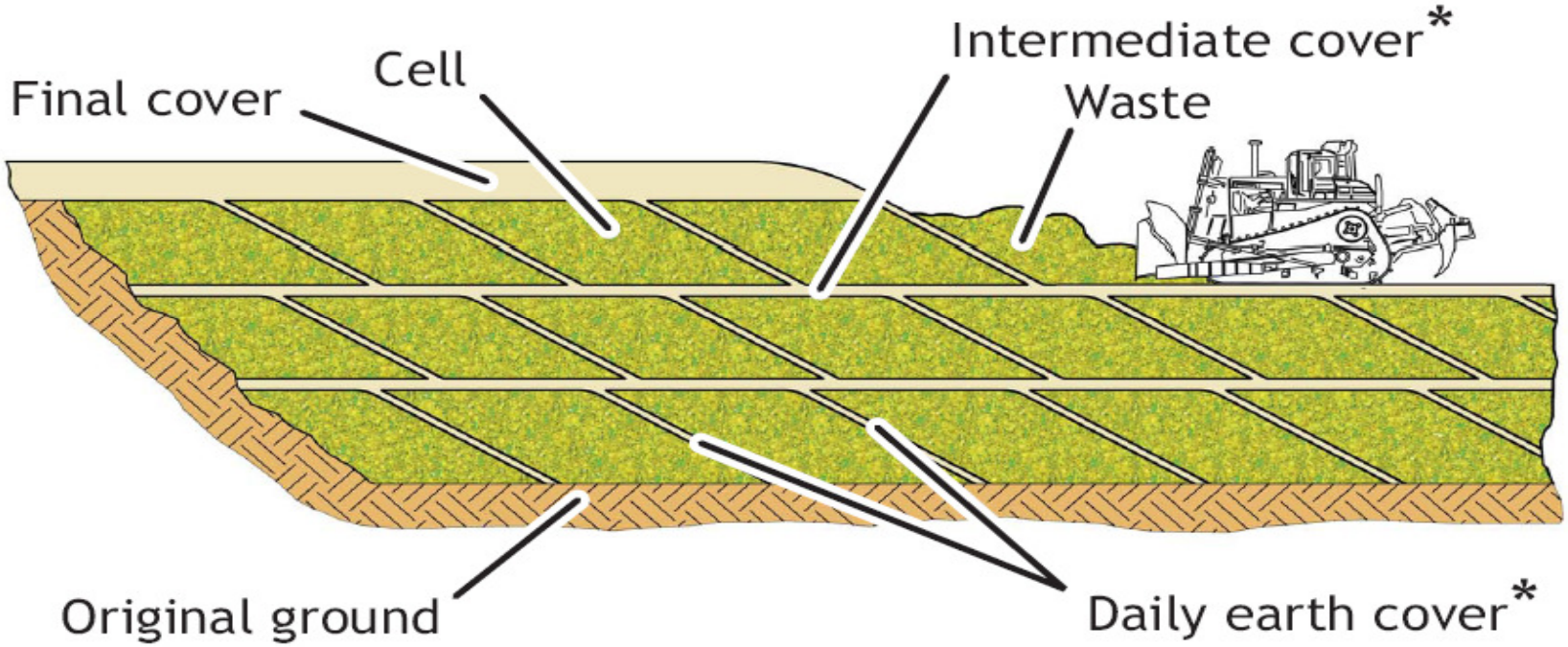
Site Areas – Operable Unit 1

- Radiological Areas 1 and 2 received municipal solid waste, construction/demolition debris, and industrial wastes
- Operated from approximately 1950 to 1974
- Buffer Zone/Crossroad Property (Ford Property) became radiologically contaminated by erosion from Area 2

GENERALIZED LANDFILL OPERATION

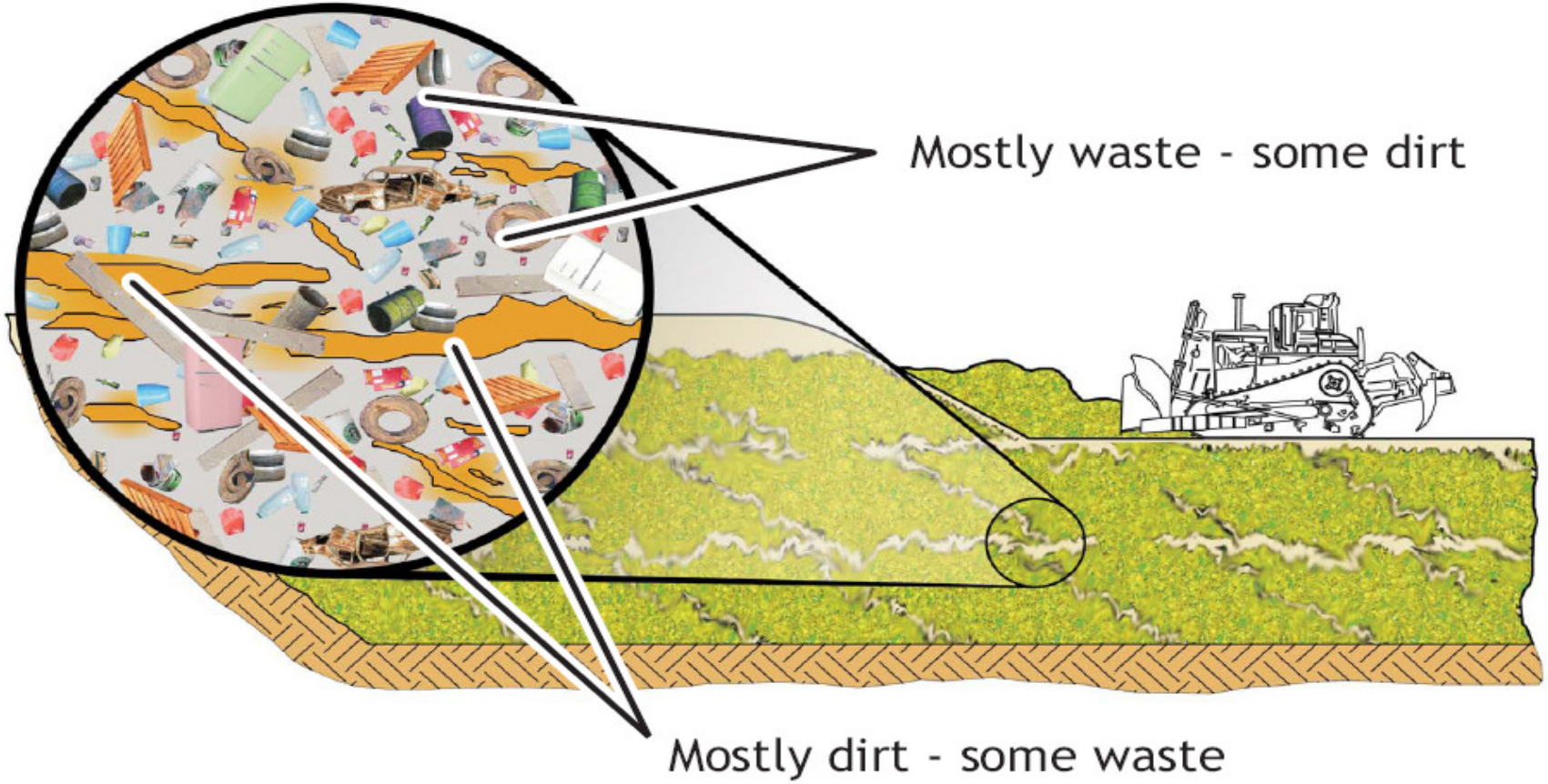


GENERALIZED LANDFILL CELL CONFIGURATION

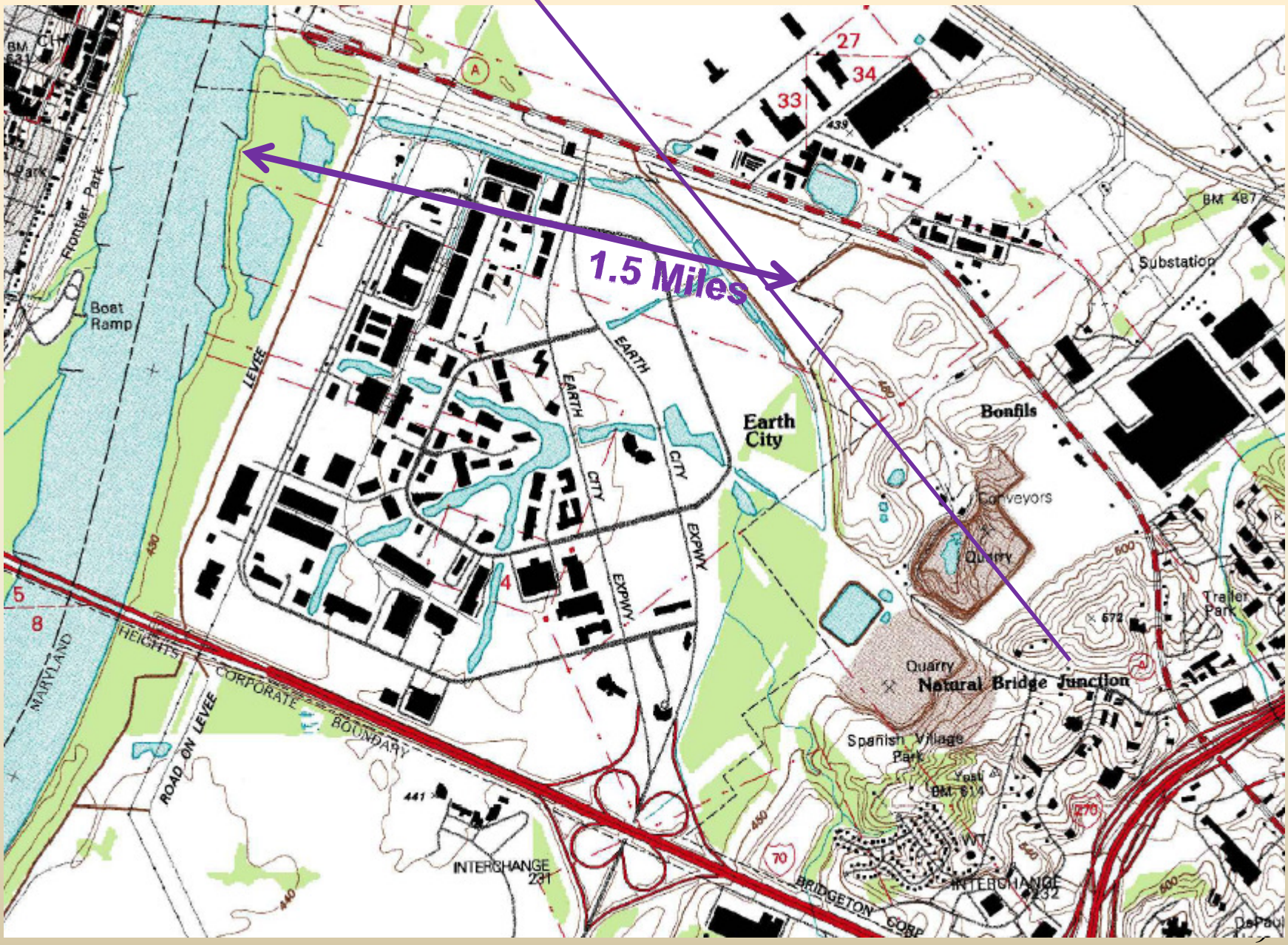


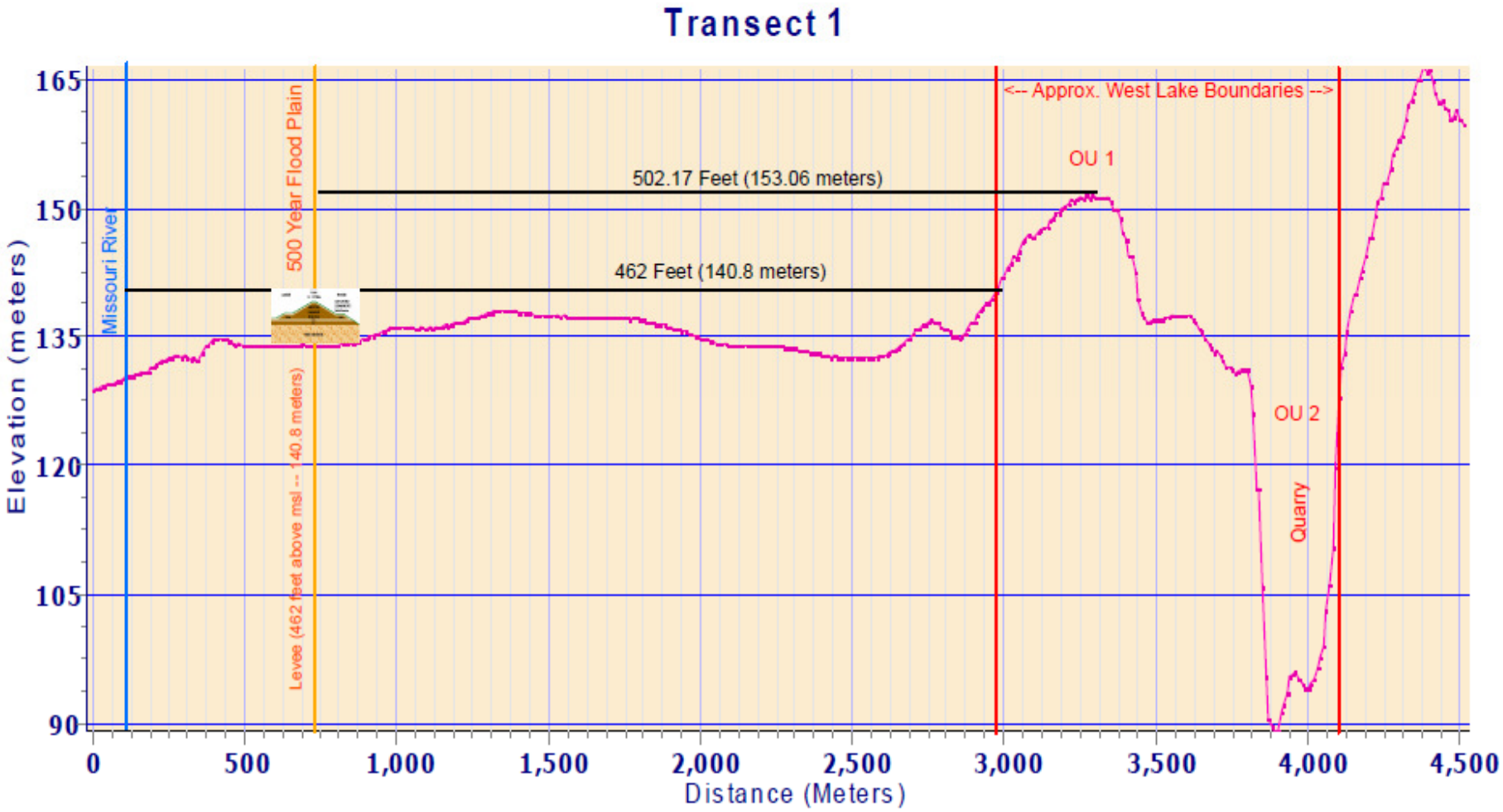
*Highly idealized soil layers. This configuration does not reflect mixing of soil with trash or distortion of soil layers by subsequent compaction and placement of additional fill.

TYPICAL MIXING OF WASTE AND DIRT IN LANDFILL

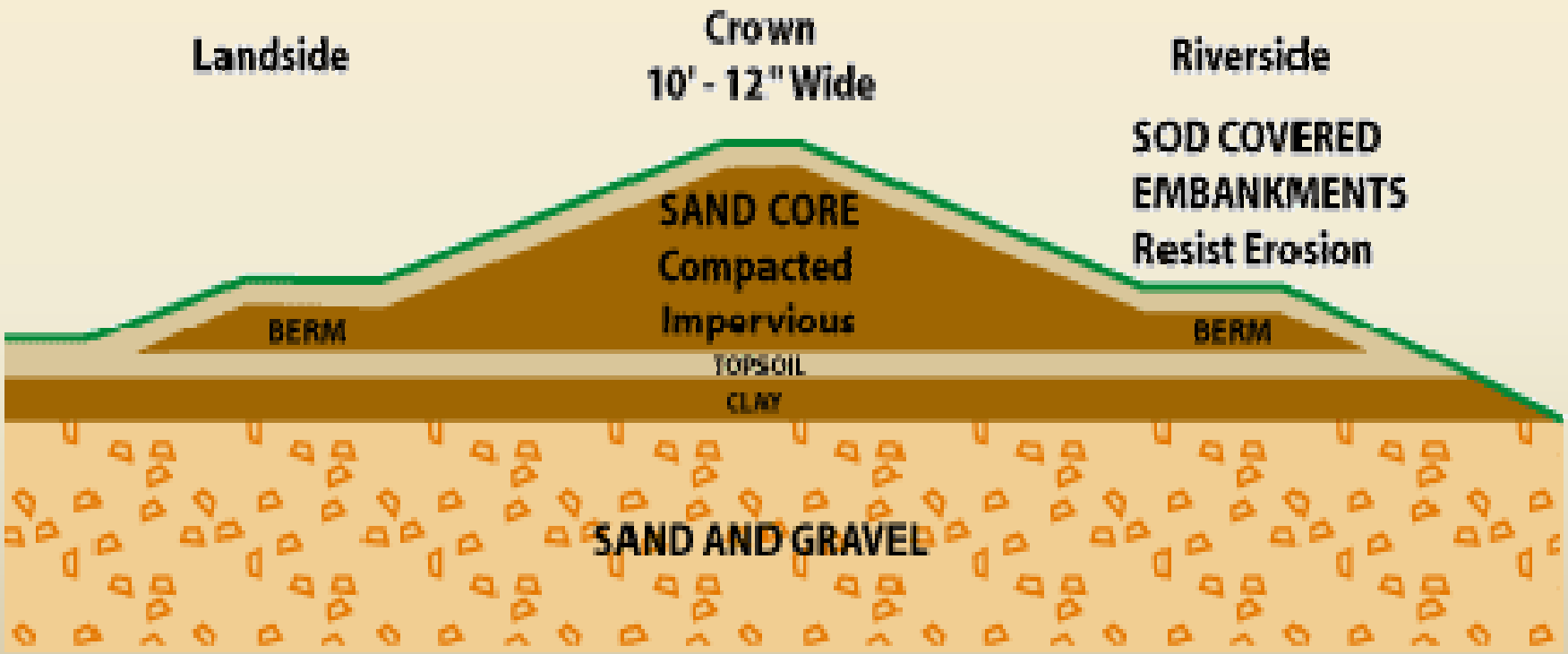


Transect 1


1.5 Miles
27
34
33
Frontier Park
Boat Ramp
LEVEE
EARTH CITY EXPWY
Earth City
Bonfils
Conveyors
Quarry
Substation
BM 487
Trailer Park
Natural Bridge Junction
Spanish Village Park
MARYLAND HEIGHTS
CORPORATE BOUNDARY
ROAD ON LEVEE
INTERCHANGE 231
INTERCHANGE 232
BRIDGETON CORP
DePaul


Transect 1
Elevation (meters)
165
150
135
120
105
90
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
Distance (Meters)
Missouri River
500 Year Flood Plain
Levee (462 feet above msl -- 140.8 meters)
502.17 Feet (153.06 meters)
462 Feet (140.8 meters)
<-- Approx. West Lake Boundaries -->
OU 1
OU 2
Quarry

Cross Section of an Engineered Levee



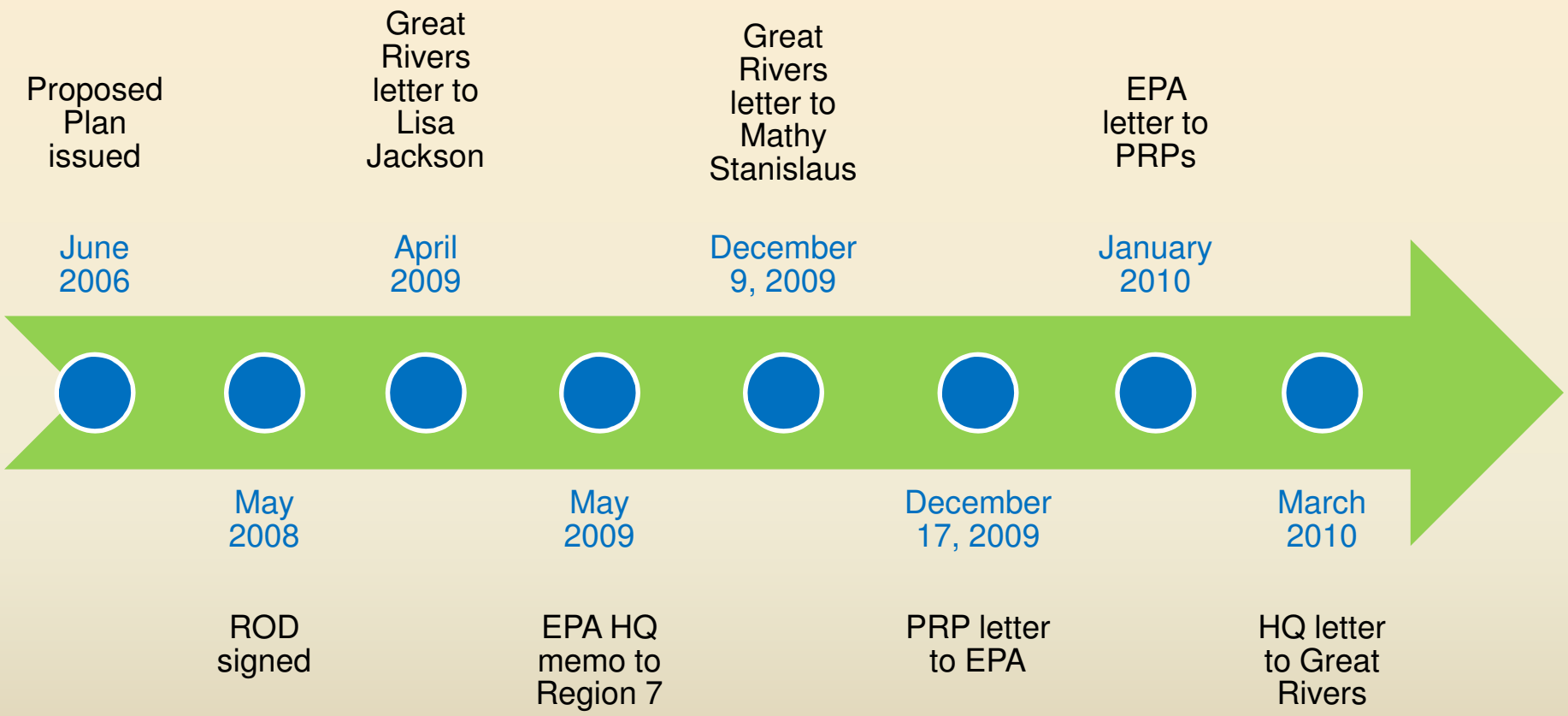
Community Involvement during ROD Process

- June 14, 2006: Proposed plan released, public comment period begins
- June 22, 2006: First public meeting in Bridgeton, MO
- August 14, 2006: Extended public comment period
- September 14, 2006: Second public meeting in Bridgeton, MO – focused on radiation issues

Community Involvement during ROD Process (cont'd)

- October 14, 2006: Second extension to public comment period
- December 29, 2006: Public comment period ends after more than 6 months
- March 27, 2008: Public comment period reopened and a third public meeting held in Bridgeton, MO – focused on levee issues
- April 9, 2008: Public comment period ends

The road to the SFS for OU-1



Remedies evaluated in the SFS

- The SFS re-evaluates the ROD remedy and the complete excavation and off-site disposal remedies *in greater detail* than was done in the original FS
- The SFS also includes an evaluation of complete excavation and on-site disposal of radiologically-contaminated material, at the request of EPA HQ
- No new investigation or sampling

Evaluation criteria for Remedies

- The NCP at 40 CFR 300.430 (e) (9) specifies nine criteria to use for the evaluation:

Two “Threshold” Criteria

Five “Primary Balancing” Criteria

Two “Modifying” Criteria

Evaluation Criteria (cont'd)

- "Threshold" Criteria:

1. Overall protection of human health and the environment

2. Compliance with ARARs

Evaluation Criteria (cont'd)

- "Primary Balancing" Criteria:

1. Long-term effectiveness and permanence
2. Reduction of toxicity, mobility or volume through treatment
3. Short-term effectiveness
4. Implementability
5. Cost

Evaluation Criteria (cont'd)

- "Modifying" criteria:

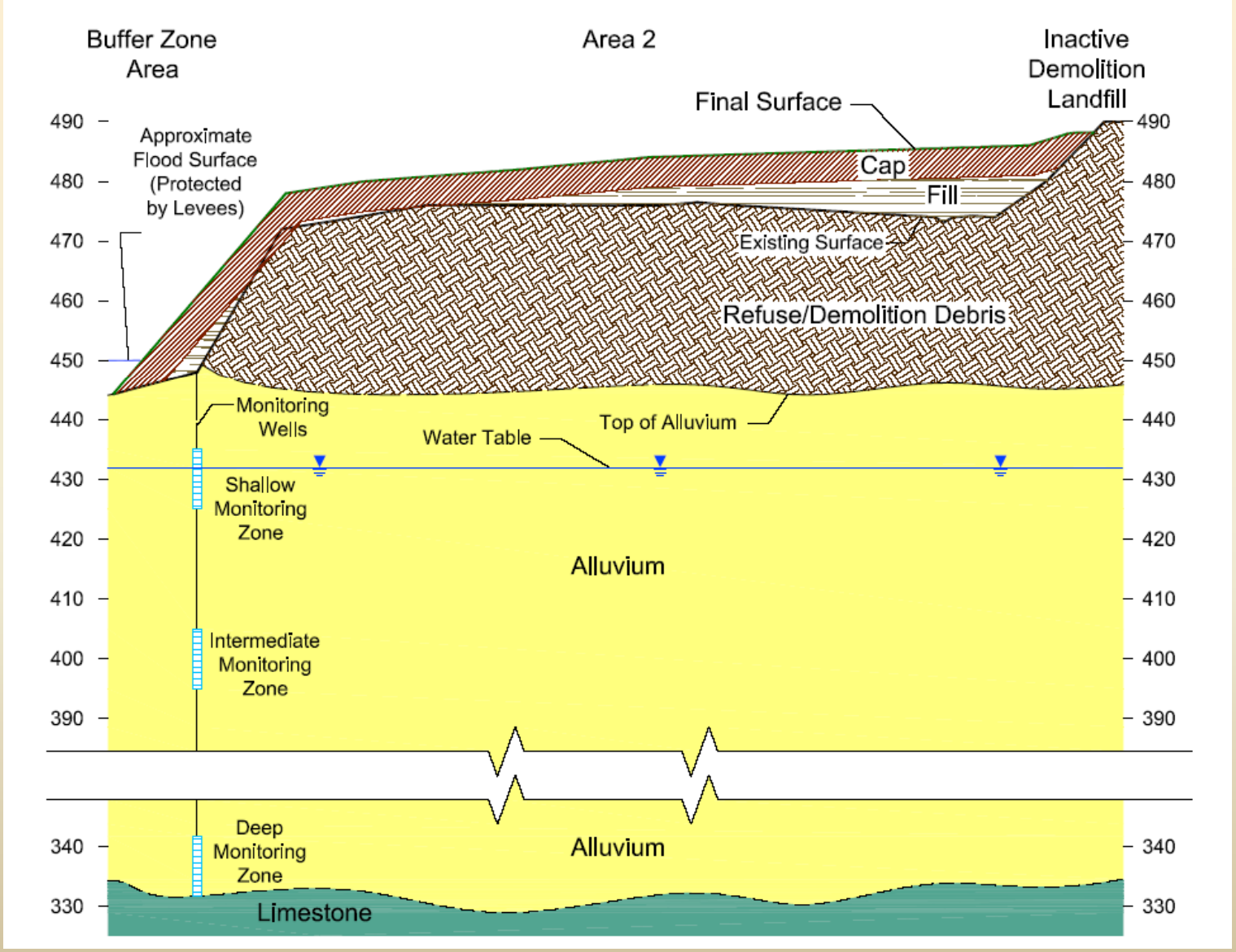
1. State Acceptance

2. Community Acceptance

Cap-in-Place (ROD Remedy)

- Meets “Threshold” and most “Primary Balancing” criteria
- Does not meet preference for treatment
- Is implementable and effective in short term and long term
- Costs $41.4M
- 3 years to complete with unconstrained funding

Cross section of Landfill and Cap



Excavation and Off-Site Disposal

- Meets “Threshold” and most “Primary Balancing” criteria
- Does not meet preference for treatment
- Is effective in the long term
- Has issues with short-term effectiveness
- Has issues with implementability
- Costs $259M to $415M
- 4 years to complete with unconstrained funding, 22-38 years if Fund-lead ($10M per year)

Truck Route to RR Spur

Transporting Waste from Landfill to Railcar

- Amount of hazardous fill to move = 440,000 cubic yds
- Number of truckloads from West Lake Landfill to railhead = 23,000
- Number of Truck miles = 345,000
- Estimated number of accidents = 1.3

*Assuming 3.8 accidents/1,000,000 truck miles

Class I Railroads of North America

- Limited number of railroads between St. Louis, MO and Salt Lake City, UT

Additional Risk with Transporting Waste on Rail to Utah

- Number of railcars to transport waste from St. Louis to Clive Disposal Facility =

  5,750 railcars
- Assume 100 railcars/trainload = 57 trains
- Train miles = 180,000
- Risk of injury or death = 4

*one injury or death for every 42,720 train miles

Excavation and On-site Disposal

- Does not meet all “Threshold” criteria
- Meets most “Primary Balancing” criteria
- Does not meet preference for treatment
- Is effective in the long term
- Has issues with short-term effectiveness
- Has issues with implementability
- Costs $137M
- 6 years to complete with unconstrained funding, 10 years if Fund-lead ($10M per year)

Source: Google Earth

0 1600
SCALE IN FEET

N

Figure 6

Setback From Airport Runway

West Lake Landfill OU-1 Supplemental Feasibility Study

EMSI Engineering Management Support, Inc.

Summary of Remedies

	Cap-in-Place	Excavation and Off-site Disposal	Excavation and On-site Disposal
Threshold Criteria	✓	✓	Does not meet all ARARs
Balancing Criteria	✓	Short-term effectiveness and implementability issues	Short-term effectiveness and implementability issues
Time to Complete (Unconstrained)	Three years	Four years	Six years
Time to Complete (Fund-Lead)	Five years	22-38 years	Ten years
Cost	$41.4M	$259M to $415M	$137M

Note: None of the three remedies satisfy the preference for treatment.

Community Acceptance

- Great Rivers opposes the ROD remedy, wants excavation with off-site disposal
- Some members of public are on the record supporting the ROD remedy
- St. Louis Airport Authority opposes both excavation remedies
- St. Louis Aldermen passed a resolution calling for excavation with off-site disposal
- Water utility does not oppose ROD remedy

State Involvement

- State concurred on the ROD in 2008
- State letter to EPA dated May 4, 2009 suggesting use of ARRA funds to remove radiological contamination from the site and thereby create jobs
- State (Missouri DNR) has been fully involved in preparation of SFS work plan and SFS report from the beginning

State concerns with SFS

- Language allowing regrading under the ROD remedy vs. preliminary cap design in SFS
- Requests for additional sampling
- ARARs

Implementation Issues

- Noise, dust and vapor exposure for nearby residents and businesses
- Bird strike mitigation for aircraft
- Contaminant migration concerns
- Waste hauling/transportation issues
- Schedule and cost considerations
- Airport easement and FAA ROD
- Potential litigation

SFS Path Forward

- Briefings for EPA HQ, congressionals
- Final SFS report released to public, **not** for public comment
- Draft Decision Document (ESD, ROD amendment, or new ROD)
- Public Comment Period on the Decision Document and public availability session
- Final Remedy Selection

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Table 10: Comparative Analysis of Alternatives

Evaluation Criteria	ROD-Selected Remedy	"Complete Rad Removal" with Off-site Disposal	"Complete Rad Removal" With On-site Disposal
Threshold Criteria			
Overall Protection of Human Health and the Environment	All of the alternatives would be protective of human health and the environment. All alternatives eliminate or reduce potential exposures to (1) external gamma radiation, (2) radon emissions, (3) inhalation or ingestion of contaminated soil or wastes, (4) dermal contact with contaminated soil or waste, and (5) dispersal of contaminants in fugitive dust. All of the alternatives would reduce potential infiltration of precipitation into the waste and thereby reduce the potential for leaching to groundwater. All alternatives include institutional controls to ensure that only land and resource uses that are consistent with the remedy and protective of human health and the environment are allowed in the future.		
Compliance with ARARs			
Compliance with Chemical-Specific ARARs	All of the alternatives would comply with chemical-specific ARARs including (1) uranium mill tailing standards for radon emissions, maximum concentrations for groundwater protection, and cleanup of contaminated land (Buffer Zone and Crossroad Property), (2) radon NESHAP, (3) Missouri radiation protection standards, and (4) Missouri maximum contaminant levels (MCLs).		
Compliance with Location-Specific ARARs	Would meet location-specific ARARs including solid waste regulation standards relative to 100-year floodplain and proximity to airport runways.	Would meet location-specific ARARs including solid waste regulation standards relative to 100-year floodplain and proximity to airport runways.	Would meet location-specific ARARs including solid waste regulation site selection standards relative to airport runways, 100-year floodplain, wetlands, seismic zones, and unstable ground. May not meet all FAA requirements (TBCs) relative to airport runways because location of on-site cell is within 8,000 feet of end of westernmost runway at Lambert-St. Louis International Airport.
Compliance with Action-Specific ARARs	Would meet action-specific ARARs including Missouri solid waste regulations closure and post-closure standards and uranium mill tailing standards for longevity of disposal facilities.	Would meet action-specific ARARs including Missouri solid waste regulation closure and post-closure standards, DOT and NRC standards for shipment of radioactive wastes, and disposal facility waste acceptance criteria.	Would meet action-specific ARARs including Missouri solid waste regulations for design, operation, closure and post-closure of a solid waste landfill and uranium mill tailing standards for longevity of disposal facilities. Would NOT comply with Missouri solid waste prohibition on disposal of radioactive contaminated material in solid waste disposal cell.

Table 10: Comparative Analysis of Alternatives (continued)

Evaluation Criteria	ROD-Selected Remedy	"Complete Rad Removal" with Off-site Disposal	"Complete Rad Removal" With On-site Disposal
Primary Balancing Criteria			
Long-Term Effectiveness and Permanence			
Magnitude of residual risks	Highest long-term risk that would remain upon completion of the remedial action (1.3×10^{-6}) is within EPA's target risk range of 1×10^{-6} to 1×10^{-4}.	Highest long-term risk that would remain upon completion of the remedial action ($<1 \times 10^{-7}$) is less than EPA's target risk range of 1×10^{-6} to 1×10^{-4}.	Highest long-term risk that would remain upon completion of the remedial action (1.5×10^{-6}) is within EPA's target risk range of 1×10^{-6} to 1×10^{-4}.
Adequacy and reliability of controls	Engineering measures including construction, inspection and maintenance of a final cover would be the primary methods used to control waste materials that remain on site. These types of measures have been demonstrated to be effective at numerous solid waste and NCP sites. Conceptual design of the new landfill covers is based on established designs for solid waste disposal sites, augmented to limit increased gamma radiation and radon emissions expected to occur over a 1,000 period from decay of thorium. Includes rip-rap armor along toe of Area 2 to provide protection against flooding in the unlikely event of failure of the Earth City Flood Control levees or stormwater management systems. Engineering measures would be augmented and supported by existing and additional institutional controls which also have been used at numerous solid waste and NCP sites.	Includes excavation and removal of radiologically-impacted materials above levels which would allow for unrestricted use relative to radiological contamination to an off-site disposal site, and thus is potentially more reliable than the other alternatives. Engineering measures including construction, inspection and maintenance of a final cover would be the primary methods used to control waste materials that remain on site. These types of measures have been demonstrated to be effective at numerous solid waste and NCP sites. Engineering measures would be augmented and supported by existing and additional institutional controls which also have been used at numerous solid waste and NCP sites.	Engineering measures including construction and closure of a new engineered waste disposal cell and construction, inspection and maintenance of a final cover would be the primary methods used to control waste materials that remain on site. These types of measures have been demonstrated to be effective at numerous solid waste and NCP sites. Engineering measures would be augmented and supported by existing and additional institutional controls which also have been used at numerous solid waste and NCP sites. Conceptual design of the new landfill cell is based on established designs for solid waste disposal sites, augmented to limit increased gamma radiation and radon emissions expected to occur over a 1,000 period from decay of thorium.

Table 10: Comparative Analysis of Alternatives (continued)

Evaluation Criteria	ROD-Selected Remedy	"Complete Rad Removal" with Off-site Disposal	"Complete Rad Removal" With On-site Disposal
Primary Balancing Criteria (cont.)			
Reduction of Toxicity, Mobility or Volume through Treatment	None of the alternatives include treatment technologies that would reduce the toxicity, mobility or volume of waste material through treatment as a primary component. Treatment technologies are generally not applicable to the site wastes due to the nature and overall large volume of wastes, combined with the fact that radionuclides are naturally occurring elements that cannot be neutralized or destroyed by treatment. All of the alternatives include off-site treatment and disposal of hazardous wastes in accordance with the RCRA regulations if any such wastes are encountered during implementation of the remedy.		
Short-Term Effectiveness			
Protection of the community during any remedial action	Lowest potential for impacts to the community: Transportation accident incidence:0.61 Carcinogenic risk to residents:3.3×10^{-6} Carbon dioxide emissions: 8,350 tons	Highest potential for impacts to the community: Transportation accident incidence:1.4 Carcinogenic risk to residents:2.1×10^{-5} Carbon dioxide emissions: 35,400 tons	Lower potential for impacts to the community: Transportation accident incidence:0.79 Carcinogenic risk to residents:2.0×10^{-5} Carbon dioxide emissions: 17,900 tons
		Excavation of RIM would create depressions in the waste where precipitation could accumulate increasing the potential for infiltration, leaching and creation of a plume of contamination in groundwater.	Excavation of RIM would create depressions in the waste where precipitation could accumulate increasing the potential for infiltration, leaching and creation of a plume of contamination in groundwater.
	This alternative poses the least potential for increased bird strikes to aviation operations at nearby Lambert-St. Louis International Airport.	This alternative poses potential for increased bird strikes to aviation operations at nearby Lambert-St. Louis International Airport.	This alternative poses greatest potential for increased bird strikes to aviation operations at nearby Lambert-St. Louis International Airport.
Protection of workers during remedial actions	Lowest potential for impacts to workers Industrial accident incidence – 4.7 Carcinogenic risk – 7.2×10^{-5} Worker dose (TEDE) – 50 mrem/yr	Greater potential impacts to workers from increased handling of RIM Industrial accident incidence – 7.6 Carcinogenic risk – 7.6×10^{-4} Worker dose (TEDE) – 260 mrem/yr	Greater potential impacts to workers due to increased handling of RIM Industrial accident incidence – 9.0 Carcinogenic risk – 7.4×10^{-4} Worker dose (TEDE) – 260 mrem/yr
Environmental impacts of any remedial action	No measurable long-term impacts to plants or animals are expected to occur from any of the alternatives. No wetlands are present on-site and no endangered species were identified in the site area. Regrading and/or excavating Area 2 would disturb the landfill surface and destroy the habitat that currently exists in this area, but this would be replaced by vegetative cover equivalent to an early stage field succession.		

Table 10: Comparative Analysis of Alternatives (continued)

Evaluation Criteria	ROD-Selected Remedy	"Complete Rad Removal" with Off-site Disposal	"Complete Rad Removal" With On-site Disposal
Primary Balancing Criteria (cont.)			
Short-Term Effectiveness (cont.)			
Time until RAOs are achieved	Implementation of institutional controls is included as part of all of the alternatives and would take approximately 1 year to implement. Potential threats would be addressed upon implementation of institutional controls. No potential threats would remain after implementation of any of the alternatives. Note: NTP for entries below is notice to proceed with RD.		
	RAOs would be achieved upon completion of construction 3 yrs after NTP w/ no fiscal constraint 5 yrs after NTP if fiscal constraint	RAOs would be achieved upon completion of construction 4 yrs after NTP w/ no fiscal constraint 29 yrs after NTP if fiscal constraint	RAOs would be achieved upon completion of construction 6 yrs after NTP w/ no fiscal constraint 13 yrs after NTP if fiscal constraint
Implementability			
Technical Feasibility	All of the alternatives are constructible.		
		There is uncertainty regarding the actual volumes of RIM that would need to be removed and the volume of daily cover that would be added resulting in uncertainty the actual disposal volume. The ability to remove deeper occurrences of RIM from Area 2 is a technical difficulty with this alternative and might result in schedule delays. The ability to locate a rail spur near the site or to construct a rail spur to and on the site is a technical difficulty that could limit the performance and schedule of this alternative. Reductions in the number of rail cars or the frequency of exchange of full and empty rail cars could impact the schedule for this alternative.	There is uncertainty regarding the actual volumes of RIM that would need to be removed and the volume of daily cover that would be added resulting in uncertainty the actual disposal volume. The ability to remove deeper occurrences of RIM from Area 2 is a technical difficulty with this alternative that might result in schedule delays. Construction and operation of a new engineered disposal cell is a common technology that has been demonstrated to be reliable. Only one possible location for a new disposal cell could be identified due to the Missouri river geomorphic floodplain. Subsurface conditions at this location are unknown and could affect technical feasibility and/or capacity of a new disposal cell.

Table 10: Comparative Analysis of Alternatives (continued)

Evaluation Criteria	ROD-Selected Remedy	"Complete Rad Removal" with Off-site Disposal	"Complete Rad Removal" With On-site Disposal
Primary Balancing Criteria (cont.)			
Implementability (cont.)			
Technical Feasibility (cont.)	Landfill cover systems have been used extensively and with proper inspection and maintenance have been demonstrated to be reliable. Stormwater controls and environmental monitoring are commonly used techniques that have been demonstrated to be reliable.	Excavation and offsite disposal is a common and reliable technology. Landfill cover systems have been used extensively and with proper inspection and maintenance have been demonstrated to be reliable. Stormwater controls and environmental monitoring are commonly used and demonstrated reliable techniques. Per the FAA, the reliability of most bird mitigation technologies are questionable.	Landfill cover systems have been used extensively and with proper inspection and maintenance have been demonstrated to be reliable. Stormwater controls and environmental monitoring are commonly used and demonstrated reliable techniques. Per the FAA, the reliability of most bird mitigation technologies are questionable.
	The only future actions anticipated to be required for all of the alternatives are ongoing inspection, monitoring, maintenance and, if needed, repair of the final landfill covers which should be easily implemented. All of the alternatives include a provision for a contingent landfill gas control system in the event the monitoring of subsurface occurrences of landfill gas or radon indicates a need for such a system.		
	Performance of all the alternatives can be monitored and potential risk of exposure in the event of failure of any of the alternatives would be low.		
Administrative Feasibility	Requires coordination and permitting with MSD for disposal of leachate and stormwater during construction. Requires access to Crossroad Property for investigation/removal of soil. Requires coordination with Earth City Flood Control district for design and operation of long-term stormwater management systems. May require preparation and approval of a traffic control plan for St. Charles Rock Road.	Implementation would require approval and verification of current acceptability for off-site disposal from EPA. Use of the Clean Harbors facility for disposal would require approval by the Rocky Mountain Low Level Radioactive Waste Compact. Construction of a rail spur would require leasing/acquisition of property located on the east side of St. Charles Rock Rd. and permission to construct a rail crossing over St. Charles Rock Rd.	Requires approval of City of St. Louis (unlikely based on prior discussions) to temporarily remove its Negative Easement and Restrictive Covenant against additional landfilling at the site and resultant impacts to airport safety. Requires coordination with and possible approval by the FAA for construction and operation a new disposal cell within 10,000 ft of the end of the westernmost runway at Lambert-St. Louis International Airport.

Table 10: Comparative Analysis of Alternatives (continued)

Evaluation Criteria	ROD-Selected Remedy	"Complete Rad Removal" with Off-site Disposal	"Complete Rad Removal" With On-site Disposal
Primary Balancing Criteria (cont.)			
Implementability (cont.)			
Administrative Feasibility (cont.)		Requires coordination and permitting with MSD for disposal of leachate and stormwater during construction. Requires access to Crossroad Property for investigation/removal of soil. Requires coordination with Earth City Flood Control district for design and operation of long-term stormwater management systems. May require development and approval of a traffic control plan for St. Charles Rock Road.	Requires MDNR approval to construct haul roads over previously closed portions of the permitted landfill. Requires coordination and permitting with MSD for disposal of leachate and stormwater during construction. Requires access to Crossroad Property for investigation/removal of soil. Requires coordination with Earth City Flood Control district for design and operation of long-term stormwater management systems. May require preparation and approval of a traffic control plan for St. Charles Rock Road.
Availability of Services and Materials	Preliminary discussions with MSD indicate that it is willing and has sufficient capacity to accept leachate or stormwater that may be generated during construction. Alternatively, off-site disposal facilities are available to accept these materials if necessary	Only 2 or possibly 3 off-site disposal facilities are available that could accept the types of wastes in Areas 1 and 2. Preliminary discussions with MSD indicate that it is willing and has sufficient capacity to accept leachate or stormwater that may be generated during construction. Alternatively, off-site disposal facilities are available to accept these materials if necessary.	Preliminary discussions with MSD indicate that it is willing and has sufficient capacity to accept leachate or stormwater that may be generated during construction and leachate that may accumulate in the new on-site disposal cell. Alternatively, off-site disposal facilities are available to accept these materials if necessary.
	Adequate equipment, materials, and specialists necessary to implement this alternative are anticipated to be available.		

Table 10: Comparative Analysis of Alternatives (continued)

Evaluation Criteria	ROD-Selected Remedy	"Complete Rad Removal" with Off-site Disposal	"Complete Rad Removal" With On-site Disposal
Primary Balancing Criteria (cont.)			
Implementability (cont.)			
Availability of Services and Materials (cont.)	Technologies included as part of this alternative are generally available and sufficiently demonstrated. No prospective technologies are anticipated as part of this alternative.	Technologies included as part of this alternative are generally available and sufficiently demonstrated. No prospective technologies are anticipated as part of this alternative. Use of physical separation techniques could, if effective, reduce the overall cost of this alternative; however, the potential effectiveness, implementability, risks and cost of such techniques cannot be determined from available information. An on-site pilot-scale test would be necessary to make such determinations.	Technologies included as part of this alternative are generally available and sufficiently demonstrated. No prospective technologies are anticipated as part of this alternative.
Cost			
Capital cost	$41,400,000	$259,000,000 - $415,000,000	$117,000,000
O&M costs	$42,000 - $414,000	$40,000 - $412,000	$52,000 - $604,000
Total costs (30 years):			
No fiscal constraint			
Present worth	$43,000,000	$250,000,000 - $401,000,000	$112,000,000
Total (non-discounted)	$45,000,000	$262,000,000 - $419,000,000	$121,000,000
Fiscally constrained ($10M/yr):			
Present worth	$46,000,000	$211,000,000 – *Not Estimated*	$121,000,000
Total (non-discounted)	$49,000,000	$286,000,000 – *Not Estimated*	$141,000,000

The cost estimates summarized above and provided elsewhere in this SFS are feasibility level cost estimates; that is, they were developed to a level of accuracy such that the actual costs incurred to implement the alternatives should fall within a range bounded by 50% above and 30% below these estimates.